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DEPARTMENT OF ENERGY, MINES AND RESOURCES

PAPER 66-50

JURASSIC AND (?) TRIASSIC ROCKS OF THE EASTERN SLOPE OF RICHARDSON MOUNTAINS NORTHWESTERN DISTRICT OF MACKENZIE 106 M and 107 B (parts of)

(Report, 3 figures and 10 plates)

J. A. Jeletzky

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ABSTRACT

The area is characterized by thin and incomplete development of the Jurassic System, which is largely represented by shallow-water, marine to non-marine (?) clastics (sandstones and more or less sandy siltstones with greater or lesser interbeds of coarser clastics). Within the area the Jurassic shallow-water sandstones and siltstones gradually become replaced laterally by the neritic to (?) non-marine sandstones, grits, and conglomerates toward the south. Westward the shallow-water facies is replaced by the deep-water, predominantly pure shales and various siltstones. The same probably happens at the northern end of the range. The thicknesses of all Jurassic isochronous units increase markedly westward and (?) northward. The southern shoreline of the Jurassic sea must have been situated closely south of Vittrekwa River basin because of the observed facies changes and apparently complete absence of marine Jurassic rocks south therefrom.

The predominantly sandy lower part of the Jurassic System north of Vittrekwa River basin is named Bug Creek Formation. The presence of a pronounced disconformity within this formation and the apparently erosionally-caused absence of its lower Jurassic part in the Rat River area indicate the flexing and uplift of the Aklavik arch at that time. The predominantly silty to shaly upper part of the Jurassic System of the same area is named Husky Formation which also includes basal Cretaceous rocks.

The Bug Creek Formation thins out on Stony Creek and at Teeweechee Mountain and presumably wedges out completely south of these localities. The Husky Formation becomes laterally replaced by the predominantly coarse clastics named North Branch Formation, between Stony Creek and the North Branch of Vittrekwa River. The North Branch Formation is underlain by the undated, (?) Palaeozoic to (?) Jurassic shale unit.

The Triassic (?) rocks were only found in the Rat River Gorge and adjacent parts of Aklavik Range. Their upper part is referred to as the Coaly shale division. This unit is underlain by pebble-conglomerates and coarse, pebbly sandstones with interbeds of finer-grained clastics, named the Brat Creek Formation which disconformably overlie early Permian sandstones and siltstones in at least one section. The palynological data suggest Triassic age in preference to the also possible Permian (late Permian only?) age. A number of important sections measured by the writer and others is appended to the report.

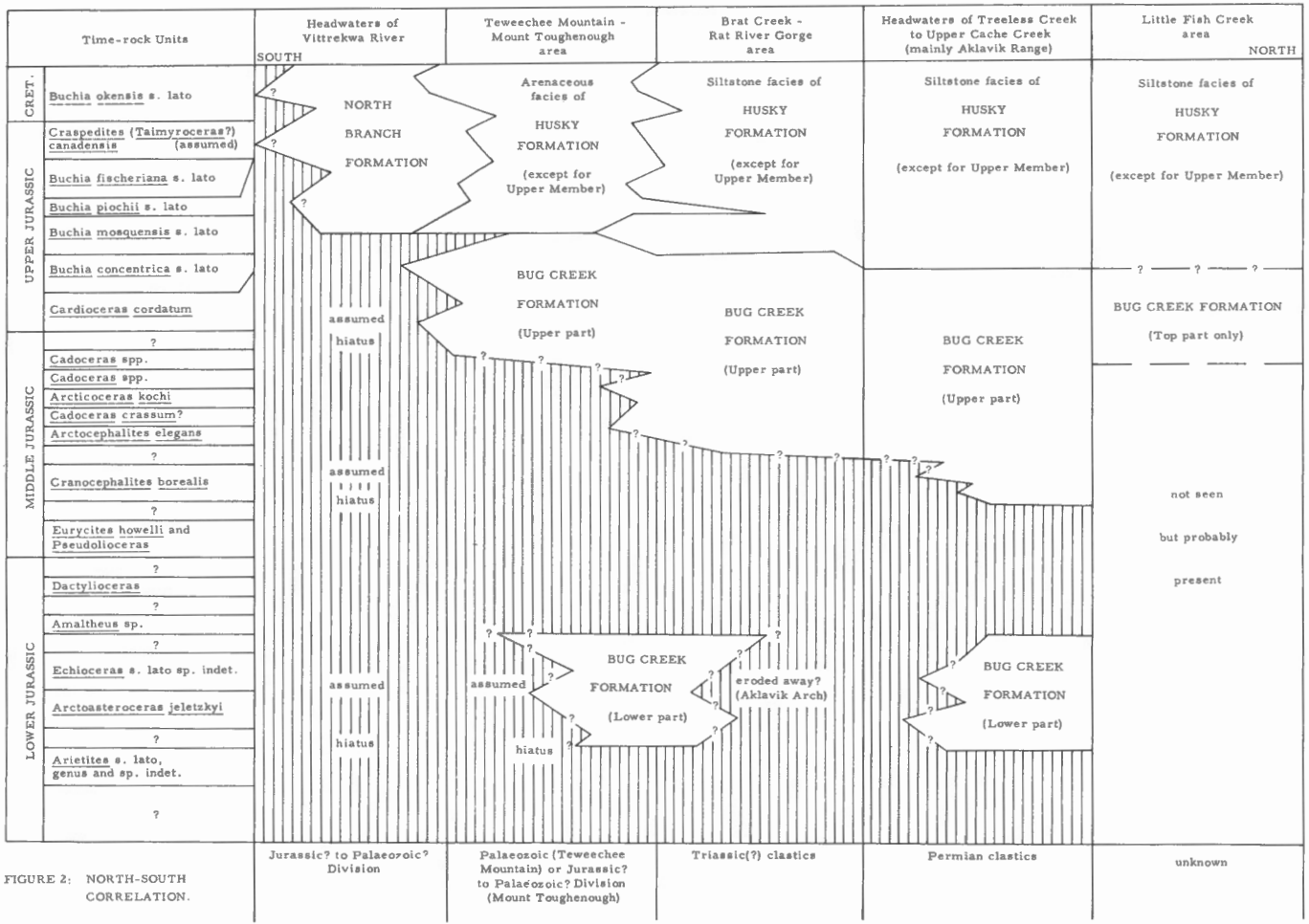

FIGURE 2: NORTH-SOUTH CORRELATION.

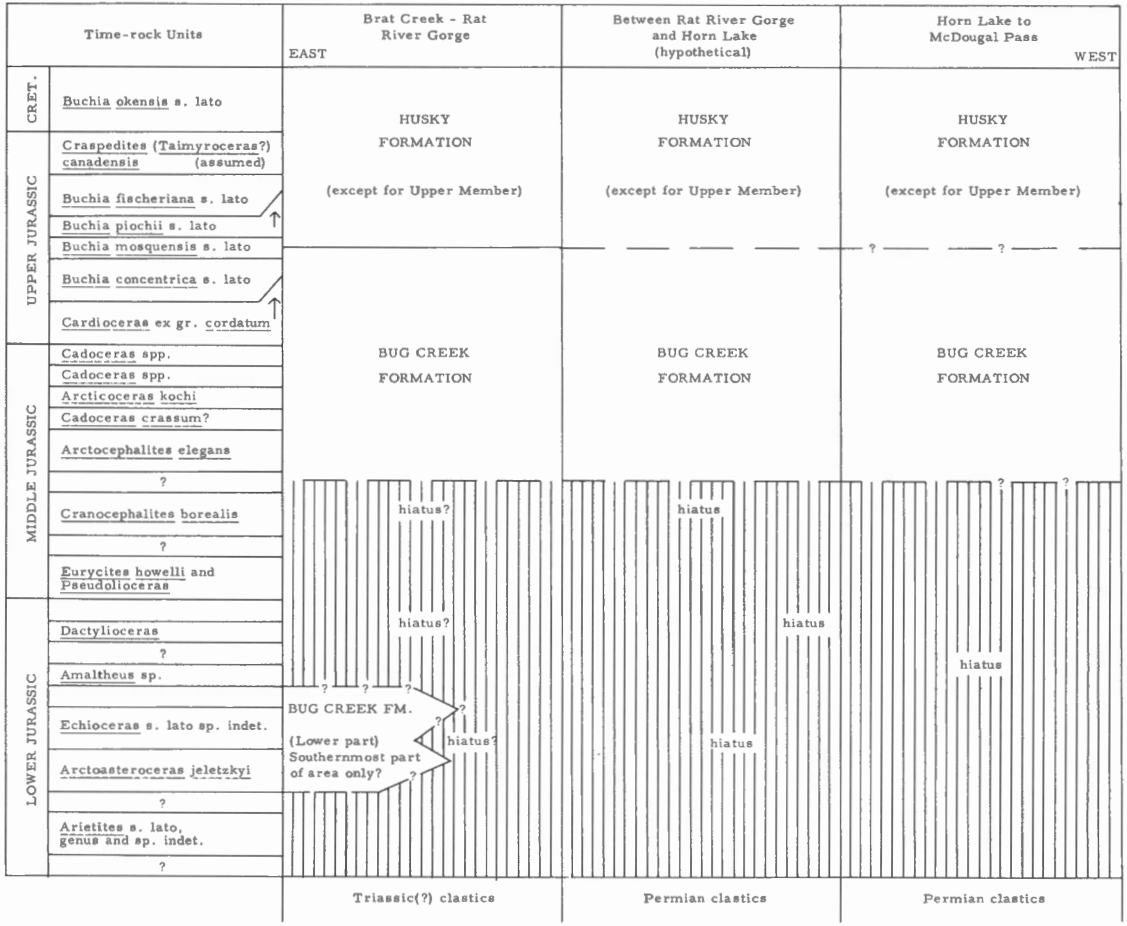

FIGURE 3: EAST-WEST CORRELATION

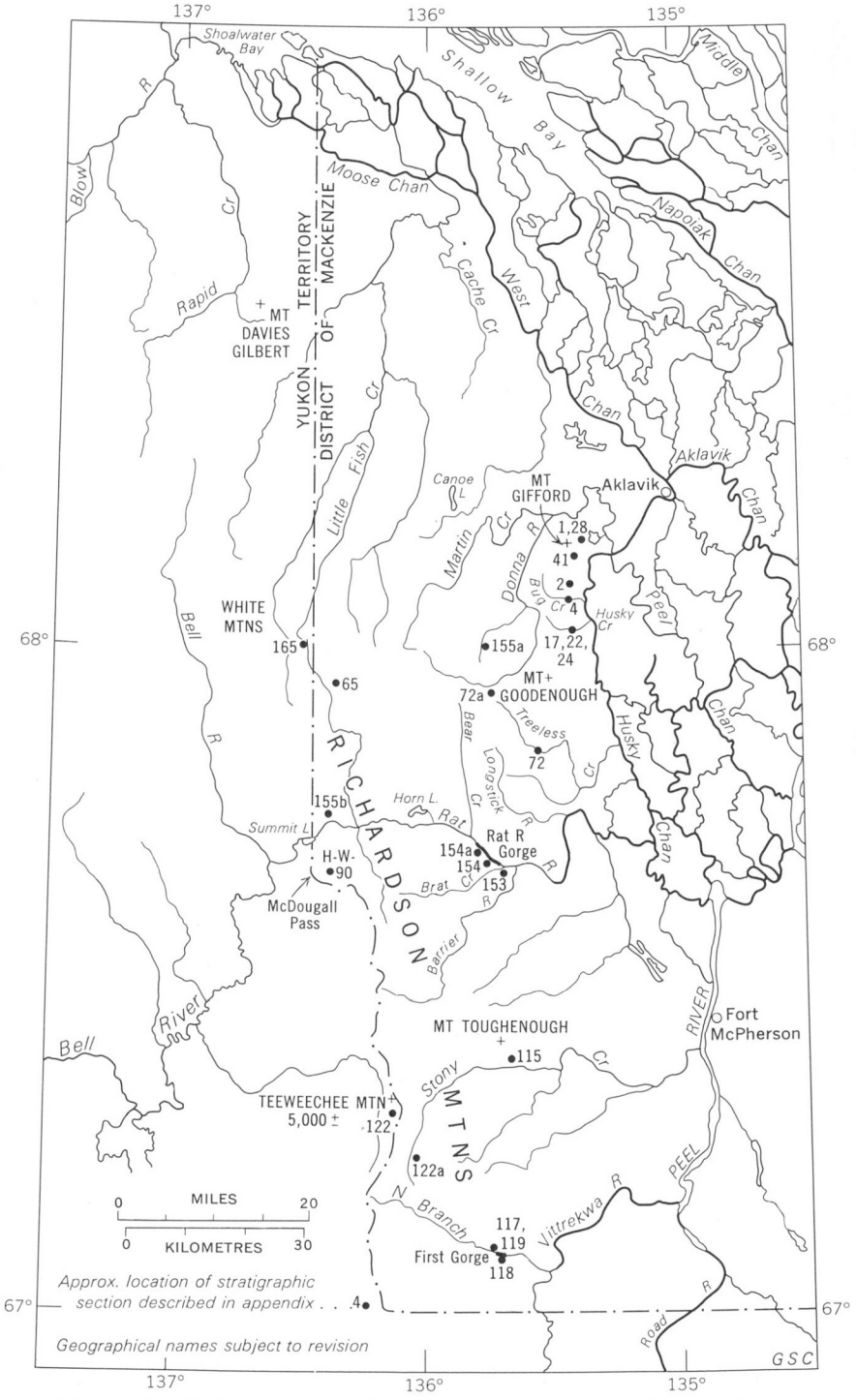

Figure 1. Index map showing location of stratigraphic sections and new or little known geographical terms used in this report.

JURASSIC AND (?) TRIASSIC ROCKS OF THE EASTERN SLOPE OF RICHARDSON MOUNTAINS

INTRODUCTION AND ACKNOWLEDGMENTS

The main objective of this report is to summarize the information now available about the Jurassic rocks of the eastern slope of Richardson Mountains. It also describes, however, some undated, possibly Jurassic rocks exposed on North Branch River and near Mount Toughenough as well as the minor outcrop areas of the presumably Triassic, non-marine rocks occurring in Rat River basin. The latter rocks had previously been dated provisionally as Jurassic (Jeletzky, 1963, p. 79) on palynology, but this age determination was later withdrawn.

This report is largely based on personal field work in the area in 1955, 1958 and 1959 but also makes use of certain published and unpublished information listed below.

Very little has been published on the Jurassic geology of the eastern slope of Richardson Mountains since the first Jurassic marine fossils brought in by oil geologists from that area were identified by Dr. F.H. McLearn and Dr. L.F. Spath in 1946.

Gabrielse's (1957) report on the geological reconnaissance of northern Richardson Mountains lists Upper Jurassic fossils from several sections and points out several areas where Jurassic rocks are present. Jeletzky's (1958a, b) reports briefly describe the Jurassic sequence of Aklavik Range and describe in considerable detail the stratigraphy and biochronology of the Uppermost Jurassic (Upper Tithonian or Upper Volgian) rocks of the same area. Martin's (1959, pp. 2427, 2429-30) summary of the stratigraphy and depositional tectonics of the North Yukon Lower Mackenzie region touches only briefly on the most general features of Jurassic rocks of Richardson Mountains. Some more recent reports by Jeletzky (1960, 1961a, b; 1963) deal mainly with the Uppermost Jurassic (Upper Tithonian or Upper Volgian) rocks. A small scale preliminary map showing the interpretation of distribution of the Jurassic rocks on the eastern slope of Richardson Mountains favoured by the officers of Operation Porcupine was recently published as GSC Map 10-1963.

The Jurassic palaeontology of the eastern slope of Richardson Mountains is better known, as most of the Jurassic ammonites and some Buchias collected there by the writer and other workers have already been described and figured by Frebold (1958, 1960, 1961, 1964 and Jeletzky, (1966). The palaeontological and biochronological information contained in the published reports of H. Frebold and in his numerous unpublished fossil reports was invaluable for dating and correlation of the Jurassic rocks of the area.

The information now available about the Jurassic geology of the eastern slope of Richardson Mountains is rather unevenly distributed and often rather incomplete. This report reflects, therefore, only the present state of our knowledge of these rocks and their fossils and includes numerous data requiring further verification and amplification. Every attempt was made, therefore, in the text of this report to separate the interpretations and generalizations from factual observations and proven correlations, and to indicate the degree of their reliability.

During the season of 1958 the writer was assisted in the field by A.K. Crank and T.C. Shearer. The field work was greatly facilitated by the assistance of the Subdistrict Administration of the Department of Northern Affairs and National Resources for the Aklavik area and of other residents of Aklavik and McPherson. Shell Oil Company of Canada, Texaco Exploration Company of Canada, and J.C. Sproule and Associates, Calgary kindly assisted with transportation and other facilities which greatly speeded up the survey of several poorly accessible parts of the area. Shell Oil Company of Canada has, furthermore, kindly released for publication the palaeontological report of Mr. A.P. Audretsch dealing with plant microfossils of the Triassic? rocks outcropping in the Rat River Gorge. Mobil Oil Company of Canada provided valuable unpublished data gathered in 1946 by Mr. J.H. Manning. Dr. D. Bruce Bullock of Bullock and Associates, Ltd., Consulting Geologists, Calgary and the Amerada Petroleum Corporation have kindly released for publication the important geological section measured on Snafu Ridge southwest of Horn Lake and made available some of the fossils collected by their field men from that and some other sections. They have also permitted the publication of certain fossil identifications made by Dr. C.H. Stelck. The British American Oil Company, Ltd. kindly released for publication an important section (Goat and Eagle section) measured by their geologists on the eastern slope of White Mountains together with a list of fossils identified from that section by Dr. C.H. Stelck, University of Alberta.

All Upper Tithonian (= Upper Volgian or? Purbeckian) fossils listed in this report have been identified and dated by the writer. Among older Jurassic fossils, all representatives of the family Buchiidae Cox, 1953 (= Aucellinae Lahusen, 1897), some other generically identified pelecypods, and all belemnites have been identified by the writer, except for specifically indeterminate Buchia in Snafu Ridge section and indeterminate belemnites in this and in the Goat and Eagle section. All pre-Upper Tithonian ammonites, all specifically identified pre-Upper Tithonian pelecypods, except for the representatives of Buchiidae, and all other pre-Upper Tithonian invertebrate fossils have been identified and dated by H. Frebold of this Survey, except for the bulk of fossils from the Snafu Ridge and Goat and Eagle sections. The latter fossils were identified by Dr. C.H. Stelck, University of Alberta, with the single exception of Arietites genus and species indet., which was identified by H. Frebold of this Survey. Plant fossils have been identified and dated by D.C. McGregor of the Geological Survey of Canada and

Mr. A. P. Audretsch of the Shell Oil Company of Canada. All basal Cretaceous fossils listed in this report have been identified and dated by the writer. All of these fossils are illustrated in Jeletzky (1964b).

As interpreted in this and previous reports of the writer, the eastern slope of Richardson Mountains includes the belt of more or less strongly dislocated, predominantly Mesozoic rocks exposed east of their largely Palaeozoic core. However, north of White Mountains and in the interval between White Mountains and Teeweechee Mountain massif the eastern slope can only be defined arbitrarily as the Richardson Mountains do not have any well defined Palaeozoic core there. The western boundary of the eastern slope can, thus, be drawn roughly as the line running from the mouth of Moose Channel through Mount Davies Gilbert and along the eastern slope of White Mountains. From the southern end of White Mountains the western boundary runs through Summit Lake and McDougall Pass to the so called Snafu Ridge and from this latter south to the watershed between Rock River and Stony Creek at Teeweechee Mountain. South of Teeweechee Mountain this boundary runs more or less southeastward along the east flank of the Palaeozoic core of the anticlinorium of southern Richardson Mountains essentially coinciding with the Mesozoic-Palaeozoic boundary on the North Branch of Vittrekwa River, Vittrekwa River itself, Road, Trail, Caribou and Snake Rivers. No Jurassic rocks are, however, known to occur on the eastern slope south of the latitude of headwaters of Vittrekwa River.

As defined above, the eastern slope of Richardson Mountains coincides essentially with the eastern marginal part of the Jurassic trough of the Richardson Mountains and northern Porcupine Plains (Jeletzky, 1961b, 1963) characterized by relatively thin and incomplete development of the Jurassic System. The Jurassic rocks of the eastern slope are, furthermore, largely represented by shallow water, marine (sandstones and more or less sandy siltstones with greater or lesser interbeds of coarser clastics) to non-marine (?) (coaly or carbonaceous sandstones or siltstones and coarser clastics) facies. This shallow water marine to non-marine (?) facies of the Jurassic rocks is replaced by the deep water facies (pure shales and siltstones) at or closely west of the above mentioned line. The thicknesses of all Jurassic isochronous units (palaeontological zones) increase markedly westward at the same time. These facies changes must await description in greater detail in a forthcoming report dealing with the Jurassic rocks of Central and Western Richardson Mountains and northern Porcupine Plains.

The Triassic (?) rocks were only found in the Rat River Gorge and adjacent parts of Aklavik Range. They are represented by non-marine rocks (coaly shale, coaly or carbonaceous sandstones, and coarse clastics). These rocks were previously considered to be either Jurassic? (e.g. Jeletzky, 1963, p. 79) or Permo-Carboniferous (Operation Porcupine, GSC Map 10-63) in age.

The text of this report is arranged in two parts. The first part deals with the stratigraphical nomenclature, general description of rock-stratigraphic units, their age and correlation, and related topics. The second part is an Appendix, which gives a detailed description of all the most important Triassic(?) and Jurassic sections measured on the eastern slope by the writer and some other persons (e.g. Snafu and Goat and Eagle sections). In the Appendix the writer's sections are arranged in ascending order according to the field numbers assigned to them in the writer's notebooks. These sections are referred to by the same field numbers throughout the first part of the report.

TRIASSIC(?) ROCKS

Brat Creek Formation

A thick pebble conglomerate and pebbly sandstone unit underlying the Coaly shale division in Rat River Gorge and on the eastern slope of Bear Creek Dome is herein named the Brat Creek Formation from the creek that falls into Rat River from the south at the lower end of Rat River Gorge and about 3/4 of a mile upstream from its confluence with Barrier River (see Fig. 1). The exposures of Brat Creek Formation in the southeast (left) bank of Brat Creek about 1/4 mile up from its mouth (see units 1-2 of Section 153 and Pl. I, Figs. 1-2) are designated as its type section.

Brat Creek Formation typically consists of fine to medium pebble conglomerate, except for its topmost 20 to 40 feet which are represented by grey to light grey, coarse, often gritty and pebbly sandstone in most sections studied. The conglomerate is mostly light to whitish grey or buff but includes interbeds and nests of dark brown, orange to intensively rust-weathering, ferruginous conglomerate; it is for the most part friable to almost unconsolidated but with local interbeds and nests of well cemented, medium hard conglomerate. Bedding is mostly distinct and thin but markedly lenticular. Beds of 1 to 3 inch pebbles alternate with those of finer pebbles and others of coarse, pebbly grit. Pebbles are commonly poorly rounded and oriented with their long axes along bedding planes. Abundant coarse sandy and gritty matrix occurs in most beds. Interbeds of coarse grained, arkosic, gritty, whitish grey to medium grey sandstone occur at intervals throughout the thickness of the formation. Some beds of coaly sandstone and fairly pure coal occur in the middle part of the formation in Rat River Gorge where it contains, furthermore, much more pebbly sandstone than at its type locality. Pebbles of variously coloured chert strongly predominate but pebbles of grey, fine to coarse grained sandstone and hard, grey shale are also common in some sections. Some red jasper pebbles have been noted. The conglomerate tends to become coarser toward the visible base of the formation in its Brat Creek and Rat River Gorge sections.

The contact with the overlying Coaly shale division is sharp and uneven with deep depressions in the surface of Brat Creek Formation filled out by the shale of the Coaly shale division (see Section 154 in the Appendix). The lower contact was only observed in the northernmost outcrop of Brat Creek Formation (see Section 72a in the Appendix) where it overlies the Permian sandstones with Spirophyton-like whorls with regional unconformity. The same contact relationships as in Section 72a probably prevail on Brat Creek and in Rat River Gorge but the base of Brat Creek Formation was not seen in any of the sections studied there and may perhaps be cut off by faults.

The Brat Creek Formation seems to become less coarse westward as in at least one section near the upper end of Rat River Gorge (Pl. II, Fig. 1) it is largely represented by pebbly sandstones with interbeds and nests of fine pebble conglomerate; unfortunately this section was only briefly visited. At least one 12 to 15 feet thick bed of reasonably pure, black, subbituminous ? coal occurs in the upper part of this section and other thin (2-4 inches thick) layers or lenses of similar coal accompanied by 2-4 feet thick beds of light grey to beige pure shale occur near the visible base. The microplants identified from the Brat Creek Formation by Mr. A.P. Audretsch, Shell Oil Co., Ltd. (see below) were probably collected in this very section. The visible thickness of Brat Creek Formation in this important section is at least 150 feet (base covered). A northeastern source of sediments is suggested for the clastics of Brat Creek Formation.

The maximum observed thickness of the Brat Creek Formation is at the type section. There it is tentatively estimated to be in the order of 500 feet. The best sections seen in Rat River Gorge (Section 154 of the Appendix, etc.) expose only the top 150 feet or so of the formation and at the northwesternmost section seen (Section 72 of the Appendix) only the lower 60 feet is exposed. Another 80 feet of Brat Creek Formation could possibly be concealed, however, between the top of its exposure there and the base of the exposure of the overlying Intermediate sandstone member of the Bug Creek Formation. Barring the presence of an unrecognized fault within the covered interval of Section 72a the thickness of Brat Creek Formation there does not exceed 140 feet and is probably considerably less than that.

The Brat Creek Formation was not observed anywhere on the eastern slope, except on lower Brat Creek, in Rat River Gorge, and on the eastern slope of Bear Creek Dome (in the headwaters of Treeless and Bear Creeks). North of Bear Creek Dome it is believed to be represented largely or entirely by a hiatus that separates the Bug Creek Formation from the underlying Permian sandstone unit (see below). This is suggested by its marked thinning out northward and by the absence of any unit resembling the Brat Creek Formation north of the headwaters of Treeless and Bear Creeks. It is possible, however, that the conglomerate member and the underlying Basal sandstone member of the Bug Creek Formation in Section 155a at the headwaters of Martin Creek actually represent the thin wedge of the Brat Creek Formation (see below). This assignment would, however, conflict

with the current interpretation of the Brat Creek Formation as a coarse clastic apron deposited on the southern slope of the Aklavik Arch during and after uplift sometime during the Triassic time and derived from contemporary erosion of its crest area. This orogenic episode was previously tentatively dated as late Lower or? early Middle Jurassic (Jeletzky, 1963, pp. 79-80). The re-evaluation of the age of plant microfossils collected by the writer in the Coaly shale division and the dating of the Brat Creek Formation by Mr. A.P. Audretsch, Shell Oil Co. of Canada Ltd. does not affect the writer's structural conclusions, except for indicating the occurrence of two orogenic episodes instead of one and suggesting a general Triassic age for the older episode.

The apparently complete absence of comparable conglomeratic units south of Lower Brat Creek agrees well with the above interpretation of the nature of Brat Creek Formation. There is, indeed, no indication of a contemporary (i.e. Triassic?) positive tectonic structure anywhere between the lower Brat Creek and Stony Creek and one cannot expect large masses of pebble conglomerates to occur more than 10 to 20 miles away from their source area. The geographically restricted occurrence of Brat Creek conglomerates and their facies changes within the Rat River Gorge suggest that only the northeastern part of the ancestral Aklavik Arch was raised above sea level sometime during the Triassic(?) time to shed the coarse clastics onto the lowland situated immediately south of it.

Except for marine Upper Triassic shales and limestones discovered by officers of Operation Porcupine at the headwaters of Caribou River south of the area studied by the writer (GSC Map 10-1963), only the Hettangian and(?) Rhaetian coal-bearing clastics of Bonny Lake and Blow Pass area (Jeletzky, 1963, pp. 77-79, text-fig. 6) could possibly be partly correlative with the Brat Creek Formation. Considering the presence of the marine Upper Triassic rocks in Barn Mountains and on Babbage River (unpublished intradepartmental fossil reports and GSC Map 10-1963), these data suggest that a broad belt of elevated land occupied most of the Richardson Mountains during part or all of Triassic time. This land mass probably separated completely the Upper Triassic seas of the Canadian part of the Cordilleran geosynclinal belt from those of the Canadian part of the Brooks Range geosyncline.

The only fossils known to occur in the Brat Creek Formation are pollen and spores collected by geologists of the Shell Oil Co. of Canada Ltd. from the upper 160 feet of the formation in the upper part of Rat River Gorge. According to the written communication of Dr. H.G. Bassett of June 10th, 1963 the results of their examination are the following: "Since receiving your letter, I have asked our palynologist, Mr. Audretsch, to check samples from the lower part of the Rat River Gorge section. I quote his results:

"Samples 21, 100 and 158 contain a Permian to Lower Triassic microflora. The presence of Vittatina, which is a strictly Permian genus and the absence of non-striated bisaccate grains (Conifers) might indicate a Permian rather than a Triassic age. The flora is completely different in composition compared with the microflora from the few L. Triassic (Toad-Grayling) samples we have examined from N.W. Alberta. However, there is always the possibility that the Vittatina grains are reworked and that different environmental conditions produced a L. Triassic floral assemblage different to that from Alberta. According to our somewhat scanty knowledge, there are no indications for an U. Triassic age."

Considering the stratigraphic data given below and the evaluation of a rather similar microflora collected by the writer from the overlying Coaly shale division by D.C. McGregor of this Survey (see below) the writer gives a tentative assignment of the Brat Creek Formation to the Triassic. It is, of course, also possible for this formation to include rocks of both Upper Permian and Triassic age or, even to be of Upper Permian age in entirety.

The stratigraphic relationships of the Brat Creek Formation with the underlying Permian (presumably late Lower Permian) rocks were only observed on the east slope of Bear Creek Dome (see Section 72a in the Appendix). In this section the Brat Creek conglomerates overlie disconformably and probably regionally unconformably the Permian sandstones with Spirophyton-like whorls. These sandstones contain Spiriferella sp. cf. S. keilhavii von Buch and other Permian brachiopods in more northerly parts of Aklavik Range (Bug Creek area). P. Harker of this Survey, who has identified this fauna comments on its age as follows: "Lots 27006, 27007, 27009, and 3/3 contain fossils of Permian age. Species of Spiriferella are especially characteristic of the Permian of the boreal region. Spiriferella keilhavii, and productids of the neoinflatus and irginaeformis groups occur in the Permian fauna of the Canadian Arctic Islands and suggest an approximate faunal correlation with the Aklavik region. The age is probably mainly Leonardian." This is the only section known to the writer where the superposition of the conglomerate unit referable to the Brat Creek Formation on Permian (Leonardian?) rocks younger than the Permian or? Upper Carboniferous breccia or conglomerate unit (Jeletzky, 1958a, p. 1593) is incontrovertible. Even should this particular exposure of the Brat Creek Formation be of Permian age in part or completely, it is definitely different from and younger than the breccia unit, with which it was often correlated (unpublished data of oil geologists). The age of the Brat Creek Formation in other sections can only be determined indirectly by lithological correlation with the conglomerate unit referred to the Brat Creek Formation in the Section 72a. The best distinctive lithological features of the type Brat Creek Formation and its outcrop in Section 72a suggestive of such correlation are as follows:

1. Predominantly buff to rusty colour in weathered state;
2. poor to reasonably good sorting and rounding of pebbles;
3. presence of a considerable percentage of sandstone and shale pebbles in addition to chert and jasper pebbles; and
4. the presence of apparently non-marine, light grey to beige pure shale, coaly shale, and interbeds of reasonably pure coal.

The Permian or? Upper Carboniferous breccia or conglomerate unit is, in contrast, extremely poorly sorted and consists for the most part of angular fragments rather than rounded pebbles, furthermore it is intensively red-weathered and appears to lack sandstone and shale pebbles of the type that is reasonably common in the type Brat Creek Formation. No coaly rocks have, finally, been observed in this unit and its shaly interbeds are rose- to red-coloured, limy and contain similarly coloured bud-like concretions. Although pronounced these lithological distinctions are not considered to be completely reliable by the writer. It is to be hoped that the tentative correlation of the type Brat Creek Formation with the conglomerate unit of the Section 72a will eventually be established by the discovery of diagnostic fossils in these two sections. The same is true of the tentative Triassic? dating of all exposures of the Brat Creek Formation at present based solely on the occurrence of microflora in one of its Rat River Gorge exposures.

Coaly shale division

Brat Creek Formation is disconformably overlain by some 80 to? 150 feet of apparently non-marine, black, light to dark grey, creamy white and beige-coloured, pure shales. The black to dark grey shale varieties are often carbonaceous to coaly and contain nests and interbeds of impure coal. Poorly preserved macroplant remains are locally abundant but no other macrofossils have been observed in this division. The contact with the overlying Bug Creek Formation was not clearly exposed in any of the sections studied.

The Coaly shale division was only observed on lower Brat Creek and in the Rat River Gorge (Pl. I, Fig. 2). Its contact relationships with the underlying Brat Creek Formation have already been described.

The only diagnostic fossils found in the Coaly shale division are spores and pollen collected in unit 4 of Section 153 (see Appendix). This microflora was at first tentatively dated as Jurassic and provisionally assigned to the lower half of the Jurassic by D.C. McGregor. This age was used by the writer for the purpose of dating and structural interpretation of the Brat Creek Formation (Jeletzky, 1963, p. 79). More recently, however, D.C. McGregor has re-evaluated this microflora and dates it as follows:

"The overall constitution of this assemblage indicates that it is more likely Triassic. It has some Permian affinities, the most obvious being the presence of Vittatina. However, striate coniferoid forms are rare and such typically Permian genera as Nuskoisporites, Hamipollenites, and Aumancisporites were not found. Monosulcites and cf. Pteruchipollenites are relatively common, and in conjunction with the rarity of striate bisaccate pollen suggest that the sample may be Triassic rather than Permian in age.

"Three specimens of ?Classopollis torosus were seen, and one of ?Eucommidites troedssoni. The presence of these species has not been confirmed and should be questioned until further material can be examined. Neither has previously been reported from pre-Jurassic beds, but on the other hand, there is as yet not enough well documented data on ranges of lower Mesozoic species to eliminate the possibility that they may occur in the Triassic."

Because of the above discussed microfloral evidence and its direct superposition on the presumably Triassic Brat Creek Formation the Coaly shale division is tentatively dated as Triassic and is considered to be only slightly younger than the Brat Creek Formation. The lithology of the Coaly shale division is suggestive of its deposition in swampy lowlands. The effects of the orogenic disturbance of the Aklavik Arch reflected in the conglomeratic lithology of the underlying Brat Creek Formation are no longer apparent by the time of deposition of the palustral rocks of the Coaly shale division. There rocks were, therefore, possibly deposited during the general subsidence of the Richardson Mountains area, which coincides in time with the transgressions of the Upper Triassic (Norian) seas in the Caribou River and Barn Mountains-Babbage River areas.

JURASSIC ROCKS

CORRELATION METHODS AND ZONAL INDICES USED

For reasons fully discussed elsewhere (Jeletzky, 1961a, pp. 3-4; 1963, pp. 57-58) the safe recognition and lateral extension of all Jurassic rock units recognized within the area depends on the direct or indirect determination of their relative age by means of a set of fossil zones worked out by Frebold (1958, 1960, 1961, 1964) and the writer (Jeletzky, 1958b, 1960, 1961a, 1963, 1964, 1966; and in Frebold, 1964) for the Jurassic rocks of Arctic Canada. It was, unfortunately, often impossible to date the rock units or their key sections directly , that is by means of diagnostic fossils found in these units and sections themselves. Such rock units or sections had to be dated and correlated indirectly, that is with reference to either underlying or overlying rock units containing diagnostic fossils or the more or less

distant, lithologically or stratigraphically similar rock units or sections containing diagnostic fossils. The indirect dating of rock units is naturally much less precise and reliable than direct dating. Dating and correlation by means of the lithological comparison of unfossiliferous sections with more or less distant fossiliferous sections is, obviously, the least reliable method of all. This method is, in fact, subject to most or all of the uncertainties of standard lithostratigraphical correlation; it was accordingly only used in extreme cases when no better methods of dating and correlation were available.

The following palaeontological zones and beds (in the sense of Frebold, 1961, p. 25) have so far been recognized in the Richardson Mountains and adjacent areas of Arctic Canada. Most of them have also been recognized on the eastern slope.

Series	Stage	Zones and Beds
UPPER JURASSIC	UPPER TITHONIAN	Undescribed craspeditid ammonite and Buchia ex gr. uncitoides
		?
	or	Craspedites (Taimyroceras?) canadensis Buchia unschensis
	UPPER VOLGIAN	Buchia fischeriana s. lato
		Buchia richardsonensis and Buchia ex gr. piochii s. lato
		?
	PORTLANDIAN s. str.	Buchia piochii var. russiensis, B. piochii var. mniovnikensis and B. aff. fischeriana
		Buchia mosquensis s. lato (including B. mosquensis var. rugosa)
	KIMMERIDGIAN	
	UPPER OXFORDIAN	Buchia concentrica s. lato (= ? B. bronni Rouillier)
	LOWER OXFORDIAN	Cardioceras ex gr. cordatum

Series	Stage	Zones and Beds
MIDDLE JURASSIC	CALLOVIAN	No index fossils known
		Cadoceras spp.
	BATHONIAN	Cadoceras spp.
		Arcticoceras kochi
		Cadoceras crassum?
		Arctocephalites elegans
		No index fossils known
	BAJOCIAN	Cranocephalites borealis
		No index fossils known
		Erycites cf. howelli and Pseudolioceras sp.
LOWER JURASSIC	TOARCIAN	No index fossils known
		Dactylioceras sp.
		No index fossils known
	PLIENSBACHIAN	No index fossils known
		Amaltheus sp.
		No index fossils known
	SINEMURIAN	Echioceras (s. lato) sp. ind.
		Arctoasteroceras jeletzkyi
		No index fossils known
		Arietites (s. lato) gen. et sp. indet.
	HETTANGIAN	Psiloceras canadense (doubtful)

No Hettangian index fossils have been found anywhere in the area, or for that matter anywhere else in the Richardson Mountains, and this time interval is believed to be represented either by a hiatus beneath the Sinemurian rocks or by non-marine rocks (Jeletzky, 1963, pp. 77-79, Fig. 6). Early Sinemurian rocks are believed to be present only near the western margin of the area as late Sinemurian fossils such as Oxynoticeras oxynotum and Arctoasteroceras jeletzkyi have been found only a few feet above the Jurassic-Permian contact in Aklavik Range, and Lower Sinemurian Arietites s. lato, genus and species indet. was only found at one locality near the Yukon-Northwest Territories border north of Rat River (see Goat and Eagle section and in Frebold, 1960, p. 1).

The early to mid-Callovian Cadoceras spp. fauna is the youngest ammonite fauna sufficiently common to be practically useful in zonal correlation within the area. Apart from Amoeboceras, subgenus and species indet. found only once in the Aklavik Range, the younger Jurassic rocks of the area have only yielded occasional representatives of generically and specifically indeterminable phylloceratids. The early Oxfordian Cardioceras ex gr. cordatum zone seems to be restricted to northwestern Richardson Mountains. Only Buchia (better known as Aucella) species were available for dating and correlation of the Upper Jurassic rocks of the area. All Buchia species and variants listed in the zonal table and throughout the report are figured (and in part described) elsewhere (Jeletzky, 1965, 1966; and Jeletzky in: Frebold, 1964, Pl. XLIX, Fig. 3; Pl. L, Figs. 2-8; Pl. LI, Figs. 4-5).

Most of the belemnites are too poorly preserved to be biochronologically useful and only relatively few could be generically identified. It is important to note, however, that belemnites seem to be completely absent in the pre-Toarcian rocks of the Richardson Mountains and northern Porcupine Plains. This regional phenomenon has been used successfully to date some of the long ranging and facies bound pelecypod faunas of the area whenever these lacked ammonites. Also the presence of specifically indeterminable Buchia forms of general Jurassic affinities (Jeletzky, 1962) was found to be biochronologically useful as being diagnostic of the Upper Jurassic.

STRATIGRAPHY AND AGE

Only the Uppermost Jurassic (Upper Tithonian or Upper Volgian) rocks, forming the upper part of the Husky Formation of this report, outcrop extensively within the area. Outcrops of older Jurassic rocks are mostly scattered and limited within the area as they mostly only appear in the crests of anticlines, in the central parts of the Mesozoic dome-like structures and on the scarps of major post-mid-Upper Cretaceous (Alpine?) faults.

In close proximity with the Palaeozoic core of Richardson Mountains outcrops of older Jurassic rocks are likewise scattered and limited, they are only preserved in the axial parts of the synclines and basins or as fault slices between larger areas of Palaeozoic rocks.

Because of strong and rather irregular variations in lithology and thickness of the Jurassic rocks in the north-south and east-west directions, more than one set of lithological units of formational and member rank had to be used. As already mentioned (Jeletzky, 1961a, pp. 3-4, 1963, pp. 57-58), none of these units are sufficiently different and unique to be safely distinguished on lithology alone from lithologically similar units in other parts of the geological column of the area; they can only be related to each other by means of their fossil content. The most important lithological units of formational rank are shown in Figures 2-3. It is conceivable that additional sets of formational units may be needed when the Jurassic rocks of the Canoe Lake and Little Fish Creek areas are studied in greater detail.

Bug Creek Formation

Throughout that part of the area confined between Mount Toughenough and Teeweechee Mountain in the south and the latitude of Mount Davies Gilbert in the north the greater part of Jurassic system is contained in a single, 100? to 2,000 feet thick sandstone-siltstone unit. This predominantly sandstone unit was previously referred to as "older Jurassic rocks" or "unnamed sandstone unit" by Jeletzky (1958a, 1960, 1961a, b) and is named herein the Bug Creek Formation. The name is derived from Bug Creek which cuts through the east slope of the Aklavik Range at about 68°04' north latitude and reaches Husky Channel via an unnamed lake immediately north of Bug Lake (see Jeletzky, 1960, geol. map). The walls of Bug Creek canyon, which begins about 1 1/2 miles west of Bug Lake and ends about 7/8 of a mile farther west atop of Aklavik Range expose the complete sequence of Bug Creek Formation (Jeletzky, 1961b, Fig. 3; this paper Pl. III, Figs. 1-2; Pl. IV, Figs. 1-2; Pl. V, Figs. 1-2). The easier accessible section along the southern wall of the canyon was selected as the type section of the formation (see Section 4 of the Appendix).

Aklavik Range, Martin Creek and Canoe Lake area

The Aklavik Range between the headwaters of Jimmy Creek in the south and Mount Gifford in the north is considered as the area of typical development of Bug Creek Formation. The following description of Bug Creek Formation is based on the detailed study of several excellent sections in this area including its type section. So far as known, the equally good

sections of Bug Creek Formation exposed on Martin Creek west of Aklavik Range and the less satisfactorily exposed sections around Canoe Lake and in headwaters of Cache Creek do not differ materially from the sections of Aklavik Range. These sections are considered to be within the area of typical development of the formation.

Stratigraphy

Bug Creek Formation comprises a 400 to 800 feet thick succession of clean to silty, mostly fine grained, quartzose sandstones interbedded with considerable units and beds of grey to dark grey, more or less sandy siltstone and some interbeds of grey, silty shale. Shale and siltstone interbeds carry concretions and bands of calcareous shale, impure limestone and/or clay ironstone. Minor interbeds of medium to coarse gritty and pebbly sandstone and pebble conglomerate appear to be confined to the lower 100 to 250 feet of the formation. In its type section Bug Creek Formation has a measured thickness of about 662 feet.

The following lithological members of Bug Creek Formation are recognizable in descending order in all studied sections; some of these members are recognizable beyond the area of typical development.

1. Upper sandstone member comprising the upper 200 to 250 feet of the formation and overlain directly by Husky Formation. The Upper sandstone member consists mostly or almost exclusively of massive-looking to heavily bedded, blocky fracturing, grey to buff, sometimes lavender-tinged, fine to medium grained, clean, quartzose sandstone. This sandstone is mostly well cemented and reasonably hard; it may become dense and quartzite-like in some sections, especially in the west and southwest parts of the area. This sandstone is resistant and tends to form precipitous bluffs and steep escarpments (Jeletzky, 1961b, Fig. 3). Variable but always minor interbeds of softer, speckled grey to dark grey, fine grained sandstone occur in the Upper sandstone member.

2. Sandstone-siltstone member comprises 170 to 190 feet of softer, fine grained, often more or less silty, often dark grey and shale-like looking sandstones which immediately and apparently gradationally underlie the Upper sandstone member. These sandstones are interbedded with considerable dark grey, sandy to very sandy siltstones. Some interbeds of dark to brown grey, silty shale with clay ironstone concretions and bands occur as well; these interbeds tend to increase in number and thickness westward and? northward. All rock varieties tend to be soft and weather recessively producing gentle slopes or depressions between bold escarpments or steeper slopes built of the Upper and Intermediate sandstone members.

3. Intermediate sandstone member consists of 70 to 100 feet thick succession of weathering-resistant and largely clean, quartzose sandstones somewhat resembling those of the Upper sandstone member. These sandstones apparently gradationally underlie the sandstone-siltstone member. The Intermediate sandstone member consists of largely lenticular interbedding of more or less hard and cliff-forming, buff to whitish grey, fine grained sandstones with similar rose-coloured, bright red, wine red and green sandstones. All colour phases are mostly thin bedded and intensively crossbedded unlike the generally massive-looking to heavily bedded, blocky fracturing and uniformly coloured sandstones of the Upper sandstone member. Minor interbeds of medium to coarse grained, sometimes gritty and pebbly sandstone often accompanied by belemnite "battle fields" form another distinctive feature of Intermediate sandstone member. Some interbeds and nests of coaly sandstone may occur in the southernmost sections of the member (see Section 17 of the Appendix). The lower contact is erosionally disconformable and is usually accompanied by a chert pebble conglomerate of varying thickness. This conglomerate is mostly anywhere from 6 inches to 4 feet thick; in some sections, however, it appears to reach some 40 feet in thickness (e.g. Section 155a of the Appendix). In such instances it becomes a distinctive lithological member in its own right and is recorded as the sixth or Conglomerate member of Bug Creek Formation. It should be stressed, however, that no diagnostic fossils have been found either in the Conglomerate member itself or in the underlying and overlying units assigned to the Bug Creek Formation in Section 155a. The correlation of this Conglomerate member with the much thinner pebble conglomerates occurring at the base of the Intermediate sandstone member in other better dated sections is, therefore, based only on the lithology of the units concerned, absence of Spirophiton-like whorls in them, and the presence of such whorls in the grey sandstones disconformably underlying the unit correlated with the Basal sandstone member. As already mentioned (p. 5), the Conglomerate member and the underlying unfossiliferous sandstones of Section 155a could also be correlative with the Triassic? Brat Creek Formation, although this is considered to be unlikely. The stratigraphical and structural significance of the erosional disconformity and pebble conglomerate occurring at the base of the Intermediate sandstone member is discussed below.

4. Grey siltstone member consists of a 70 to 90 feet thick succession of dark to bluish grey, often reddish to rust-weathering, more or less soft and friable, commonly sandy to very sandy siltstone and similar, mostly silty shale. This member may include some concretions and bands of calcareous shale and/or impure, bluish grey, cryptocrystalline limestone. Some interbeds of fine grained, silty, ferruginous sandstone and clay ironstone occur locally near the top and base of the unit. The Grey siltstone member appears to be absent in all measured sections south of Martin Creek and Mount Goodenough massif. Farther north it disconformably underlies the Intermediate sandstone member. The Grey siltstone member weathers markedly

recessively and tends to produce overgrown gentle slopes or depressions between steeper slopes or bold escarpments of the Intermediate and Basal sandstone members (see Jeletzky, 1961b, Fig. 7).

5. Basal sandstone member consists of 40 to 60 feet thick succession of grey to brown or rust-coloured, ferruginous sandstones with interbeds of grey to rust-coloured, ferruginous, sandy siltstone. This member gradationally underlies the Grey siltstone member. The sandstones of Basal sandstone member are characteristically fine to medium grained, poorly sorted, often gritty and pebbly and rich in phosphatic nodules representing casts of pelecypods and gastropods; they are often calcareous and contain numerous concretions and inclusions of strongly calcareous sandstone; scattered well rounded pebbles of black or grey chert occur in most beds of the member and mostly range from 1/8 to 1/2 inch in diameter. The number of these pebbles appears to increase southward in the Aklavik Range. Nests and thin lenses of these pebbles appear locally in the southernmost known sections of the member in the proximity of Jurassic Butte (see Sections 17 and 24 of the Appendix and Jeletzky, 1961b, Figs. 5, 7; this paper, Pl. 6, Fig. 1).

The Basal sandstone member appears to be absent completely in all sections situated between the headwaters of Martin Creek and Mount Goodenough massif on the one hand and the Barrier River highlands on the other (see below).

Contact with the underlying Permo-Carboniferous rocks is in the nature of a regional unconformity (Jeletzky, 1958a, p. 1593) as the Basal sandstone member overlies at least two different units of this sequence in different parts of Aklavik Range. Close to 400 feet of Permian rocks have been eroded away in some of these sections prior to the deposition of the Basal sandstone member.

It should be stressed that all above described lithological types of Bug Creek Formation are indistinguishable lithologically from the Devonian and Permo-Carboniferous clastic types occurring in the same area. The red-weathering, Permian or? Upper Carboniferous sedimentary breccia (Jeletzky, 1958a, p. 1593) is the only exception. The reliable differentiation of Bug Creek clastics from their Palaeozoic analogs is only possible with the aid of fossils. Among these belemnites are the most easily recognizable, common diagnostic elements of the Bug Creek Formation while the even more common and easily recognizable Spirophyton-like problematica appear to be restricted to the underlying Permian sandstones and siltstones.

Age and Correlation

The Upper sandstone member of Bug Creek Formation did not yield any diagnostic fossils within the area of its typical development, or for that matter anywhere else. This member is, however, mostly or entirely marine in origin as indeterminate pelecypods and very rare indeterminate ammonite fragments have been observed in some of the sections in Aklavik Range. Upper sandstone member is, however, overlain with a sharp and possibly disconformable contact by the basal beds of Husky Formation which contain Buchia concentrica (Sowerby) s. lato diagnostic of the Upper Oxfordian and Lower Kimmeridgian time.

The upper part of the underlying Sandstone-siltstone member has yielded Cadoceras (Stenocadoceras) canadense Frebold (in press) and Cadoceras septentrionale Frebold var. latidorsata Frebold (in press). According to Dr. Frebold these ammonites are either mid- or early Callovian in age; they are, thus, younger than the late Bathonian Cadoceras crassum and related forms found at various localities in the same general area. Being conformably and gradationally underlain by early to mid-Callovian rocks and possibly disconformably overlain by the Upper Oxfordian or early Kimmeridgian rocks the Upper sandstone member can only be of late Callovian and/or Oxfordian age.

The top part of the Intermediate sandstone member has yielded Cranocephalites borealis Spath, which is tentatively considered to be an index fossil of the Upper Bajocian rocks of the boreal realm (Frebold, 1961, p. 26). The larger part of Sandstone-siltstone member confined between Cadoceras (Stenocadoceras) canadense beds above and the Cranocephalites borealis-bearing part of the Intermediate sandstone member below must, therefore, correspond to Cadoceras spp., Arcticoceras kochi, Cadoceras crassum? and Arctocephalites elegans zones of the Bathonian stage.

The larger lower part of the Intermediate sandstone member underneath its Cranocephalites borealis beds (see Section 4 of the Appendix) did not yield any ammonites. The large Acroteuthis-like Pachyteuthis forms of the Cranocephalites borealis beds range, however, down to the base of the Intermediate sandstone member. Such belemnites are, however, completely unknown in the Erycites cf. E. howelli and Pseudolioceras sp. zone of central and northern Richardson Mountains. The writer is therefore, inclined to date all these beds of Intermediate sandstone member as late to mid-Bajocian. This dating must, however, remain tentative pending the discovery of diagnostic ammonites in the lower or middle part of Intermediate sandstone member.

The lower and middle parts of Grey siltstone member has yielded Echioceras s. lato sp. indet. an Upper Sinemurian index fossil (Frebold,

1960, p. 26). The highest occurrence of this ammonite is about 26 feet below the top of the member. Younger beds of the member have only yielded non-diagnostic pelecypods and gastropods. As this fauna lacks any belemnites, however, it is tentatively dated pre-Toarcian (pre-Upper Lias). If this conclusion is correct, all the Toarcian as well as the lower Bajocian and part or all the Middle Lias (Pliensbachian stage) are absent between the Grey siltstone and Intermediate sandstone members of Bug Creek Formation in the area of its typical development. This conclusion agrees well with the presence of an erosional boundary mostly accompanied by a basal conglomerate at the base of the Intermediate sandstone member in all better exposed sections of Bug Creek Formation in Aklavik Range and on Martin Creek (see Sections 17, 24 and 155a of the Appendix and Fig. 3). The marked thickening of Bug Creek Formation on the eastern slope of White Mountains (see Section 165 of the Appendix and Fig. 3) and the appearance of the Toarcian ammonites in this general area (Frebold, 1960, p. 4) also favours this interpretation. The hiatus between the lower and upper parts of Bug Creek Formation in Aklavik Range and on Martin Creek was explained by Jeletzky (1963, p. 79) as the result of flexing and uplift of the northeasterly trending ancestral Aklavik Arch sometime in the late Lower or? earliest Middle Jurassic time. The revision of age of the Brat Creek Formation and Coaly shale division does not invalidate this interpretation, as there is other evidence, such as the apparent disappearance of the Basal sandstone and Grey siltstone members south of Martin Creek and Mount Goodenough massif and the reappearance of the time equivalents of the Basal sandstone member south of Rat River, favouring these tectonic movements. If so, the Upper Sinemurian sea covered all of the eastern slope at least as far south as Ager and Westermann's (1963, p. 602) fossil locality between Rat and Barrier River (long. W. 135°49'; lat. N. 67°36') but was completely eroded from the intervening belt representing the crest of Aklavik Arch prior to the deposition of the Intermediate sandstone member and its equivalents. This interpretation finds further support in the apparently complete absence of the equivalents of the Basal sandstone and Grey siltstone members in the Horn Lake-McDougall Pass area (see pp. 24-25, Snafu Ridge section, etc.), which lies on the southwestern continuation of the ancestral Aklavik Arch.

The Basal sandstone member has yielded such diagnostic Upper Sinemurian ammonites as Oxynoticeras oxynotum (Quenstedt), Gleviceras? sp. indet. and Arctoasteroceras jeletzkyi Frebold, 1960. The latter form ranges throughout the member (see Sections 4 and 24 of the Appendis), with the exception of its basal 10 to 15 feet (including the basal conglomerate). Assuming that the age of these undated basal beds of the member does not differ materially from that of the Upper Sinemurian beds that immediately and gradationally overlie it, we must conclude that the early Lower Jurassic sea flooded the area of typical development of Bug Creek Formation only in late Sinemurian time. Only a hiatus at the base of Bug Creek Formation corresponds to the Lower Sinemurian and Hettangian stages in this area.

Little Fish Creek area

The northernmost exposures of Bug Creek Formation known to the writer occur on a major left (southwesterly) tributary of Little Fish Creek (marked by a cross in Fig. 1). There the typically developed Upper sandstone member outcrops in several strongly faulted sections in both banks of the creek about 10 miles south of Mount Davies Gilbert. So far as known, only the upper 80 to 100 feet of this member are exposed in these sections. Blackish grey shale and siltstone of Husky Formation overlie the light grey to buff, massive-looking and mostly dense, fine grained sandstone of Bug Creek Formation with a sharp, possibly disconformable contact; they outcrop in both banks of the creek for the next 1 3/4 to 2 miles upstream. No continuous section of Husky Formation was observed, however, and the southern end of its outcrops was not reached.

West of the here discussed confluent of Little Fish Creek the quartzose sandstones of Bug Creek Formation seem to thin out and then completely wedge out within the next 5 to 8 miles. Still farther west only insignificant sandstone beds and members have been observed in the sequence of Jurassic and Lower Cretaceous shales and siltstones which is at least 7,000 to 8,000 feet thick. The lithological monotony of rocks and the extreme paucity of index fossils prevented the writer from subdividing this sequence and recognizing the time equivalents of the Jurassic formations of the eastern slope within it during the brief reconnaissance of this sequence.

Nothing at all is known about the thickness and facies of the older members of Bug Creek Formation in Little Fish Creek area. Because of the general tendency of all Jurassic units of eastern Richardson Mountains to become progressively thicker and more shaly toward the north and west, these parts of the Bug Creek Formation may well be largely represented by shale and siltstone and be at least as thick and complete as those observed on the eastern slope of White Mountains.

Eastern Slope of White Mountains

West of Martin Creek area the facies of Bug Creek Formation changes, its thickness increasing gradually until it becomes at least three to four times as thick as in Aklavik Range on the eastern slope of White Mountains Dome (see Sections 65 and 165 of the Appendix and Fig. 3). The lithology of the Bug Creek Formation appears to be extremely variable within shortest distances. In Section 65 (Goat and Eagle) the formation is represented almost exclusively by various sandstones while in Section 165 situated only about 5 miles farther northeast it includes considerable units of pure to silty shale with clay ironstone. These lithological changes in Section 165 are ascribed tentatively to Section 165 being farther away from the

ancestral Aklavik Arch, more data are needed, however, to confirm or to reject this interpretation.

The Section 165 can be correlated satisfactorily with the previously described succession of the Aklavik Range, in spite of its greater thickness and more shaly lithology. The Upper sandstone member of this section retains much of its typical lithology, except for the greater ratio of dark grey, silty sandstones and the appearance of clay ironstone concretions and bands. The top of the member was not seen; its thickness increases sharply, however, as no less than 920 feet of the Upper sandstone member is exposed in this Section. The Sandstone-siltstone member changes its facies markedly and is only recognizable because of its stratigraphic position; it is represented by clay shale with clay ironstone concretions but apparently lacks any interbeds of silty sandstone. The thickness of the Sandstone-siltstone member equivalent is, however, only 140 feet in the Section 165 as against 170 or more in the Aklavik Range. The Intermediate sandstone member has retained its typical lithology, except for the appearance of scattered clay ironstone concretions; its thickness has, however, increased markedly reaching 371 feet in Section 165. No trace of an erosional disconformity or pebble conglomerate was, however, observed at the base of the Intermediate sandstone member in this section, or for that matter in any other section visited in the area. This circumstance and the silty and clayey character of sandstones forming the basal 50 to 80 feet of the member suggests its conformable and gradational superposition on the underlying Jurassic rocks, which are represented by 147 to? 200 feet thick unit of dark grey shale with clay ironstone in the proximity of Section 165. According to its stratigraphic position, this Basal shale member should include rocks equivalent to the Grey siltstone and Basal sandstone members of the Aklavik Range. This purely lithological correlation is, unfortunately, only supported by the occurrence of large Pachyteuthis sp.indet., apparently conspecific with those occurring in the Bathonian-Bajocian rocks of the Aklavik Range, in the units 5 to 7 inclusive of Section 165. The Basal shale member of this section is believed, however, to include younger rocks than its stratigraphic equivalents in Aklavik Range. Not only is its contact with the overlying Middle? Bajocian rocks conformable and gradational but the Toarcian and? Lower Bajocian ammonites have been found at an unknown level in the proximity of Section 165 (Frebold, 1960, p. 4). Judging by the lithology of enclosing rock, these ammonites have been collected from the equivalents of the Basal shale member. It is suggested tentatively, therefore, that this member may include at least all of the Pliensbachian and Toarcian stages in addition to the Upper Sinemurian stage; it could include Lower Bajocian as well. The hiatus separating the Grey siltstone member from the Intermediate sandstone member in the Aklavik Range-Martin Creek area seems, therefore, to be absent completely in the proximity of the Section 165 on the eastern slope of White Mountains (Fig. 3).

The Basal shale member of the eastern slope of White Mountains should also include some Lower Sinemurian rocks containing Arietites, genus and species indet. (Frebold, 1960, p. 3) has been reported from a locality just east of Section 165. This ammonite too is enclosed in clay ironstone matrix compatible with its having been collected from rocks of the Basal shale member.

The eastern slope of White Mountains is the westernmost part of the area known to the writer where the Bug Creek Formation retains much of its lithological habit. All Jurassic sections studied west of the Palaeozoic core of White Mountains can only be correlated with those of the eastern slope on their fossil content as most of sandstone units become replaced by shales and siltstones in this interval.

Headwaters of Treeless and Bear Creeks, Brat Creek and Rat River Gorge

The upper part of Bug Creek Formation retains most of its characteristic lithological features between Mount Goodenough massif and Martin Creek on the one hand and the headwaters of Treeless and Bear Creek on the other. Its Basal sandstone and Grey siltstone members are, however, not recognizable and apparently absent in all sections studied south of Mount Goodenough massif and the headwaters of Martin Creek.

The adjacent Section 65 (Goat and Eagle) of the Bug Creek Formation is of comparable thickness (1,124 feet); it consists, however, almost entirely of various sandstones (often quartzites) and lacks any thick shale units comparable with the Sandstone-siltstone member equivalent and the Basal shale member of Section 165. An early Sinemurian fauna including Arietites genus and species indet. (= Vermiceras sp. indet. of Dr. C.H. Stelck, University of Alberta) was found in talus within a largely covered interval 600 to 682 feet above the assigned base of the Bug Creek Formation. This ammonite was found, furthermore, above beds containing belemnites and Inoceramus, which the writer has never observed elsewhere in the area. Although this section was not personally seen by the writer it is hard to escape a suspicion that it is repeated by faulting rather than continuous. If this assumption is correct the slightly sandy shale of the basal 80 feet of the interval 562-682 could correspond to some part (a fault slice?) of the Basal shale member of Section 165. The clay ironstone matrix of Arietites genus and species indet. (Frebold, 1960, p. 3) is, at any rate, compatible with its having been collected from the equivalent of the Basal shale member of Section 165. Accepted as it stands, the almost exclusively sandy character

of Section 65 (Goat and Eagle) could be explained by its closer proximity to the crestal part of the ancestral Aklavik Arch as compared with Section 165.

The Bug Creek Formation changes lithologically between the Mount Goodenough massif and headwaters of Martin Creek on the one hand and the headwaters of Treeless and Bear Creeks on the other. The Basal sandstone and Grey siltstone members are no longer recognizable either on lithology or fossil content in all sections studied in this part of the area, beginning with the eastern slope of Bear Creek Dome of Jeletzky (1961b, pp. 571-2, Fig. 2) and are believed to have been completely removed by erosion. The thickness of the Sandstone-siltstone member becomes, furthermore, markedly reduced in the same area (only about 50 feet thick in Section 72a), which is compensated by increase in thickness of the Upper sandstone member to some 600 feet or more in Section 72a and other adjacent sections. The Intermediate sandstone member becomes, on the contrary, more silty in its basal 80 feet. Siltstone may form about 50 per cent of the rock in this part of the member. The age of the basal beds of the Intermediate sandstone member should be about the same as in the more northerly parts of Aklavik Range. Acroteuthis-like forms of Pachyteuthis characteristic of this member elsewhere but not known to range into the underlying rocks were found throughout the thickness of the Intermediate sandstone member in Section 72a and other sections.

An interval about 80 to 100 feet thick underlying the Intermediate sandstone member in the area concerned is invariably poorly exposed or covered in the sections studied. Judging by the patches of silty or shaly rocks containing poor plant remains, this interval is already underlain by the previously discussed Triassic? rocks correlative with those of the Coaly shale division of Rat River Gorge and lower Brat Creek.

South of the headwaters of Treeless and Bear Creeks extensive but scattered, strongly faulted and consequently incomplete exposures of Bug Creek Formation abound on Brat Creek and in Rat River Gorge within the Barrier River Fault Block (Jeletzky, 1961b, pp. 568-9, text-figs. 20-21; this report Pl. II, Fig. 1; Pl. VI, Fig. 2). In Rat River Gorge and farther south on Brat Creek and between Brat Creek and Barrier River the Bug Creek Formation is represented by 300 to 400 feet of light grey to buff, mostly fine grained, clean and quartzose sandstone. This sandstone is for the most part lithologically identical with that of the Upper sandstone member of the more northerly sections; it includes, however, considerable interbeds of the thin bedded, ripple marked and crossbedded, multicoloured sandstones similar to those of the Intermediate sandstone member. No silty units similar to that of the Sandstone-siltstone member of the Aklavik Range have, however, been observed on Brat Creek or in Rat River Gorge; nor was it

possible to see any regularity in the vertical distribution of different sandstone varieties in the sections studied. The absence of any silty units similar to the Sandstone-siltstone member of the Aklavik Range is probably due to their lateral replacement by cleaner and harder sandstone varieties closer to the southeastern margin of the Jurassic basin of the Richardson Mountains. This interpretation is consistent with the previously mentioned thinning out of this unit in the headwaters of Treeless and Bear Creeks as compared with more northerly sections.

As already mentioned, the Bug Creek Formation of the Brat Creek-Rat River Gorge area does not seem to include any rocks older than the equivalents of the Intermediate sandstone member, except near its southern margin where the equivalents of the Basal sandstone member have been reported to be present between Barrier and Rat River (Ager and Westermann, 1963, p. 602). This interpretation (Fig. 1) is, however, largely based on negative evidence and needs further verification.

The upper part of the Bug Creek Formation on Brat Creek and in Rat River Gorge appears to be distinctly younger than its top beds in Aklavik Range. In the latter area, and apparently west and north therefrom as well, the basal beds of Husky Formation (see there) contain the Upper Oxfordian to Lower Kimmeridgian Buchia concentrica s. lato fauna. On Brat Creek and in Rat River Gorge, however, the basal beds of Husky Formation contain the early forms of Buchia mosquensis s. lato of mid- or? late Kimmeridgian age (see Sections 153 and 154 of the Appendix). The late Jurassic subsidence of the eastern slope of Richardson Mountains (Jeletzky, 1963, p. 80), which resulted in the abrupt replacement of the shallow water Bug Creek sandstones by the deeper water and more pelagic siltstones and shales of Husky Formation has, therefore, occurred appreciably earlier in the northern part of the eastern slope (Aklavik Range to (?) Little Fish Creek area) than farther south (Brat Creek-Rat River Gorge area). It will be shown later in this report that yet farther south the basal beds of the arenaceous facies of Husky Formation and those of the North Branch Formation contain even younger, presumably early Portlandian forms of B. mosquensis s. lato. The upper boundary of the Bug Creek Formation is, thus markedly diachronic in the north-south direction (and presumably in west-east direction as well, although this cannot be demonstrated biochronologically as yet) over all that part of the eastern slope formerly covered by Jurassic seas.

In Brat Creek-Rat River Gorge area the Bug Creek Formation is still marine, in part at least, as a few poorly preserved marine pelecypods have been seen (but not collected) locally in its lower part. No diagnostic fossils of any kind have, however, been found in Bug Creek Formation there, except for those reported by Ager and Westermann (1963, p. 602) from a

point situated farther southwest than any visited by the writer in this part of the area. As already mentioned, however, this late Sinemurian fauna is believed to have been collected from the lower part of the formation, which is completely absent in the Brat Creek-Rat River Gorge sections.

Mount Toughenough area

No outcrops of Bug Creek Formation have been observed between the middle course of Brat Creek on the one hand and Mount Toughenough on the other (see Jeletzky, 1960, geol. map). However, on the southeastern shoulder of Mount Toughenough about 100 feet or so of typical Bug Creek sandstones lithologically identical with those of the Brat Creek-Rat River Gorge area (see Section 115 of the Appendix) are exposed. These sandstones are overlain by the arenaceous facies of Husky Formation transitional to that of North Branch Formation and appear to be underlain by poorly exposed micaceous, brownish grey shales similar to those of the ? Palaeozoic to ? Jurassic shale division outcropping on North Branch of Vittrekwa River directly beneath the North Branch Formation (Fig. 2). It is, therefore, probable that the exposed thickness of Bug Creek Formation in Mount Toughenough section is close to its total thickness in that part of the eastern slope. Considering the apparently complete absence of Bug Creek sandstones farther south in Vittrekwa River basin, it seems fair to conclude that the Mount Toughenough exposure represents a thin wedge of the Bug Creek Formation occurring at or close to the southeastern margin of its occurrence. Whether or not the Bug Creek Formation simply wedges out in this area or becomes laterally replaced by the shales of ? Palaeozoic to ?Jurassic shale division is not known.

Horn Lake-McDougall Pass area

West and southwest of Rat River Gorge the Bug Creek Formation occurs in its normal stratigraphical position between the Permian clastics below and Husky Formation above. Neither Brat Creek conglomerate nor the Coaly shale division have been seen in any of the sections measured in this part of the eastern slope. As on the eastern slope of White Mountains, the Bug Creek Formation appears to loose its lithological identity at or closely west of McDougall Pass and Summit Lake by passing laterally into a sequence of shale and siltstone several thousand feet thick with only insignificant units of dense, quartzite-like sandstones and quartzites.

The total thickness of Bug Creek Formation in Horn Lake-McDougall Pass area is considerably greater than in Aklavik Range and Brat Creek-Rat River Gorge areas; it approaches, in fact, the thickness measured on the eastern slope of White Mountains in spite of the fact that only time equivalents of the upper three members of Bug Creek Formation of Aklavik Range are present in this part of the area (see below and in Sections 155,

155b and 166 of the Appendix). The complete thickness of Bug Creek Formation is 1,345 feet in Section H-W-90 (see in Appendix) on Snafu Ridge about 10 miles south of McDougall Pass. It is believed to be somewhat greater here than in the sections north of Summit Lake.

The Bug Creek Formation is only recognizable as a gross lithological unit in Horn Lake-McDougall Pass area. It is represented by a more or less irregular interbedding of grey, buff or brown, often rust- to orange-weathering, fine grained, quartzose sandstones interbedded with lesser units and beds of dark grey to black, silty shales and sandy siltstones with clay ironstone concretions and bands. The sandstones are often calcareous and are mostly or entirely marine, judging by the presence of marine fossils in many parts of the sequence. This lithology is obviously transitional between that observed in more easterly parts of the eastern slope on the one hand and the almost entirely shaly development of contemporary Jurassic rocks west of McDougall Pass and Summit Lake. None of the lithological members recognizable in the Aklavik Range, on Martin Creek, on the eastern slope of White Mountains and farther north can be differentiated in any of the sections measured in Horn Lake-McDougall Pass area including the complete section of the formation on Snafu Ridge. Nor is it possible at present to propose a local set of lithological members.

Fossils collected in the basal beds of Bug Creek Formation in the Horn Lake-McDougall Pass area strongly suggest that no rocks older than the Arctocephalites elegans zone, and possibly Cranocephalites borealis zone, are present in this part of the area. The time equivalents of the Grey siltstone and Basal sandstone members of the Aklavik Range and those of the Basal siltstone member of the eastern slope of White Mountains are assumed to be absent there because of the subsequent erosion caused by the flexing and upheaval of the ancestral Aklavik Arch prior to the deposition of the Intermediate sandstone member equivalents. As already mentioned, however, this interpretation needs more palaeontological support. It would be most important to establish, in particular, whether or not the Lower Jurassic rocks reappear south of Snafu Ridge (Section H-W-90 of the Appendix) as it seems likely.

The hiatus separating the Jurassic rocks of Horn Lake-McDougall Pass area from the underlying rocks is considerably greater than that occurring in the Aklavik Range and on the eastern slope of White Mountains (Fig. 2). No basal Jurassic conglomerates corresponding to those of the last mentioned areas have, however, been observed in most sections studied in Horn Lake-McDougall Pass area. There the contact between the Jurassic and Permian rocks is nearly paraconformable throughout and very easy to miss if one does not watch closely the disappearance of belemnites and the appearance of Spirophyton-like whorls in the lithologically similar sandstones above and below the contact.

Teeweechee Mountain area

The southwesternmost exposures of Bug Creek Formation known to the writer occur in the steep slopes of the high mountainous massif (about 5,500 feet) forming the crest of Richardson Mountains at about 67°14' north lat. and 136°08' west long. (Pl. IX, Fig. 1). This massif forms the watershed between Stony Creek and North Branch of Vittrekwa River on the one hand and northern confluents of Rock River on the other. In these sections (see Sections 122 and 122a of the Appendix) the Bug Creek Formation transgressively overlaps Upper Devonian to Permian? rocks and is apparently disconformably overlain by the arenaceous facies of Husky Formation. No rocks equivalent to the ? Palaeozoic to ? Jurassic shale division have been seen in any of the sections studied.

Bug Creek Formation is represented by 200 to ? 300 feet of light to medium grey, very fine grained to fine grained, well sorted and clean, quartzose sandstones which are mostly hard, dense and quartzite-like. Sandstones are mostly thin bedded but contain interbeds of indistinctly bedded to massive-looking sandstones. No fossils of any kind have been found.

The general appearance of Bug Creek Formation in Teeweechee Mountain area is similar to that of the Mount Toughenough section and the thickness is in the same order of magnitude. These exposures are, therefore, assumed to be close to the southern margin of formation's occurrence and to represent its thin wedge similar to that of Mount Toughenough section in the southeast The apparently complete absence of Bug Creek sandstones in the adjacent sections of the North Branch of Vittrekwa River supports this conclusion.

Husky Formation

The formal name Husky Formation is introduced herein for the unit, 800 to 2,100 (or more?) feet in thickness of dark to brownish grey shale and siltstone with mostly minor interbeds of coarser clastics previously referred to as the Lower shale-siltstone division (Jeletzky, 1958b, pp. 3-7; 1960, pp. 3-5; 1961a, pp. 6-9; 1961b, p. 537, Fig. 1).

Husky Formation overlies the Bug Creek Formation whenever this latter occurs and is not known to overlap transgressively any older rocks. South of the upper course of Stony Creek and in Teeweechee Mountain area it is largely replaced laterally by sandstones and pebble conglomerates of North Branch Formation.

The name Husky Formation is derived from Husky Creek which cuts through the east slope of Aklavik Range at about 68°01'20" North lat. and reaches Husky Channel via an unnamed lake (see Fig. 1). Section 22 measured along the north slope of the creek at the point 3 1/2 miles west of

Husky Channel and 1 mile southeast of the top of Jurassic Butte was selected as the type section of Husky Formation. The upper part of this section has already been described (Jeletzky, 1958b, pp. 18-27) and the lower part (see Jeletzky, 1961b, Fig. 10; this report Pl. VIII, Fig. 1) is described in the Appendix of this report. The Upper member of the formation is best known from Sections 11 and 16 (Jeletzky, 1958b, pp. 39-47 and 66-67). This report is largely concerned with the Jurassic part of Husky Formation and the Jurassic-Cretaceous boundary which runs through its upper part. The description of stratigraphy and age of the uppermost Jurassic (Upper Tithonian) and early Lower Cretaceous part of the formation was already given in the above mentioned reports of the writer. This information is not repeated in this report and the description of the Uppermost Jurassic and early Lower Cretaceous part of Husky Formation is limited to such new data as became available, and to some conclusions resulting from these new data.

Little Fish Creek area

The northernmost exposures of Husky Formation known to the writer occur in the middle course of major left (southwesterly) confluent of Little Fish Creek (marked by a cross in Fig. 1). There, moderately to strongly faulted and folded shales and siltstones of the Lower member (restricted) of Husky Formation outcrop in both banks of the creek for some 2 miles upstream from the previously described outcrops of Bug Creek Formation. The basal beds of Husky Formation did not yield any diagnostic fossils in these sections; its younger beds, estimated to be a few hundred feet above the base, contain locally Buchia mosquensis (Buch) s. lato and B. piochii s. lato. It is estimated that these younger beds comprise at least 800 feet of typical dark to brownish or blackish grey shales and siltstones of the Lower member (restricted) with interbeds of grey, fine grained sandstone. No continuous section was observed, however, and the southern end of outcrops of Husky Formation was not reached. The upper part of Husky Formation, including its red-weathering shale member, has been observed from a distance in steep slopes of high, meza-like hills situated a couple of miles east of the creek; it is capped by buff sandstones of the Lower sandstone division in these sections.

No index fossils of the Husky Formation have been collected west of the here discussed outcrops in the Central Richardson Mountains. It is, therefore, unknown which part of the already mentioned at least 7,000 to 8,000 feet thick shale-siltstone sequence outcropping there corresponds to the Husky Formation of the eastern slope.

Little Fish Creek and Cache Creek area

Extensive exposures of Husky Formation are known to exist on Little Fish Creek east and southeast of its already described exposures on

the left confluent of Little Fish Creek. So far as known these sections do not differ materially from those observed farther south on Martin Creek and in Aklavik Range. Only the Arenaceous member is not known to occur in this area. None of these sections was, however, studied in detail by the writer.

Aklavik Range and Martin Creek area

Aklavik Range and Martin Creek area is considered to be the area of typical development of Husky Formation. The following description of this formation is based on the detailed study of a number of incomplete but otherwise good sections in Aklavik Range between headwaters of Treeless Creek and lower canyon of Donna River. Even better, possibly complete, sections of the formation have been observed from the distance in the east bank of Martin Creek; none of these has, however, been studied on the ground. The extensive sections of Husky Formation exposed in the upper part of Boneyplum Creek have not been studied in any detail. North and northwest of lower Donna River only incomplete and scattered outcrops of the formation have been observed east of Canoe Lake and headwaters of Cache Creek.

Stratigraphy

In the area of its typical development Husky Formation consists predominantly of dark grey, blackish grey or brownish grey shales and siltstones interbedded with rather variable but largely minor amounts of grey, fine grained to very fine grained and silty sandstone, medium to coarse grained, gritty to pebbly sandstone and fine to medium pebble conglomerate. Numerous 1/3 to 3 feet thick bands and various concretions of hard, rust to wine-red weathering clay ironstone are common in most parts of the succession. Cannon ball like concretions of grey shale and siltstone may be common locally. Nests and layers of Buchia coquina and limestone concretions occur here and there.

All studied sections are incomplete. The estimate of the complete thickness of Husky Formation is, therefore, based on a somewhat tentative correlation of several sections. This task has been made difficult by the lithological monotony of the formation and dearth of the easily recognizable horizon marker beds within it. The best estimate obtained for the central part of Aklavik Range is in the order of 1,200 to 1,270 feet. This estimate may be somewhat too high as only between 1,040 and 1,070 feet of rocks was actually measured in good, continuous sections and the remaining 160 to 200 feet represent an allowance for faulted out beds which have only been observed in some short and discontinuous sections not easily comparable with other sections. The total thickness of Husky Formation in headwaters of Treeless Creek is believed to be only between 800 and 900 feet and the same may be true of the unexplored sections seen on Martin Creek.

The lower contact of Husky Formation is always sharp and uneven. Numerous small hollows and pockets of the undulating upper surface of Bug Creek Formation are filled out by the fissile, sulphur-stained shale of basal Husky Formation. No accumulation of coarser detritus particles, let alone a basal conglomerate was, however, observed at the base of Husky Formation (see Sections 2 and 22 of the Appendix). This contact may therefore reflect an abrupt, regional subsidence of the sea bottom accompanied by organic or inorganic etching of the upper surface of Bug Creek Formation, rather than its upheaval and emergence followed by erosion and subsidence.

The upper contact of Husky Formation was described elsewhere in this report. The formation has been subdivided into an Upper and Lower member (Jeletzky, 1958b, p. 4). There is no need to revise the Upper member but the Lower member is clearly subdivisible either on regional or areal basis; it is, furthermore, too thick to be practically useful. Two new informal members are, accordingly, introduced in this report for the lithologically distinctive units formerly treated as the upper part of the Lower member and this term is restricted herein for the underlying, thicker part of the "Lower member" of the previous usage. As it will be shown below, at least one of the new members is a widespread unit which retains its lithological identity through the most part of the eastern slope and can even be recognized on the western slope of the Richardson Mountains.

The new scheme of lithological subdivision of Husky Formation is the following (in descending order):

1. Upper member. This member comprises from 85 to 140 feet of mostly more or less thin alternation of dark to blackish grey, sandy to very sandy siltstone with lesser amounts of lighter grey, fine to very fine grained, silty to very silty sandstone and dark grey to black shale; some light grey to buff sandstone interbeds appear near the top of the unit. Perhaps the most distinctive feature of the Upper member is the rarity or absence of the marked to intensive rust to red-brown weathering habit and of the red brown, orange or wine-red weathering clay ironstone concretions and bands. Whenever present, the concretions of the Upper member tend to be grey to dark grey, hard shale or siltstone. The monotonously dark to blackish grey rocks of the Upper member are, furthermore, more sandy than those of the underlying members, with the exception of the Arenaceous member. These characteristic features of the Upper member are well represented in Sections 11 and 16 (Jeletzky, 1958b, pp. 39-47 and 66-67); they are, however, less typically displayed in some other sections (see Section 72 of the Appendix). The Upper member grades imperceptibly into the Lower sandstone division (Jeletzky, 1958b, p. 4; 1961b, Fig. 15); its lower contact was, however, nowhere observed because of faulting or discontinuous outcrops. It is assumed that its complete thickness is in excess of 200 feet.

The Upper member is a good horizon marker if palaeontologically controlled. Although it can be easily distinguished from other members of Husky Formation on lithology alone, it is indistinguishable from several sandy siltstone units occurring in the Lower Cretaceous, older Jurassic and Palaeozoic rocks of the area. One has, accordingly, to establish the identity of Husky Formation on palaeontological grounds before subdividing or correlating its sections on lithology.

The Upper member is not limited to the Aklavik Range but occurs in some other parts of the eastern slope and is distinguishable even on the western slope of Richardson Mountains (Jeletzky, 1961a, pp. 8, 30).

2. Red-weathering shale member. This member includes the uppermost 55 to 75 feet of the "Lower member" of previous reports (see above). Its top was not definitely recognized in any of the best sections on the eastern slope but it is believed to underlie immediately and gradationally the sandy siltstones of the Upper member. The complete thickness of this member is assumed to be close to or in excess of 100 feet in central Aklavik Range. In the complete but somewhat anomalous section measured in headwaters of Treeless Creek (see Jeletzky, 1960, p. 6; Section 72 of the Appendix) it is only 55 to 60 feet thick, however.

The Red-weathering shale member is light to dark grey, or brownish grey, often distinctly banded or laminated, pure, commonly calcareous shale with numerous, mostly calcareous clay ironstone bands and concretions. Some of these concretions are ferruginous limestone rather than true clay ironstone. Shale and clay ironstone both weather markedly to intensively rust to orange and/or wine red. The different shades of these colours usually have a distinctly banded appearance in the outcrops (Pl. VII, Fig. 1). Whenever present, this unit of intensively red-weathering shale stands out in the outcrops, as on the west slope of Richardson Mountains (Jeletzky, 1961a, p. 8), where it can commonly be traced for miles from the air or from distant observations, and is clearly discernible even in poor exposures. The Red-weathering shale member is nearly always fossiliferous and, as it corresponds essentially or? entirely to the basal Cretaceous Buchia okensis zone, it conveniently marks the position of the Jurassic-Cretaceous boundary within Husky Formation. This lithologically distinctive unit is a good horizon marker which is not limited to Aklavik Range but occurs throughout the investigated part of the eastern slope of Richardson Mountains. As already mentioned (Jeletzky, 1961a, p. 8), furthermore, the same intensively red-weathering unit occurs in the same stratigraphic position in the middle part (Bell River basin) of the western slope of Richardson Mountains. More recently the presence of this red-weathering unit was established in several sections of the northern part of the western slope and it seems likely that it is equally characteristic for the area north of headwaters of Bell River. Even in the sandstone-conglomerate sequence of North Branch Formation the palaeontologically proven time equivalents of Buchia okensis zone are characterized by the same red-weathering habit and by the presence

of interbeds of rust to red-weathering, hard, ferruginous sandstone and sandy or silty clay ironstone (see Section 118, units 34-35 of the Appendix).

Although it is very distinctive within the sequence of Husky Formation the Red-weathering shale member is not a unique phenomenon in the geological column of the eastern slope of Richardson Mountains. Similarly coloured shales occur in the Upper shale-siltstone division, in Permian shale-siltstone units and farther down in the Palaeozoic. The Permian or? Carboniferous red-weathering sedimentary breccia is, furthermore, indistinguishable from the Red-weathering shale member when seen from a distance. It is accordingly necessary to establish the identity of Husky Formation and/or Red-weathering shale member on palaeontological grounds before using it for correlation purposes. Frequent palaeontological rechecking is, furthermore, recommended in view of frequent faulting and often poor outcrops in most parts of the area.

3. Arenaceous member. This member consists of some 40 to 120 feet of fine to (rarely) coarse grained, silty and often gritty and pebbly sandstone interbedded with an about equal amount of sandy, often more or less gritty and pebbly siltstone, and some shale. Most rocks are drab grey and the rust- to red-weathering habit is not pronounced. Minor interbeds of fine pebble conglomerate occur. Several beds of greenish grey to blackish green, moderately to strongly glauconitic sandstone and siltstone (often gritty and pebbly) form the top 1 to 6 feet of the member. The contact with the overlying Red-weathering shale member appears to be conformable and gradational, although fairly abrupt. The grey shales of the latter member are sandy and glauconitic in the basal 1-3 feet.

The maximum development of the Arenaceous member was observed in the type section of Husky Formation (see Section 22; Jeletzky, 1958b, pp. 19-21) where beds 15 to 25 inclusive are referable to this member. The Arenaceous member is, thus, 116 to 120 1/2 feet thick in this section; its topmost glauconitic beds are, however, faulted out there and its complete thickness must be close to 120-125 feet. The lithology of Arenaceous member in Section 28 (see in Appendix) is particularly characteristic, although it is much thinner there. Sections 1,41 and 72 also expose typically developed Arenaceous member (see in Appendix).

Unlike the Red-weathering shale member, Arenaceous member was only observed in Aklavik Range in headwaters of Boneyplum Creek and in headwaters of Treeless Creek. It seems likely that its absence west and north of this area is caused by the basinward change of facies resulting in the rapid pinching out of all arenaceous beds and members of Husky Formation and their replacement by shales and siltstones. The absence of Arenaceous member on Brat Creek is, however, more likely simulated by its nonexposure in the sections studied. Farther south the Arenaceous member is absent because of the shoreward facies changes of Husky Formation. No traces of Arenaceous member have been seen anywhere on

the west slope of Richardson Mountains (Jeletzky, 1961a, p. 8). Being a typical clastic wedge formed in the proximity of the eastern shore of the Upper Tithonian (=Upper Volgian) basin of the Richardson Mountains the Arenaceous member is not a reliable horizon marker. Even in Aklavik Range it is lithologically similar to the thinner units of coarser clastics occurring in the Lower member (restricted) of Husky Formation. Only the occurrence of the Arenaceous member immediately below the Red-weathering shale member permits its recognition in short, intermittently exposed or faulted sections.

The Arenaceous member is interesting in being apparently the only reflection of the widespread late Cimmerian (s. l.) orogeny (Arkell, 1956, p. 636, Table 28) on the eastern slope of Richardson Mountains. The only post-Oxfordian erosional boundary observed in the Upper Jurassic rocks of the area (Jeletzky, 1958b, p. 5) occurs within this member. This boundary does not coincide with the Jurassic-Cretaceous boundary but occurs deeper within the Upper Tithonian stage. It was, moreover, not found in most of the sections studied on the eastern and western slopes of Richardson Mountains (Jeletzky, 1960, p. 4; 1961a, p. 8) and so does not seem to be regional in nature. No biochronologically measurable hiatus was observed at that erosional boundary. These movements attributable to the Deister phase of the late Cimmerian or Nevadan (s. l.) orogeny apparently only caused a distinct shallowing of the eastern margin of the Jurassic trough of Richardson Mountains which did not result in the Upper Tithonian sea leaving any part of the area. The Berriasian and Valanginian marine rocks of the area appear, therefore, to be essentially a continuation of the late Upper Jurassic (? Upper Oxfordian-Upper Tithonian) cycle of sedimentation initiated with the beginning of deposition of the shale and siltstone sequence of Husky Formation.

4. Lower member (restricted). As restricted herein the Lower member of Husky Formation embraces all rocks confined between the top of Bug Creek Formation and the base of Arenaceous member; its upper contact appears to be conformable and gradational in all sections studied. The thickness of redefined Lower member is estimated to range between 749 and 810 feet in different parts of Aklavik Range. In the type section of Husky Formation its complete thickness is 734 1/2 to 749 feet.

The restricted Lower member is characterized by the predominance of shale, silty shale and various siltstones. These vary in colour from blackish to brownish or light grey when fresh but tend to weather markedly or intensively brown, rust or maroon. The shales and siltstones of the Lower member are mostly soft to medium hard and weather recessively; they carry, however, numerous bands and concretions of hard and weathering-resistant clay ironstone up to 3 feet in thickness, usually brownish grey when fresh but weathering rust, orange, or wine-red. Variable but always minor, intercalations of sandy siltstones and fine grained, mostly silty sandstones occur at irregular intervals. These coarser clastics are, as a rule,

very poorly sorted and contain scattered coarse sand and grit particles and scattered small pebbles of chert, quartz and clay-ironstone. Grit and pebbles may, occasionally form thin lenses or nests. Accumulations of Buchia shells are largely confined to these coarser grained interbeds and may form veritable coquina layers and nests within them. The here discussed interbeds of coarse clastics are lithologically similar to those of Arenaceous member; they are, however, not known to exceed 10 to 12 feet in thickness or to form persistant beds traceable over considerable distances within Aklavik Range. No clearcut subdivision of the restricted Lower member is apparent at this stage of the writer's research. It should be noted, however, that the lower 300 to 350 feet of the member are somewhat more shaly than the younger beds; they mostly contain only a few beds of dark grey, hard, sandy siltstone and shale-like, grey silty sandstone. Interbeds of coarser clastics are even more exceptional in this part of the member (see Section 22 of the Appendix). The overlying part of the member tends to be somewhat more silty and sandy and contains more gritty and pebbly interbeds rich in Buchia shells (see Sections 1 and 72 of the Appendix and in Jeletzky, 1958b, pp. 22-27). The boundary between these subdivisions of the Lower member tends to coincide with that between Buchia mosquensis and Buchia piochii zones or to run through the upper part of the latter zone.

Age and Correlation

The age of the Upper member has already been discussed (Jeletzky, 1958b, p. 6; 1960, pp. 9, 12). The occurrence of Buchia cf. uncitoides (Pavlow) s. lato in some discontinuous outcrops apparently representing its lower part and beds transitional to the underlying Red-weathering shale member suggests that it includes this zone as well as the younger Buchia volgensis zone.

The Red-weathering shale member essentially corresponds to the basal Cretaceous Buchia okensis zone; the index fossil of this zone and the accompanying Tollia (Subcraspedites) aff. suprasubditus (Bogoslovsky) and T. (S.) aff. hoeli (Frebold) first appear a few feet above the base of this member in most sections studied. The Cretaceous-Jurassic boundary occurs, therefore, close to and is assumed to coincide with the lithological boundary between Red-weathering shale and Arenaceous members throughout Aklavik Range. Farther west and north it is drawn on the previously described colour change at the base of the Red-weathering shale member, as this latter essentially coincides with the first appearance of a prolific and typical Buchia okensis fauna. The same appears to be true of the western slope of Richardson Mountains (Jeletzky, 1961a, p. 8 and unpublished data).

The upper 25 to 35 feet of the Arenaceous member did not yield any diagnostic fossils. The unique occurrence of Buchia okensis var. elliptica (Pavlow, 1907) near the visible top of the member in Section 22 (Jeletzky, 1958b, pp. 5, 19-20) does not constitute a valid reason for

placement of these beds into the basal Cretaceous as similar forms are known to occur occassionally in the latest Jurassic rocks. Only the appearance of abundant and typical representatives of Buchia okensis (Pavlow) s. lato is considered to be diagnostic of the basal Cretaceous (early Berriasian) age of the rocks concerned. As already mentioned, this fauna only appears higher in the basal few feet of the Red-weathering shale member. Typical and well preserved representatives of Buchia fischeriana (d'Orbigny) s. lato have, on the other hand, never been found in the here discussed upper part of the Arenaceous member. This suggests its being somewhat younger and correlative with Craspedites (Taimyroceras?) canadensis and Buchia unschensis beds of the Canadian Arctic Archipelago, which likewise overlie beds carrying prolific and typical representatives of B. fischeriana s. lato and so are comparable to some (lower?) part of the youngest Jurassic (Craspedites nodiger zone) rocks of the Central Russian basin (Jeletzky, 1966). This tentative correlation of the upper part of Arenaceous member agrees well with the placement of the Jurassic-Cretaceous boundary at the base of Red-weathering shale member.

The lower part of the Arenaceous member and the top part of the restricted Lower member contain the Buchia fischeriana s. lato fauna dominated by the morphologically advanced, large representatives of the species (Jeletzky, 1958b, p. 5; 1966). This fauna is now known to range through some 300 to 320 feet of beds in some sections (e.g. Section 1 of the Appendix), although elsewhere (e.g. Section 22, Jeletzky, 1958b, pp. 20-22 and Section 72 of the Appendix) it only ranges through some 80 to 100 feet of beds. As the thickest development of Buchia fischeriana zone seems to be confined to the northern end of Aklavik Range while its thinner development is only known from the southern part of this Range, more rapid sedimentation in the north (and northwest?) part of the area seems to be indicated. Beds containing Buchia richardsonensis, early forms of B. fischeriana s. lato, B. piochii s. str., B. piochii var. russiensis, and B. piochii var. mniovnikensis can locally be differentiated between Buchia fischeriana zone proper and the underlying beds where B. piochii var. russiensis and B. piochii var. mniovnikensis are associated only with B. aff. fischeriana (Jeletzky, 1966). These beds are shown separately in the zonal table accompanying this report (pp. 10-11). For all practical purposes, however, they have to be treated as part of the generalized Buchia piochii zone.

The middle part of the Lower member (restricted) contains the so called Buchia piochii s. lato fauna, which was already discussed elsewhere (Jeletzky, 1958b, p. 5, 1965, pp. 17-18; 1966). As already mentioned, these beds are probably subdivisible in two or more Buchia zones and straddle the boundary between the Upper Portlandian s. str. and Upper Tithonian (= Upper Volgian) stages. These beds with Buchia richardsonensis and early forms of B. fischeriana s. lato are tentatively placed into the basal Upper Volgian while the underlying beds characterized by the absence of B. richardsonensis and (?) B. fischeriana s. lato are tentatively correlated with the Epivirgatites nikitini and Virgatites virgatus zones of the late

Portlandian s.str. (Jeletzky, 1966). These underlying beds are, furthermore, characterized by the rarity or absence of the typical representatives of B. piochii s.str. and the abundance of B. piochii var. russiensis, B. piochii var. mniovnikensis, and B. aff. fischeriana (Jeletzky, 1965, pp. 17-18; 1966). In the present state of our knowledge it is, however, difficult to recognize these subdivisions of the Buchia piochii zone in many parts of the area studied and to use them as operational time-rock units. Only the generalized Buchia piochii zone embracing all beds between Buchia fischeriana s. lato and Buchia mosquensis s. lato zones is, therefore, used in the body of this report and its Appendix. Even this broad zone is, sometimes, difficult to recognize, as all its diagnostic Buchia species are relatively rare forms within the area. Some of them (e.g. B. piochii s.str., B. richardsonensis Buchia may even range up into the Buchia fischeriana s. lato zone proper in some sections (e.g. Section 1 of the Appendix). For these reasons the generalized Buchia piochii s. lato zone had to be lumped together with the adjacent Buchia zones in some of the sections studied, particularly when fossils were scarce or poorly preserved (see Sections 1 and 72 of the Appendix). So far as known, Buchia piochii fauna ranges through some 320 to 330 feet of beds in the most fossiliferous sections studied.

The lower part of the Lower member (restricted), with the exception of its basal 200 feet or so, contains Buchia mosquensis (Buch) s. lato and its allies. As interpreted in this report B. mosquensis s. lato is diagnostic of the Lower Portlandian s.str. (zones of Zaraiskites scyticus and Dorsoplanites panderi) and Middle to Late Kimmeridgian stage. It is difficult to relate the lower boundary of Buchia mosquensis zone to the standard ammonite zones of Europe. The general validity of its Middle Kimmeridgian (or older) age is, however, confirmed by the association of Amoeboceras, subgenus and species indet. with early forms of Buchia mosquensis s. lato 262 to 267 (approx.) feet above base of Section 22 (see in the Appendix). It appears to be possible to separate the Middle to Upper Kimmeridgian representatives of Buchia mosquensis s. lato from their Lower Portlandian (and latest Kimmeridgian ?) representatives and to restrict this specific name to the latter forms (Jeletzky, 1962, 1965). In this report, however, such subdivision is only indicated by the reference to the "early" or "late" forms of Buchia mosquensis s. lato pending the completion of the writer's study of the Richardson Mountains Buchia faunas.

In the type section of Husky Formation Buchia mosquensis s. lato ranges through some 179 to 182 feet of strata; it is, however, possible that the unit 4 of this section (see in the Appendix) containing a peculiar and poorly preserved Buchia fauna forms the lower part of this zone rather than the top part of Buchia concentrica zone. Elsewhere in the area its thickness appears to be in order of 200 feet.

The basal 150 to ? 200 feet of the Lower member are only poorly fossiliferous to almost unfossiliferous in most sections studied. Such

diagnostic fossils as do occur in these beds are, at that, invariably poorly preserved. All identifiable Buchia forms collected from these beds belong, however, not to Buchia mosquensis s. lato and its allies but to Buchia concentrica (Sowerby) s. lato and its allies (=B. bronni Rouillier, 1845?). Mixed faunas of Buchia ex gr. mosquensis s. lato and B. ex gr. concentrica s. lato occur, furthermore in places (see Section 22, unit 4 of the Appendix) at the top of this interval. These Buchia concentrica-bearing beds of the Lower member are, therefore, assigned to the Upper Oxfordian to Lower Kimmeridgian Buchia concentrica zone of Arctic and Western Canada. Except for generically and specifically indeterminate phylloceratids, no ammonites have been found in Buchia concentrica zone of the eastern slope of Richardson Mountains. Northwest of the Richardson Mountains (Barn Mountains and Babbage Lake area), however, the broad and short forms of B. concentrica (Sowerby), such as were figured by Frebold (1964, Pl. XLVII, Fig. 7), are sometimes associated with the Upper Oxfordian Cardioceras ex gr. cordatum (Sowerby) identified by H. Frebold of this Survey. The absence of such cardioceratids on the eastern slope, and the narrowly elongated shape of B. concentrica s. lato found there are somewhat suggestive of only the Lower Kimmeridgian part of Buchia concentrica zone being represented in the basal part of Husky Formation of our area. The narrowly elongate forms of B. concentrica s. lato that are identical with or closely comparable to its var. erringtoni (Gabb) (see Jeletzky, 1965, Pl. I, Fig. 10) seem, indeed, to be more characteristic of beds overlying the Upper Oxfordian beds where the broad and short forms of B. concentrica s. lato (see Frebold, 1964, Pl. XLVII, Fig. 7) predominate. Pending further study of these Buchia forms and considering the invariably poor preservation of our material of B concentrica s. lato from the eastern slope, these beds are only dated as of the Lower Kimmeridgian and? Upper Oxfordian age for the purpose of this report.

East slope of White Mountains

The writer was unable to find any well exposed and reasonably complete sections of Husky Formation between Martin Creek and the Palaeozoic core of White Mountains. The rocks of this formation have apparently been largely removed by erosion or are poorly exposed in the valleys representing the axial parts of synclines. Some short and partly covered sections of Husky Formation briefly examined on the west side of Bear Creek Dome of Jeletzky (1961b, p. 570, Fig. 2) in the headwaters of northern confluents of Rat River do not seem to differ materially from the corresponding parts of Husky Formation in the Aklavik Range. Only parts of the restricted Lower member of the formation have been seen in these sections.

Brat Creek-Rat River Gorge area

On Brat Creek rocks of Husky Formation occupy the axial parts of several submeridionally trending, wide open but mostly strongly faulted synclines within the Barrier River fault block (see Jeletzky, 1960, geol. map; 1961b, pp. 568-69, Fig. 20) for some 4 1/2 miles up from its mouth. Farther south they either plunge beneath the mid-Lower Cretaceous rocks or are cut off by a major fault. No complete sections of Husky Formation have been seen along Brat Creek but such exposures of the Lower member as have been seen differ from the corresponding parts of the member of Aklavik Range in containing a greater ratio of interbeds of silty sandstone and siltstone and some 20 to 40 feet thick units of grey, quartzose sandstone similar to that of underlying Bug Creek Formation (see Section 153 of the Appendix). No equivalents of the Arenaceous member or the upper part of Lower member (restricted) have been seen (covered or faulted out?). The exposures of Red-weathering member seen are, however, indistinguishable from those observed in Aklavik Range (Jeletzky, 1961b, Fig. 20; this report Pl. VI, Fig. 2) and carry a typical Buchia okensis s. lato fauna.

As already mentioned, the basal beds of the Lower member (restricted) contain the early forms of Buchia mosquensis s. lato comparable to those found in the basal beds of Buchia mosquensis zone of Aklavik Range. The biochronological implications have already been discussed in connection with the age of top beds of Bug Creek Formation in this part of the area. The lithology of the Lower member of Husky Formation is, on the whole, clearly transitional between that observed in Aklavik Range and that of its arenaceous facies exposed in Mount Toughenough and Teeweechee Mountain sections.

Only the lower 300 feet or so of the Lower member (restricted) of Husky Formation have been observed in the Rat River Gorge on top of Bug Creek Formation (Jeletzky, 1961b, Fig. 21; Sections 154 and 154a of the Appendix). These beds are essentially similar to the equivalent beds of Brat Creek exposures and are distinctly more silty and sandy than their equivalents in the Aklavik Range (see Sections 2 and 22 of the Appendix). As on Brat Creek, the basal beds of Husky Formation of Rat River Gorge carry early forms of Buchia mosquensis s. lato instead of Buchia concentrica s. lato and so are the time equivalents of the middle rather than basal part of the Lower member of Aklavik Range. The occurrence of a 35 feet thick unit of Bug Creek like sandstone and of the carbonaceous and coaly interbeds and lenses in Rat River Gorge sections (see Section 154a of the Appendix) indicates the near shore nature of Husky Formation in this part of the area which must have been situated much closer to the southeastern and eastern shores of the late Upper Jurassic basin of Richardson Mountains than the Aklavik Range and Martin Creek area.

Horn Lake-Summit Lake area

Small and intermittent exposures of Husky Formation have been noted on Rat River 2 3/4 to 4 miles upstream from the upper end of Rat River Gorge and again at the point about 9 1/2 miles upstream of this gorge. Other outcrops occur on the western slope of Bear Creek Dome about 1 mile southwest of southern end of Horn Lake. These exposures seem to be more similar to those of the Aklavik Range than to the sections observed in Rat River Gorge but they were not studied in any detail.

Husky Formation outcrops extensively on the crest of so called Snafu Ridge about 10 miles southwest of Horn Lake (see Section H-W-90 of the Appendix). In this area it is much thicker than elsewhere on the eastern slope and is largely built of uniformly coloured, dark grey to black shale with considerable interbeds of similar siltstone and some bands and concretions of clay ironstone. The presence of considerable sandstone members (up to 200 feet in Section H-W-90) in the middle part of the formation is rather interesting. This member could correspond to the Arenaceous member of Aklavik Range. Lack of diagnostic fossils and the apparent absence of the Red-weathering shale member in this and other sections visited in the area does not permit, however, any detailed correlation of the more than 2,105 feet thick Husky Formation with its considerably thinner sections in Aklavik Range.

No sections of Husky Formation have been seen by the writer in McDougall Pass and elsewhere in the proximity of Summit Lake area. One would expect, however, Husky Formation of this area to be lithologically similar to and at least as thick as the Husky Formation of Snafu Ridge.

The Snafu Ridge sections of Husky Formation are obviously transitional to the essentially shaly and tremendously thick (well in excess of 3,000 feet) development of Husky Formation in headwaters of Bell River (Jeletzky, 1961b, p. 8, corr. chart).

Mount Toughenough area

After a considerable interval underlain apparently exclusively by Lower Cretaceous rocks, the rocks of Husky Formation reappear in the southern part of a small, horst-like structure of Mount Toughenough. These exposures are on the southeastern slope of this mountain and closely north of Stony Creek (Jeletzky, 1960, geol. map, Section 115 of the Appendix).

The Mount Toughenough development of Husky Formation contrasts strongly with its previously discussed more typical development on Brat Creek and in Rat River Gorge, not to mention that of Aklavik Range. In this section the typical shales and siltstones of Husky Formation are restricted to several 50 to 100 feet thick members intercalated with several

50 to 200 feet thick members of hard quartzites and quartzite-like, fine grained sandstones. Several beds and 20 to 50 feet thick members of gritty to pebbly sandstone with 1 to 2 1/2 feet thick interbeds of pebble conglomerate occur, furthermore, in the upper part of the section. This arenaceous facies of Husky Formation is strongly transitional in its lithology to the North Branch Formation of Vittrekwa River basin and could almost as well be referred to the latter formation except for the much more shaly development of its lower part. The visible thickness of the arenaceous facies of Husky Formation in the only continuous section seen is in order of 770 to 800 feet, its top being concealed.

The equivalence of the arenaceous facies of Husky Formation to its more typical shale-siltstone facies is proven by the occurrence of Buchia mosquensis Buch s. lato, probably belonging to the late forms of the species, in the interval 268 to 318 feet (minimum values) above its base. This facies was previously mapped as Devonian or older because of its distinctive lithology and considerable induration by Foley (1944, pp. 9-10), and other workers.

The Mount Goodenough section is the southernmost point of occurrence of Husky Formation known to the writer. There is little doubt that it becomes replaced laterally by its near-shore equivalent – the North Branch Formation closely south of Stony Creek. No lithologically transitional sections of Husky Formation have been observed in headwaters of Stony Creek west of Barrier Range. One may expect, however, the presence of such sections in the area closely north of Teeweechee Mountain.

Teeweechee Mountain area

Southwest of Barrier Ridge, a ridge about 5,500 feet high, locally known as Teeweechee Mountain (Pl. IX, Fig. 1), forms the divide between the headwaters of Stony Creek and those of Rock River. Numerous good sections of the arenaceous facies of Husky Formation occur in the southeastern part of Teeweechee Mountain massif (see Sections 120 and 122a of the Appendix). These sections are rather similar to that of Toughenough Mountain, except that they show lesser ratio of sandstone-conglomerate to shale-siltstone than the latter section. Section 122a exposes what appears to be the complete thickness of the arenaceous facies of Husky Formation, which is about 1,096 feet thick there. The abnormally small thickness of Husky Formation in Section 122 (240 to 250 feet) is probably caused by faulting out of considerable parts of its sequence. The covered intervals in this section could easily harbour one or more strike faults with a considerable vertical displacement.

The occurrence of fairly typically developed and fossiliferous Lower sandstone division above Husky Formation in Section 122 indicates that the arenaceous facies of the latter formation includes time equivalents of the basal Cretaceous part of Husky Formation of more northerly areas.

As in Toughenough Mountain area, the age of the arenaceous facies of Husky Formation is proven by the occurrence of the late forms of Buchia mosquensis (Buch) s. lato in its lower part. In Section 122 these, presumably early Portlandian forms of the species occur only 40 to 50 feet above the base of the formation. If its contact with Bug Creek Formation is normal in this section, there is little or no place left for mid- to late Kimmeridgian rocks there. It is, unfortunately, impossible to verify this conclusion in Section 122a, as Buchia cf. mosquensis Buch s. lato found 95 to 105 feet above the base of this section cannot be positively identified, let alone assigned to late or early forms of the species. It is probable, in any case, that the basal beds of the arenaceous facies of Husky Formation in Teeweechee Mountain area are distinctly younger than its basal beds in the Brat Creek-Rat River Gorge area. The biochronological implications of this fact have already been discussed in connection with the discussion of age limits of Bug Creek Formation in different parts of the eastern slope.

There seems to be little doubt that the belt of the arenaceous facies of Husky Formation extends beneath the cover of Lower Cretaceous rocks all the way from Mount Goodenough to Teeweechee Mountain area. The interfingering of the North Branch Formation facies (sandstone-conglomerate) with more typical shale-siltstone facies of Husky Formation in both areas indicates clearly that the Husky Formation becomes replaced laterally by its near shore equivalent – the North Branch Formation – closely south of Mount Toughenough and Teeweechee Mountain areas. It can be assumed, furthermore, that the boundary between Husky and North Branch facies of the late Upper Jurassic basin turns north closely east of Mount Toughenough and continues on northerly course toward the lower course of Rat River below the mouth of Longstick Creek. No outcrops of Jurassic rocks are, however, known to occur anywhere in this area and this interpretation could only be verified by drilling.

?Palaeozoic to? Jurassic shale division

An at least 1,000 feet thick unit of light to dark or brownish grey, brown, rust, or red-weathering, soft shales interbedded with considerable grey, hard, partly sandy siltstone and minor coarser clastics underlies the North Branch Formation closely above the First (lower) Gorge of North Branch of Vittrekwa River (see Sections 117 and 119 of the Appendix and Pl. IX, Fig. 2; Pl. X, Figs. 1-2). Some thin layers and nests of black coaly shale with indeterminate plant remains occur in the middle part of the unit. Shales and siltstones of the unit are mostly rich in bands of clay ironstone and discus-shaped clay ironstone concretions of various size. The latter

occur in rusty weathered rows or are irregularly scattered through the thickness of unit concerned. No marine fossils have been found in this unit, except for a problematical fragment of a Pecten-like pelecypod collected near its top. Base is covered or cut off by major northerly trending faults and the upper contact is covered.

Very poor and intermittent outcrops of lithologically similar shales underlie the Bug Creek Formation on the southern slope of Mount Toughenough (see Section 115 of the Appendix). These 600 feet? thick beds are tentatively correlated with the above described shales exposed on the North Branch of Vittrekwa River.

So far as their lithology is concerned these shales and siltstones could be accommodated in any of the following units: 1) Upper shale-siltstone division (Hauterivian and Barremian); 2) Husky Formation (late Upper Jurassic and basal Cretaceous); 3) Triassic? Coaly shale division; 4) Permian shales and siltstones; and 5) Upper Devonian shales and siltstones. The rust- to red-weathering shale members of this unit are lithologically identical with Red-weathered shale member of Husky Formation. These shales and siltstones underlie the late Upper Jurassic North Branch Formation and early Upper Jurassic? Bug Creek Formation; they can, therefore, be of Middle to Lower Jurassic, Triassic or Palaeozoic age. This unit is herein designated ?Palaeozoic to? Jurassic shale division. It is briefly discussed in this report because of the possibility of its being either the non-marine facies of Middle and/or Lower Jurassic rocks of more northerly areas or that of the Triassic? Coaly shale division. So far as the writer knows rocks of the ?Palaeozoic to? Jurassic shale division have been mapped as the Upper Devonian Imperial Formation by geologists working on the eastern slope of Richardson Mountains.

North Branch Formation

The name North Branch Formation is introduced herein for the up to 600' (or more?) thick succession of various (mostly glauconitic in upper part, gritty and pebbly) sandstones, grit and pebble to cobble conglomerate occurring in headwaters of Vittrekwa River. The name is derived from the North Branch of Vittrekwa River (Jeletzky, 1961b, Fig. 2) where this formation is particularly well exposed in the First (lower) Gorge about 6 miles up from the confluence of North Branch with Vittrekwa River proper. The almost complete section of North Branch Formation exposed in the northern wall of the First Gorge (see Section 118 of the Appendix and Pl. X, Fig. 2) is selected as its type section. The basal beds of the formation are covered in this section; they are well exposed, however, nearby in Section 117 (see in the Appendix). The North Branch Formation was informally named the "Sandstone-conglomerate division" by the writer (Jeletzky, 1960, p. 5, corr. chart; 1961b, Fig. 1) who recognized its being essentially the littoral and beach? facies of upper and middle parts of Husky Formation.

Stratigraphy

The known exposures of North Branch Formation are limited to the headwaters of Vittrekwa River and those of its northern and western confluents where it outcrops on the western flank of a pronounced northerly trending ridge that occurs at about 135°40' W. long. Being weathering-resistant and ridge- and cliff-producing the North Branch Formation can most easily be followed for miles on air photographs or by distant observation from its known exposures.

From its type section in the First Gorge of North Branch Creek the North Branch Formation has been traced uninterruptedly from the air for about 5 miles northward where the above mentioned rocky ridge exposing it is cut off by a major fault. An interval of about 14 miles long separating these northernmost known outcrops of North Branch Formation from the southernmost exposures of the arenaceous facies of Husky Formation in southern slopes of Mount Toughenough was not explored but the change of facies from one to another formation must occur within this interval.

South of the type section of North Branch Formation the high rocky ridge exposing it has been followed from the air more or less uninterruptedly for 16 miles to the northern bank of Vittrekwa River proper at about 66°51'30" N. Lat. and 135°36'30" W. Long. This ridge probably continues for another couple of miles south of Vittrekwa River proper before disappearing completely. As the ridge becomes progressively lower and more narrow southward, the point of its disappearance is assumed to coincide with that of the complete wedging out of the North Branch Formation and Upper shale-siltstone division, which account for this ridge. Yet farther south on Road River no trace of North Branch Formation has been found in the sections studied. This evidence is inconclusive, however, as all observed contacts between Albian and Upper Devonian or? Lower Mississippian rocks are faults (Jeletzky, 1961b, Figs. 2, 12). There are, furthermore, some unfossiliferous coarse clastic rocks on Road River which could be equally well correlated either with the Upper Devonian or? Lower Mississippian conglomeratic division or with North Branch Formation on lithology alone.

Exposures of coarse grained sandstones and conglomerates lithologically similar to those of Sandstone-conglomerate member of North Branch Formation occur in the Second (upper) Gorge of North Branch Creek about 2 miles upstream from the type section of the formation. These strongly faulted rocks did not yield any fossils, however; they could, therefore equally well form part of the Upper Devonian or? Lower Mississippian conglomeratic division.

The narrow belt of Jurassic and Lower Cretaceous? rocks which extends for about 25 miles south of Teeweechee Mountain closely west of the crest of southern Richardson Mountains was only seen from the air. The

relative position of these Jurassic? rocks to the arenaceous facies of Husky Formation exposed in Teeweechee Mountain area suggests, however, that they belong to North Branch Formation and have been deposited at the southern margin of late Upper Jurassic basin of Richardson Mountains.

In its studied sections in Vittrekwa River basin North Branch Formation can be subdivided into (downward sequence):

1. Glauconitic sandstone member consisting of 60 to 80 feet of green to yellowish green or brownish grey, coarse to fine grained sandstones; coarse grained sandstones are mostly gritty and contain interbeds and nests of grit. Minor interbeds of rust to orange-weathering clay ironstone and ferruginous siltstone occur at irregular intervals; all rock varieties are mostly rich in glauconite grains. A 1/4 to 3/4 of a foot thick basal pebble conglomerate accompanied by a sharp and uneven, obviously erosional boundary separates the Glauconitic sandstone member from the underlying beds of North Branch Formation. Contact with the overlying Upper shale-siltstone division is regionally unconformable (Pl. IX, Fig. 2).

2. Sandstone-conglomerate member. The bulk of North Branch Formation underlying the Glauconitic sandstone member consists of various, fine to coarse grained, often gritty sandstones and less abundant interbeds of grit and pebble to cobble conglomerate (Pl. X, Figs. 1-2). Minor interbeds, lenses and nests of shale, siltstone and rust- to orange-weathering clay ironstone occur at irregular intervals; they are most prominent near the top of the member (see Section 118, beds 35 and 37). Glauconite is conspicuously absent in most beds of Sandstone-conglomerate member, only a few feebly glauconitic beds having been noted in all its sections studied. No complete sections of Sandstone-conglomerate member have been seen but some 535 feet of it are exposed in the type section of the formation. It is estimated that it is at least 610 feet thick in the proximity of First Gorge of North Branch Creek.

Age and Correlation

The Glauconitic member of North Branch Formation did not yield any fossils whatsoever. It overlies, however, disconformably the zone of Buchia okensis s. lato (see Unit 35 of Section 118 of the Appendix). This suggests its being correlative with the Buff sandstone member of Lower sandstone division, which overlies the arenaceous facies of Husky Formation in Teeweechee Mountain area (see Sections 122 and 122a of the Appendix). The top part of North Branch Formation appears, therefore, to be the nearshore but still marine equivalent of the lower part at least of Lower sandstone division of more northerly areas.

The occurrence of typical Buchia okensis s. lato fauna in large, fresh and obviously locally derived blocks some 60 to 70 feet below the top

of the underlying Sandstone-conglomerate member of North Branch Formation indicates correlation with the Red-weathering shale member of Husky Formation of more northerly areas. It is remarkable that this part of North Branch Formation retains considerable lithological similarity with this member in spite of its predominantly arenaceous lithology. The transgression of Buchia okensis time, which resulted in deposition of pure, often calcareous shales over the most part of the eastern slope, obviously was felt even near the southern margin of the basin.

Older beds of the Sandstone-conglomerate member have only yielded diagnostic fossils in its basal 75 to 100 feet (assuming the covered interval between the base of this member and the underlying ?Palaeozoic to? Jurassic division to be their normal contact (see Section 117 of the Appendix; Pl. X, Fig. 1). These basal beds have yielded the late forms of Buchia mosquensis (Buch) s. lato and Aucellina? n. sp. aff. schmidti Sokolov, which indicate the early Portlandian age for these beds (Fig. 2). Assuming that the Jurassic-Cretaceous boundary is situated closely below the level at which Buchia okensis s. lato fauna was found, which is reasonable, we must assume that the interval between the level 70 feet below top and that 100 feet above base of the member corresponds to Buchia piochii s. lato, Buchia fischeriana s. lato and Craspedites (Taimyroceras?) canadensis zones of more northerly areas of eastern slope. It is equally reasonable to assume that no rocks older than the early Portlandian part of Buchia mosquensis zone are present in North Branch Formation. Its basal beds appear, therefore, to be geologically contemporary with the basal beds of the arenaceous facies of Husky Formation in Mount Toughenough-Teeweechee Mountain area (Fig. 2). If the lower boundary of Husky-North Branch Formations is diachronic between the former area and the headwaters of Vittrekwa River and its confluents, this diachronism cannot be discovered by means of Buchia zones used in this report.

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PLATES

PLATE I

FIGURE 1: Lower part of the type section of Brat Creek Formation (Section 153 of the Appendix) in the right bank of Brat Creek at the point about 1/4 of a mile above its confluence with Rat River. Only middle and lower parts of the unit 1 of the section are shown. The beds dip toward the camera at about 35°. View downstream (northeastward and down-section) from the lower part of the steep slope (top beds of unit 1 of Section 153) shown in Figure 2. Rat River valley is visible in the far background.

FIGURE 2: Upper part of Section 153 of the Appendix showing the upper part of unit 1 of the type section of Brat Creek Formation as the light-coloured outcrop at the base of the steep slope. The Coaly shale division and the lower part of Bug Creek Formation, including unit 9 of Section 153, occupy the partly overgrown middle and upper parts of the slope. Units 11 and 12 of the section are exposed on the other side of the promontory. All beds strike northwest-southeast and dip away from the camera at 35° to 45°. View toward southeast from the station in the bed of Brat Creek opposite to the outcrops of Brat Creek Formation shown in Figure 1.

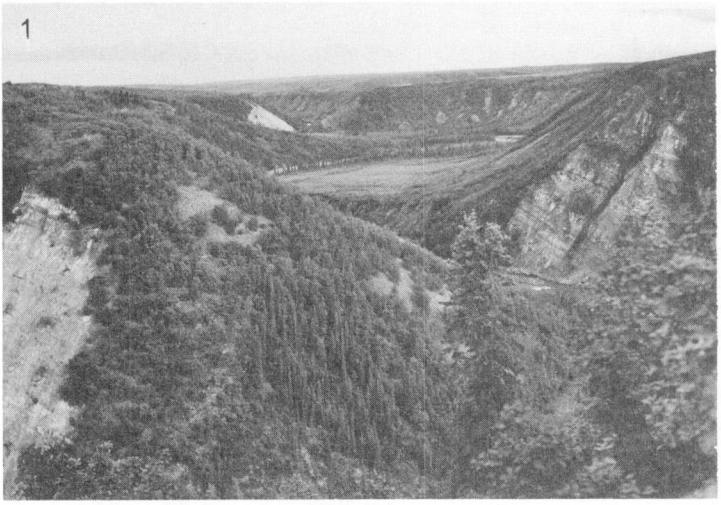
PLATE I

PLATE II

FIGURE 1. General view of Rat River Gorge. View downstream (southeastward) from a station atop of the southwestern wall of the canyon at the point about 2 1/2 miles above the mouth of Barrier River. Light-coloured sandstones of Bug Creek Formation occupy the upper and middle parts of the slopes in the foreground. Rocks of the Coaly shale division and Brat Creek Formation appear to be exposed in places underneath them near the water's level. These sections have only been observed from the distance. In the background the light-coloured promontory on the left (northeastern) side of the river exposes sandstones of Bug Creek Formation. The adjoining promontory on the opposite side of the river exposes the dark-coloured shales and siltstones of Husky Formation. The latter rocks are also exposed on both sides of the promontory in the right (southwestern) bank of the river. The upper part of the Section 154 of the Appendix was measured on the dark-coloured promontory. The rocks strike around N 30° W and dip 20° to 35° toward northeast throughout the gorge.

FIGURE 2. View of Jurassic Butte, Aklavik Range. The foreground is occupied by light-coloured sandstones of Bug Creek Formation (B) striking N 35° W and dipping 65° southwest. The same sandstones extend northwestward all the way to the top of Jurassic Butte where they become only gently tilted toward southwest. Jurassic rocks are separated from the darker coloured Permian and late Carboniferous (PC) and early Palaeozoic (OP) rocks by a major normal fault, which dips steeply toward southwest. The boundary between the late and early Palaeozoic rocks is an angular unconformity.

PLATE II



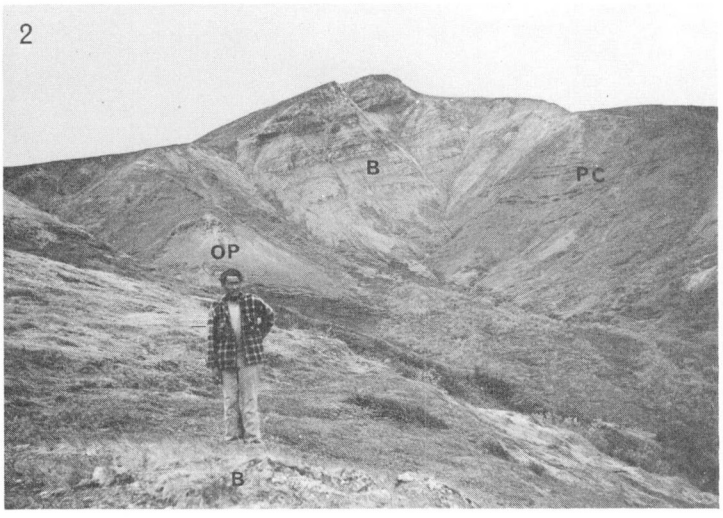
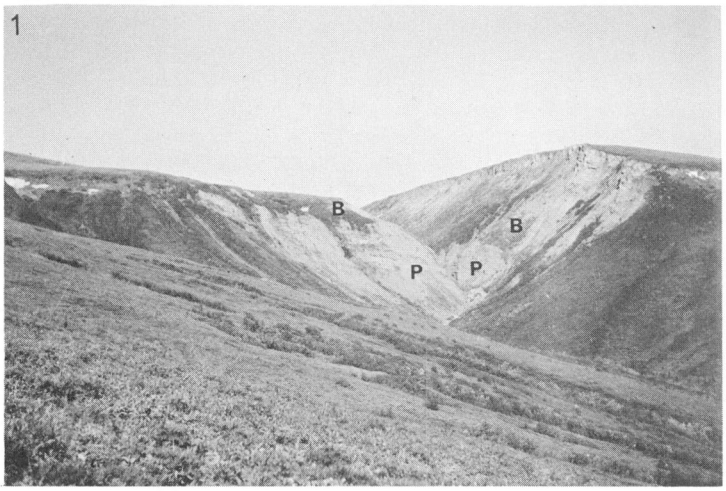


PLATE III

FIGURE 1. General view of the lower end of Bug Creek canyon, Aklavik Range. View due west-northwest from the eastern foothills of the range. The vertical inner gorge of the canyon is incised in the Permian (P) sandstones and siltstones with Spirophyton-like whorls and diagnostic brachiopod fauna. The less precipitous to gentle slopes above the inner gorge are built of sandstones and siltstones of Bug Creek Formation (B). The approximate position of the Permian-Jurassic contact is marked by a dashed line. The upper rim of the north wall of Bug Creek canyon is built of the Upper sandstone member. The gentle, grassy slopes in the foreground are underlain by the rocks of Upper shale-siltstone division, which are overthrust by the Permian-Jurassic rocks exposed in the wall of Bug Creek canyon.

FIGURE 2. An almost complete section of Bug Creek Formation (B) exposed in the northern wall of Bug Creek canyon closely above its lower end (see the left side of Fig. 1). The vertical cliffs near the upper rim of the canyon are built of the Upper sandstone member. The wall of the inner gorge at the lower margin of the photograph is built of Permian (P) rocks. The Permian-Jurassic contact is marked by a dashed line. View approximately due north from the southern side of the inner gorge. This section was not measured but it is estimated to expose about 550 feet of Bug Creek Formation.

PLATE III



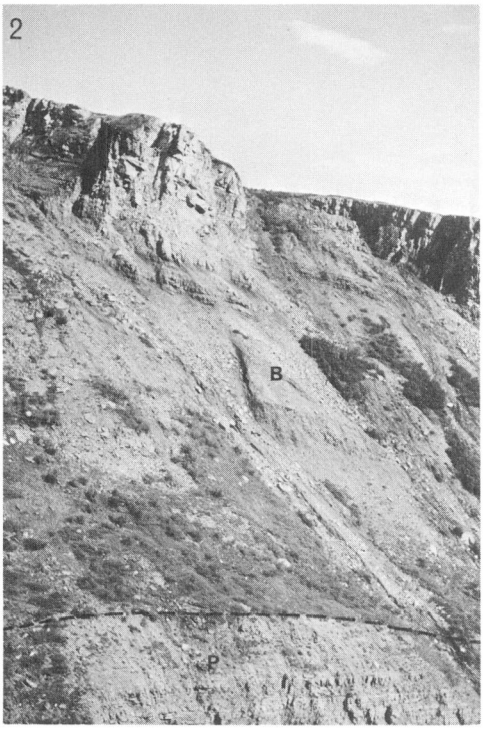


PLATE IV

FIGURE 1. Lower part of the type section of Bug Creek Formation (Section 4 of the Appendix) in the southern wall of Bug Creek canyon, Aklavik Range at the point about 1/3 of a mile above (west of) its lower end. The bluffy promontory on the right (south) side of the canyon is built of the rocks of Grey siltstone member (units 9-10 of Section 4). Echioceras s. lato sp. indet. was collected near its base (GSC loc. 26976). The north slope of the canyon (left side of the photo) is largely covered, except for the exposures of the Upper sandstone member at its upper, bluffy rim. View toward west (upstream).

FIGURE 2. Exposure of the top part of Intermediate sandstone member (lighter coloured blocky sandstone) and basal part of Sandstone-siltstone member (upper, darker coloured, platy sandstone) in the south wall of Bug Creek canyon, Aklavik Range, at the point about 3/4 mile above (west of) its lower end. The man holds his hammer at the bed 14, Section 4 of the Appendix, from which Cranocephalites borealis Spath and C. warreni Frebold have been collected (GSC loc. 26883). View due southwest.

PLATE IV

PLATE V

FIGURE 1. Erosional boundary and the accompanying conglomeratic belemnite "battle field" bed occurring 3 feet above base of bed 14, Section 4 (see p. 90). Same outcrop as that shown in Plate IV, Figure 2.

FIGURE 2. Upper part of the type section of Bug Creek Formation (Section 4 of the Appendix) at the upper end of Bug Creek canyon and about 1 7/8 of a mile above (westward) of its lower end. The rocks forming the cataract in Bug Creek's bed are the unit 26 of the Section 4 forming the top part of the Sandstone-siltstone member. The rocks exposed in and around the higher parts of the ravine of the first sizable left tributary of Bug Creek (near the right side of the photograph) belong to unit 28 of the same section and form the lower part of the Upper sandstone member. The contact with Husky Formation occurs higher up this confluent beyond and above the right rim of the photograph. View due northwest.

PLATE V

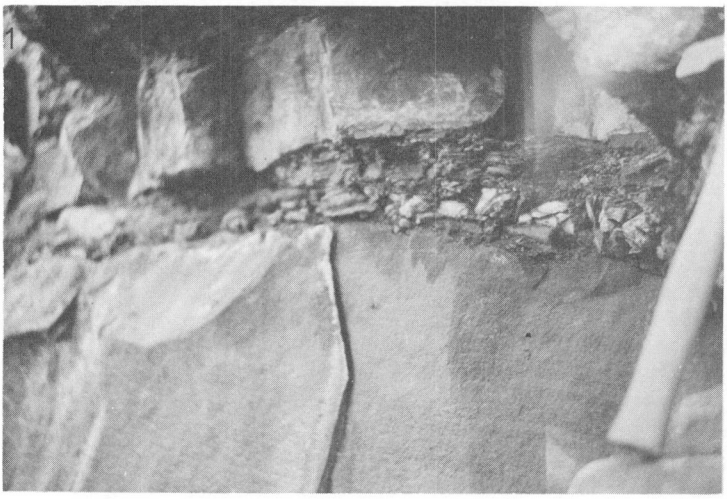


PLATE VI

FIGURE 1. View of Section 24 of the Appendix. The overturned and thrust faulted northeastern limb of Bug Creek anticline at a point about 1 mile north of Jimmy Creek and about 2 miles east-southeast of the lower end of Bug Creek canyon. Red-weathering Permian breccia (marked P) on the extreme right side of the photograph immediately underlies the Basal member of Bug Creek Formation forming a distinct hogsback across the ridge. The Permian-Jurassic boundary is marked by dotted line. The saddle just left of the hogsback is underlain by Grey siltstone member and the hogsback immediately left of the saddle is built of the rocks of Intermediate sandstone member. The top of the latter is cut off by major thrust fault the position of which is marked by a dashed line. Undivided rocks of the Husky Formation and Lower sandstone division (?) form the lower plate of this thrust (marked JC) on the left side of the photograph.

FIGURE 2. Exposure of typical light-coloured sandstones of Bug Creek Formation (marked B) in fault contact with the dark-coloured shale of the Red-weathering member of Husky Formation (marked H) in the northeast bank of Brat Creek at the point about 3/4 of a mile above its mouth. View due northwest. The structural setting of this outcrop was commented upon elsewhere (Jeletzky, 1961b, p. 568, text-fig. 20).

PLATE VI

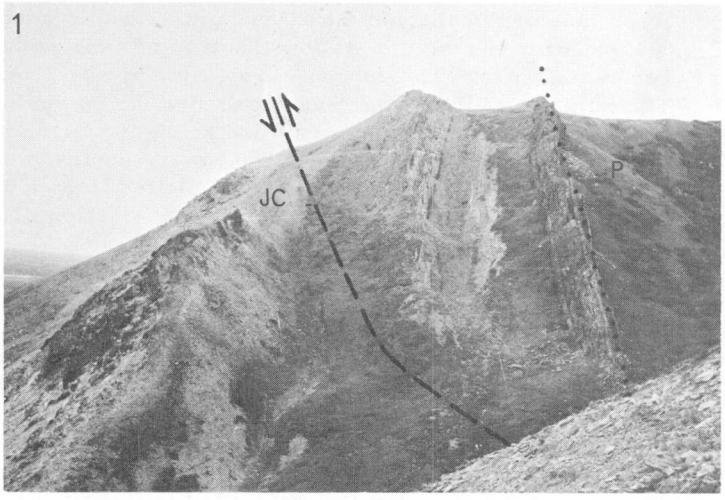
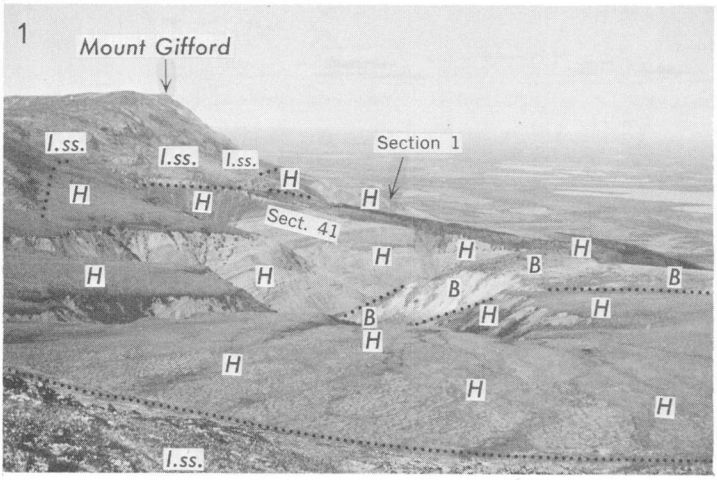


PLATE VII

FIGURE 1. North-northwest end of Mount Gifford dome (foreground) and southern slopes of Mount Gifford (middle background). View toward north-northeast across the core of the dome built of light-coloured sandstones of Bug Creek Formation (B) from a station about 3/4 of a mile south-southwest of the same core. The core is surrounded by rocks of Husky Formation (H) and those of the Lower sandstone division (l. ss.) dipping toward the camera in the foreground, westward at 30-40° in the headwaters of the creek left (west) of the core, and toward north-northwest at 30-40° in the northern banks of the same creek. Dotted lines indicate approximate positions of the formational boundaries. Section 41 was measured on the northern bank of the creek where indicated. The boundary between the light-coloured shale of the Rust-weathering member and the medium grey-coloured siltstone of the Upper member of Husky Formation is clearly visible on the left side of the photograph (underneath Mount Gifford). The position of Section 1 on the southeastern promontory of Mount Gifford is indicated in the middle background between Section 41 and the Mackenzie Delta.

FIGURE 2. Contact between the Bug Creek Formation (B) and the lower part of the Lower member of Husky Formation (H) in the canyon of an unnamed creek flowing around the north-northwest end of Mount Gifford dome, Aklavik Range. View due southwest from a photo station situated about 1/2 mile northeast of the core of the dome built of sandstones of the Bug Creek Formation (on the skyline) dipping at 40°-70° toward the camera. The same sandstones exposed in shear bluffs near the base of the slope dip toward the camera at 10°-15°. The synclinally bent shales of Husky Formation (H) occupy the middle part of the slope. Grassy slopes in the foreground are underlain by undivided rocks of Husky Formation and Lower sandstone division (JC) dipping gently to moderately toward the camera, except where cut by north-south trending faults.

PLATE VII



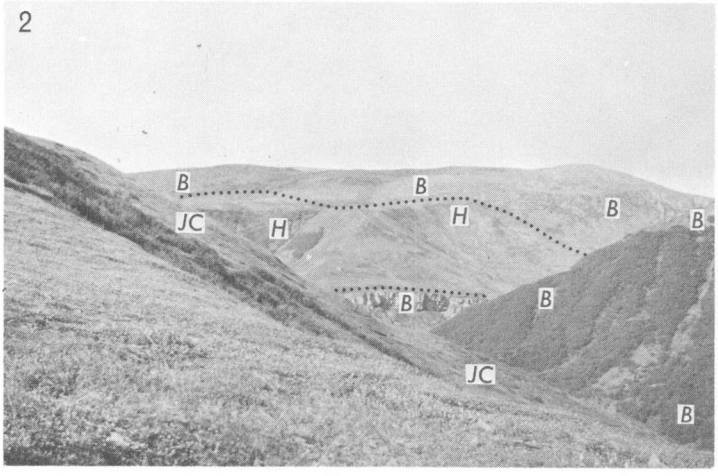


PLATE VIII

FIGURE 1. Lower part of the type section of Husky Formation (Section 22 of the Appendix and Section 1 of Jeletzky, 1958b, pp. 25-27) in the northern wall of Husky Creek canyon, Aklavik Range at the point about 5 miles north of the top of Mount Goodenough and about 3/4 of a mile southeast of the top of Jurassic Butte. View toward west-southwest (upstream) from a station in the proximity of unit 3 of Section 1 (Jeletzky, 1958b, p. 25). The man stands on the unit 9 of Section 22. Large, rust-weathering concretions of that unit are clearly visible.

A major fault separates the section from the tightly folded shales of Husky Formation occupying most of the southern wall of the canyon and the light-coloured sandstones of Bug Creek Formation (B) exposed at its base. The structural setting of this section is discussed elsewhere (Jeletzky, 1961b, Fig. 10).

PLATE VIII

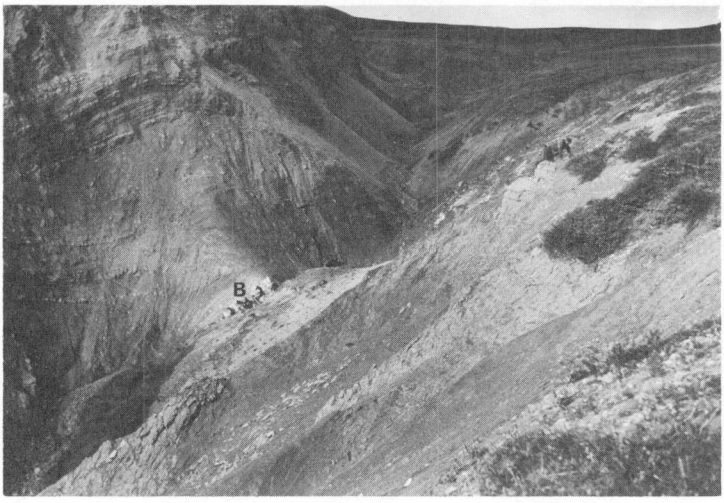


PLATE IX

FIGURE 1. Exposure of Bug Creek Formation (unit 6 of Section 122 of the Appendix) on the southeastern slope of Teeweechee Mountain massif, central part of southern Richardson Mountains on the watershed between Stony Creek and Rock River. This slope overlooks the headwaters of Stony Creek from northwest. Approximate position is: Lat. 67°18' N; Long. 136°7' W. The light coloured sandstones of Bug Creek Formation strike N 50-60° W and dip 12°-14° northeast (away from the camera). View generally toward northwest. The flat top of Teeweechee Mountain itself is visible in the right background.

FIGURE 2. The regionally unconformable contact between the Glauconitic member (G) of the type section (Section 118 of the Appendix) of North Branch Formation and the Upper shale-siltstone division (U. sh.) exposed at the lower end of the 1st (lower) gorge of North Branch of Vittrekwa River at the point about 6 miles up (west) of its confluence with Vittrekwa River proper. View downstream from the upper end of the gorge. The basal part of the type section of North Branch Formation occupies the left foreground.

PLATE IX

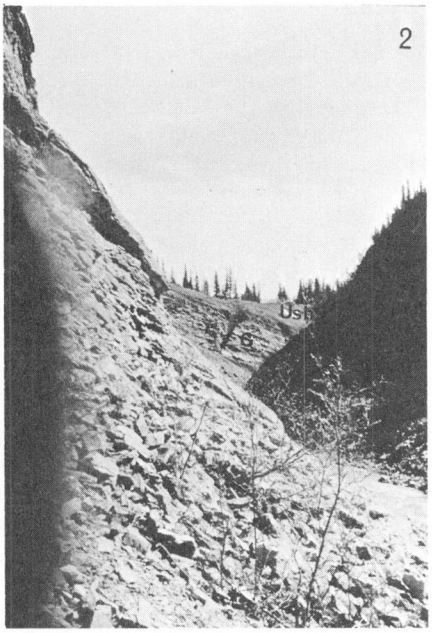


PLATE X

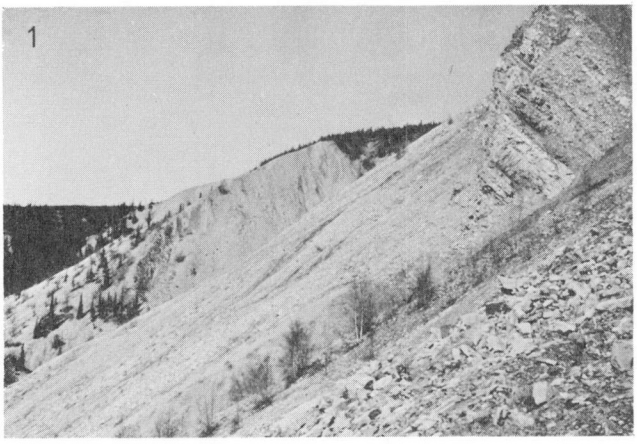
FIGURE 1. Exposures of the basal part of Sandstone-conglomerate member of North Branch Formation and of the upper part of the ? Palaeozoic to ? Jurassic shale division (Section 117 of the Appendix) in an amphitheater-like widening of the valley on the north side of North Branch of Vittrekwa River just above its lower (1st) gorge (250 to 600 yards northwest of its upper end). View generally toward northwest from the station closely southeast of the top of Section 117.

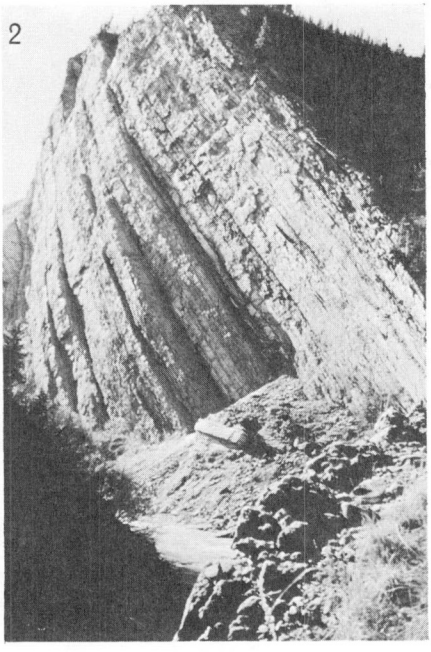
The bluff in the upper right corner of the photograph exposes units 6 and 7 of the Section 117. The gentle, partly talus-covered slope in the foreground and the more precipitous slope in the background are underlain by units 1 to 4 of the ? Palaeozoic to ? Jurassic shale division. All rocks strike N 10-20°W and dip 35-45° toward northeast.

FIGURE 2. View of the type section of North Branch Formation (Section 118 of the Appendix) in the north wall of the lower (1st) gorge of North Branch of Vittrekwa River at the point about 6 miles up (west) from its confluence with Vittrekwa River proper and 250 yards downstream of the top of Section 117 shown in Pl. X, Figure 1. View toward northwest (obliquely upstream) from the station atop of the outcrop of the Upper shale-siltstone division shown in Pl. IX, Figure 2.

The unit 34 of the Sandstone-conglomerate member of Section 118 is the youngest bed visible in the photograph. The Buchia okensis-bearing, basal Cretaceous unit 35 underlies the bottom of the wooded valley on the extreme upper right of the photograph and comes down to the water's level closely beyond its right margin. All rocks strike N 50-60°W and dip 40°-45° toward northeast.

PLATE X





APPENDIX

Selected Sections

Section 1

Location: Measured along the crest of southeastern promontory (middle part) of Mount Gifford within the interval 1/6 to 5/8 of a mile southeast of its summit. Lat. 68°09'30"N; Long. 135°22'30"W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Red-weathering shale member		
	Lower Berriasian		
	Buchia okensis zone		
45	Shale, grey-brown when fresh, weathers reddish brown to orange, often yellowish tinged, mostly pure and calcareous; weathers concretionary and often flaky or chippy, soft to moderately hard; numerous 1/4 to 1 1/2 foot thick interbeds and variously shaped (rounded, loaf-like or irregularly shaped) concretions (occurring in rows or irregularly distributed) of hard, grey-brown when fresh, weathering reddish brown to wine-red, calcareous clay ironstone occur at 1 to 5 feet thick intervals; top concealed beneath soil and vegetation extending for several hundred feet upslope; the visible top of the unit is believed to be 40 to 50 feet below the base of the Upper member of the formation; contact with underlying rocks apparently sharp. Rich and typical fauna of Buchia okensis (Pavlow, 1907) f. typ. its variants subokensis (Pavlow) and canadiana (Crickmay), B. n. sp. aff. volgensis (Lahusen, 1888), Lima (Pseudolimea) aff. blackei Cox, Pecten (Entolium) sp. indet. (GSC localities 35752, 32629, 35756, 35799, 35786, 35670) occurs throughout the thickness of the unit, with exception of its basal 1 foot. Only a few small and poorly preserved Buchia,	60	503

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	probably referable to the young growth-stages of B. okensis s. lato have been found in the basal foot of the unit (GSC loc. 35670). Rare representatives of B. uncitoides (Pavlow, 1907) var. spasskensoides (Crickmay) have been found in the topmost 5 feet of the unit (GSC loc. 35752). The giant forms of B. okensis s. lato occur throughout the unit, with the exception of its basal 1 foot visible.		
	Arenaceous member		
	Upper Tithonian (=Upper Volgian)		
	Craspedites (Taimyroceras?) canadensis zone?		
44	Sand, dark-grey, fine grained, very silty, glauconitic; some inclusions and nests of similar, glauconitic sandstone.	4	443
43	Sandstone, greenish black, fine grained, poorly sorted and silty, partly ferruginous, highly glauconitic; exposures very poor.	3 (assum.)	439
42	Sand, black, fine grained, very silty, highly glauconitic in the basal part, less so elsewhere; grades into slightly ferruginous, sandy and clayey black siltstone; outcrops intermittent and poor; the bed may be faulted.	3 (assum.)	436
41	Shale, grey to red-brown, ferruginous, weathers flaky and blocky; contains scattered rounded and irregularly shaped concretions of hard, rust-weathering clay ironstone 6 inches	5 (est.)	433

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	to 1 1/2 feet in diameter; one large, loaf-like concretion of argillaceous, grey, cryptocrystalline to finely crystalline, rust-weathered limestone occurs near the top; outcrops are mostly obscured by soil and rock debris and the lithology of this unit is imperfectly understood; top concealed beneath vegetation and debris so that it was necessary to move about 50 feet toward north from the crest of promontory to see its upper contact and overlying beds.		
40	Siltstone, light grey, soft, clayey, slightly ferruginous; weathers blocky; grades upward into ferruginous shale and red-brown clay ironstone, which show concretionary weathering at the top; grades into bed 41; one irregularly rounded quartzite cobble 6-8 inches in diameter was found imbedded in siltstone; rare, scattered, rounded quartz pebbles about 1/8 of an inch in diameter also occur in this bed; outcrops poor and obscured by overburden for the most part.	2	428
39	Shale, grey to dark grey, weathers flaky, often ferruginous; carries occasional, irregularly shaped, clay ironstone concretions 6 inches to 1 foot in diameter; outcrops largely obscured by soil cover; grades upward into bed 40.	8	426
38	A row of clay ironstone concretions, rust to red-brown coloured, shattered, irregularly shaped; imbedded in ferruginous shale.	2	418
37	Covered by thick overburden, probably underlain by the same shale as in underlying bed.	3 (assum.)	416

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Lower member (restricted)		
	Buchia fischeriana zone		
36	Shale, red-brown to grey, mostly pure, ferruginous, soft, often calcareous and may grade locally into argillaceous limestone; some similar siltstone; contains very rare, scattered, imperfectly rounded quartz pebbles 1/8 of an inch in diameter in the interval 8 to 9 1/2 feet above base; weathers concretionary and/or flaky and chippy; 1/2 to 1 foot thick interbeds of rust-coloured to wine-red, hard clay ironstone (often calcareous) and 1/4 to 2 feet long, variously shaped (rounded, loaf-like, irregularly shaped) concretions of the same occur at irregular intervals in the unit; concretions may form regular rows or be irregularly scattered; some of them are very calcareous or grade into cryptocrystalline, argillaceous limestone; marcasitic cores occur in some concretions; fossils collected in the upper 2 feet of the unit (GSC loc. 35791) include: Buchia fischeriana (d'Orbigny) s. lato and B. aff. unschensis (Pavlow); no B. okensis found; those collected 8 to 9 1/2 feet above base (GSC loc. 35758) include Lima (Pseudolimea ?) sp. indet.	15	413
35	Shale, red-brown to yellowish brown, ferruginous, weathers flaky, sometimes concretionary weathering, soft; may grade into siltstone; scattered, very rare, rounded quartz and black chert pebbles approximately 1/8 of an inch in diameter, and 1/8 to 1/2 inch in diameter, rounded clay ironstone pebbles; fossils (GSC loc. 35678) include: Buchia sp. indet. ?, Lima (Pseudolimea) aff. blackei Cox, "Turbo" aff. ferniensis Frebold?,	1	398

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	gastropod, genus and species indet.; the shale may grade laterally into clay ironstone in places.		
	The underlying beds have been measured on the southern side of the promontory; there was some difficulty in picking out the exact equivalent of bed 35 there because of the overburden possibly accompanied by some small scale faulting.		
34	Covered interval; across general strike.	1 1/2	397
33	Clay ironstone, red-brown, medium hard, concretionary weathering.	3/4 (appr.)	395 3/4
32	Largely covered by soil and debris; some exposures of grey to brown-red, ferruginous shale; probably underlain by such shale throughout.		
31	Clay ironstone, red-brown, hard, slightly silty in part, sulphur-stained at the base; contact with the overlying rocks obscured by debris; contains rare, scattered, rounded clay ironstone pebbles up to 2 inches in diameter; fossils (GSC loc. 35658) include: Buchia sp. indet. ? and "Turbo" aff. ferniensis Frebold.	1 1/2	395
30	Shale, red-brown to yellowish brown, highly ferruginous, flaky; only strongly weathered rock seen.	1	393 1/2
29	Clay ironstone, red-brown, hard, sometimes concretionary weathered; grades into the overlying bed.	1/4	392 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
28	Shale, grey to red-brown or yellowish brown, highly ferruginous in places where it is red-brown, less ferruginous elsewhere; sulphur-stained near the top, flaky weathering, soft.	3	392
27	Siltstone, grey to dark grey, locally grades into silty shale; contains frequent, scattered quartz and chert pebbles 1/4 to 1/2 inch in diameter, partly ferruginous, grades into overlying clay ironstone; fossils (GSC loc. 35659 and 35745) include: Buchia cf. piochii (Gabb) s. lato, Lima (Pseudolimea?) sp. indet., Pleuromya cf. vancouverensis Whiteaves, pelecypod, genus and species indet.	1/2	389
26	Shale, grey to red-brown, ferruginous, more so at the top than elsewhere, weathers flaky, grades into the overlying bed.	6	388 3/4
25	Siltstone, grey to red-brown, sandy to very sandy in places and apparently may grade into very fine grained, silty sandstone locally, slightly ferruginous; contains very rare clay ironstone concretions up to 1 foot in diameter and rare, scattered chert pebbles up to 1 inch in diameter; grades imperceptibly into the overlying bed; strikes N 20° E and dips 5 to 10° west; fossils (GSC loc. 35656 and 35621) include numerous Buchia piochii (Gabb, 1864) f. typ. and B. piochii var. russiensis (Pavlow), rare B. aff. fischeriana (d'Orbigny) s. lato, common Pleuromya cf. vancouverensis Whiteaves, Isognomon? sp. indet.	1	382 3/4
24	Shale, grey, partly ferruginous, becomes more ferruginous and red-brown coloured toward the top; weathers flaky; only strongly weathered rock seen.	1	381 3/4

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
23	Siltstone, grey to dark grey, slightly ferruginous in part, sandy; grades locally into silty, fine grained sandstone; weathers earthy; contains rare, scattered, rounded chert pebbles up to 1 inch in diameter; also contains some clay ironstone concretions 1 to 6 inches in diameter; grades into the overlying bed; fossils (GSC loc. 35651) include Buchia piochii (Gabb) s. lato.	2	380 3/4
22	Shale red-brown to yellowish brown, more or less strongly ferruginous, soft, weathers concretionary and/or flaky, contains numerous interbeds of grey to dark grey, soft, sometimes silty shale; numerous 1/2 to 1 1/2 feet thick interbeds of hard, red-brown to brown clay ironstone occur at intervals from 3 to 15 feet; numerous, variously shaped (rounded, loaf-like, irregularly shaped) concretions of the same clay ironstone occur scattered or form regular rows at variable intervals; these concretions range from 1 inch to 3 feet in diameter; 3 inches to 1 foot "cannon ball-like", rounded concretions of dark-grey, hard shale and siltstone with marcasitic cores occur in rows or irregularly scattered at several levels; fossils collected from a clay ironstone interbed 6 to 6 1/2 feet below the top (GSC loc. 35860) include: Pecten (Entolium) sp. indet., Lima (s. lato) sp. indet. and Pseudomelania? sp. indet.; those collected from another clay ironstone interbed 17 1/2 to 18 1/2 feet below the top (GSC loc. 35628) include: numerous Buchia fischeriana (d'Orbigny) s. lato, numerous B. piochii (Gabb) s. lato, rare B. aff. mosquensis (Buch) s. lato, Aucellina? n. sp. aff. schmidti Sokolov, Oxytoma sp. indet., Lima (Pseudolimea) aff. blackei Cox, Pecten	110 3/4	378 3/4

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	(Entolium) sp. indet., "Turbo" aff. ferniensis Frebold, gastropod, genus and species indet., Dentalium (s. lato) sp. indet.; those collected from the third clay ironstone interbed 21 1/2 to 22 1/2 feet below the top (GSC loc. 35889) include: Pecten (Entolium) sp. indet., Pecten (Pseudamussium?) sp. indet.; those collected from clay ironstone concretions in red-brown, ferruginous shale 34 1/2 to 38 1/2 feet below the top (GSC loc. 26987) include: numerous and typical representatives of Buchia fischeriana (d'Orbigny) s. lato, Buchia sp. indet., Pleuromya sp. indet., Astarte? sp. indet., Lima (Pseudolimea) aff. blackei Cox, Pecten (s. lato) sp. indet., Phylloceras? sp. indet. Judging by the lithology and appearance of fossils and enclosing rock, fossils collected by O'Neil (1924, pp. 16A-17A) on the eastern slope of Black Mountain (=Mount Gifford) are derived from this very bed and section; fossils collected from the fourth clay ironstone interbed 53 1/2 to 54 1/2 feet below top (GSC loc. 35852) include Pecten (s. lato)? sp. indet.; fossils collected from the fifth clay ironstone interbed 68 1/2 to 69 1/2 feet below the top (GSC loc. 35870) include: Aucellina? n. sp. aff. schmidti Sokolov, Pecten (Camptonectes) sp. indet. ?, gastropod, genus and species indet.; those collected from the sixth clay ironstone interbed 90 1/2 to 91 1/2 feet below the top (GSC loc. 35866) include; Buchia fischeriana (d'Orbigny) s. lato, B. fischeriana var. trigonoides (Lahusen), Pleuromya sp. indet, Thracia? sp. indet., gastropod, genus and species indet.; fossils collected from clay ironstone concretions in grey shale 95 1/2 to 96 1/2 feet below top (GSC loc. 35867) include: Buchia cf. fischeriana		

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	(d'Orbigny) (an early form?) and gastropod, genus and species indet.; and finally fossils collected from the grey to brownish grey shale forming the basal 1/4 to 3/4 of a foot of the unit (GSC loc. 35679) include: Buchia cf. fischeriana (d'Orbigny) s. lato (early forms?), Pleuromya cf. vancouverensis Whiteaves, Pecten (Camptonectes) praecinctus Spath, Lima sp. indet., Oxytoma cf. expansa Phillips, Thracia sp. indet., gastropod, genus and species indet.; grades into underlying and overlying rocks.		
	Buchia mosquensis (upper part) and Buchia piochii zones (undivided)		
21	Shale as in overlying unit and with the same clay ironstone and "cannon ball-like" shale concretions; contains interbeds of red-brown, hard clay ironstone from 1/2 to 6 feet thick; fossils collected from a clay ironstone interbed 29 1/2 to 30 1/2 feet below top (GSC loc. 35842) include: Buchia cf. mosquensis (Buch) s. lato, B. cf. piochii s. lato, Arctica? sp. indet, pelecypods, genus and species indet.; those collected from another clay ironstone interbed 36 1/2 to 37 1/2 feet below top (GSC loc. 35868) include: Pecten (Entolium?) sp. indet., Lima (s. lato) sp. indet., Dentalium (s. lato) sp. indet., fossil wood; base cut off by a major fault striking S 50° W and apparently dipping 70° east judging by the attitude of contorted shale and shear planes; displacement is not definitely known because of lithological monotony of the rocks around the fault; visible.	93 3/4	268

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	The underlying unit has been measured on the northern side of the above mentioned fault where it appears to underlie immediately the continuation of unit 21.		
20	Shale, grey to dark grey, interbedded with some rust- to red-brown weathering, ferruginous shale, soft, flaky to earthy weathering; hardly any clay ironstone concretions except for occasional, scattered small, rectangular to angular and elongate concretions with marcasitic cores and a row of closely spaced, rounded clay ironstone concretions at the base of the unit; the latter (GSC loc. 35847) yielded Pecten (s. lato) sp. indet. and gastropod, genus and species indet.	20	174
	A 20 to 25 feet wide fault zone crosses obliquely the promontory at the base of unit 20; this unit was accordingly found on its southern side where all the underlying beds of the section have been measured; the identity of unit 20 on both sides of the fault is not quite certain, however.		
19	Covered interval probably underlain by the same shale as in underlying and overlying units; assumed to correspond to 15 feet of the section.	15	154
18	Clay ironstone of usual type (as in beds 14 and 16).	1	139
17	Shale, grey, strongly weathered or completely decomposed; often covered by rock debris.	2	138

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
16	Clay ironstone, grey to yellowish brown, hard, brittle, concentrically weathered, highly fractured and cut by several minor faults; contacts obscured by debris; strikes N 20° E, dips 12° west.	1/2	136
15	Covered interval probably underlain by the same shale as in bed 17; assumed to correspond to 5 1/2 feet of the section.	5 1/2	135 3/4
14	Clay ironstone, as in bed 16; fossils (GSC loc. 35903) include Buchia? sp. indet. pelecypod, genus and species indet., Turritella (s. lato) sp. indet.; both contacts covered.	4	130
13	Almost covered interval with some patches of decomposed grey shale and streaks of clay ironstone suggestive of its being underlain by these rocks throughout; assumed to correspond to 11 feet of the section.	11	126
12	Shale, grey, often silty, ferruginous, weathers red-brown, weathers platy to flaky and grades into clay ironstone; numerous 6-12 inches long loaf-like concretions of clay ironstone; fossils (GSC loc. 35844) include: Pecten (s. lato) sp. indet., gastropod, genus and species indet.	3	115
11	Clay ironstone, red-brown to grey, interbedded with similar shale, hard to soft, ferruginous; contains rounded clay ironstone concretions and clay ironstone pebbles up to 1 inch in diameter; weathers concretionary; grades upward in bed 12; locally replete with crinoid stems and ossicles; fossils include (GSC loc. 35737): Inoceramus sp. indet., nuculoid pelecypod, genus and species indet., Patella-like gastropod, genus and species indet., Pentacrinus sp. indet., carbonized fossil wood.	5 1/2	112

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
10	Shale, as in bed 12; unfossiliferous; base covered.	1/2 (or less)	106 3/4
9	Covered interval with traces of ferruginous shale and rust-coloured clay ironstone; probably underlain with these rocks throughout; assumed to correspond to 8 feet of the section.	8?	106
8	Clay ironstone, red-brown, hard, locally grades into grey clay ironstone; concretionary; strikes N 20° E, dips 15° to 20° W; only indeterminate pelecypods have been found.	1/2 (or less)	98
7	Almost covered by rock debris and soil; patches of decomposed grey shale as below; probably underlain by such shale throughout; assumed to correspond to 3 1/2 feet of section.	3 1/2	97 3/4
6	Shale, grey to red-brown, ferruginous to slightly ferruginous, soft, weathers flaky or (more rarely) platy; silty in places, locally gypsiferous; some small to large, rounded to irregularly shaped clay ironstone and mudstone concretions; rare and thin interbeds of clay ironstone and harder grey shale protruding bankwise; outcrops often poor and intermittent; rare, indeterminate pectenids and other indeterminate pelecypods occur at several levels; fossils collected from ferruginous shale 11 to 11 1/4 feet above base (GSC loc. 35850) include: "Turbo" sp. indet., and an indeterminate rhynchonellid brachiopod; top covered; grades into underlying beds.	16 1/2	94

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Buchia mosquensis zone (middle part)		
5	Shale, grey, weathers red-brown, silty and sandy, grades into fine grained, silty sandstone locally, thinly laminated, highly ferruginous, grades in part into clay ironstone; softer beds alternate with harder, weathering-resistant beds; scattered, slightly rounded to subangular quartz and chert pebbles from 1/10 to 1/4 inch in diameter give a conglomeratic appearance to this bed; strikes N 20° E and dips 10° to 15° W; fossils (GSC loc. 35861) include Buchia mosquensis (Buch) s. lato, and Turritella (s. lato)? sp. indet.	6	77 3/4
4	Shale, grey, weathers brown or brown-red, ferruginous; weathers flaky to platy; some 1/8 to 1/2 inch in diameter, imperfectly rounded pebbles occur scattered in the lower 2-3 feet of the bed; bands of hard, rust-coloured clay ironstone 1-3 inches thick each occur at irregular intervals; contact with overlying bed 5 apparently gradational but poorly exposed, base covered; strikes N 20° E, dips 15° W; fossils (GSC loc. 35863) include Buchia mosquensis (Buch) s. lato including the giant forms of the species.	15 3/4	71 3/4
3	Covered interval occupying an almost flat part of the promontory and extending for a considerable distance downslope, probably underlain by the same shale as that of bed 4; assumed to correspond to about 25 to 30 feet of the section.	25-30?	56
2	Siltstone, buff to grey, clayey and/or sandy in places, platy, sometimes crossbedded, weathers splintery, partly ferruginous; fossils collected from the whole thickness (GSC loc. 35757) include: Buchia mosquensis (Buch) s. lato and crinoid	6	26

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	ossicles; interbedded with grey to red-brown, flaky to blocky-weathering, ferruginous shale with grades into clay ironstone in places.		
1	Shale, grey to red-brown, partly silty, weathers flaky to blocky; interbedded with thin layers of similar, somewhat sandy in part, grey to buff, platy siltstone; rare fossils collected from the whole thickness (GSC loc. 35798) include Buchia mosquensis (Buch) s. lato; base covered; grades upward into bed 2; visible.	20	20
	The slope is covered for some 250 feet below and east of bed 1; this overgrown and soil-covered slope is believed to harbour a major northerly striking fault (see Jeletzky, 1960, geol. map).		

Section 2

Location: East slope of Aklavik Range about 5/8 of a mile north-northeast of the lower end of Bug Creek Canyon in the south bank of the 1st northerly confluent of Bug Creek below its canyon's mouth; N Lat. 68°04'30"; W Long. 135°28'10".

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Lower member (restricted)		
	Buchia concentrica zone?		
3	Shale, ash to dark grey, weathers light grey and crumbly, soft to medium hard; rare septaria-like concretions of clay ironstone from 3 to 20 feet in diameter; a few poor, Cylindroteuthis-like belemnites and one Buchia sp. indet. seen on the float (none collected); top concealed at the overgrown rim of the plateau; visible.	65-70 (est.)	133
2	Shale, ash to dark grey, fissile, weathers fine flaky, sulphur-stained, soft with interbeds of harder shale, small rounded inclusions of hard, dark grey shale, those of gypsum-enriched shale and 1-4 inch marcasitic concretions are irregularly distributed; irregularly contorted and crumpled in the lower 2-5 feet, which is probably due to the slippage along the contact with unit 1 in connection with adjacent fault; contact with unit 1 is sharp and uneven and the surface of this unit is replete with small pits and depressions 1/4 to 3 inch deep and 1/2 to 4 inches wide; this "etching" may have been caused by boring marine organisms; the pits and depressions are filled out by shales of unit 2, the lower 2-3 inches of the shale being coloured light yellow and are apparently strongly enriched in sulphur; no basal conglomerate or accumulation	33	63

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	of coarse detritus of any kind has been observed at the contact of units 1 and 2 and the shale definitely rests directly on the "etched out" surface of unit 1; From 6 to 18 feet above base the shale is harder and distinctly layered; about 6 feet higher occurs a 3-6 inch thick, concretionary layer of brown, ferruginous clay ironstone (GSC loc. 26993) containing fossil wood and "Turbo" sp. indet.; poor belemnites apparently belonging to Cylindroteuthis occur on the float at this level; a persistant 3 to 5 feet thick bed rich in irregularly shaped, septaria-like clay ironstone concretions and irregularly shaped lenses and nests of pebbly and sandy, ferruginous siltstone begins 5 to 5 1/2 feet above the top of above mentioned fossiliferous layer; fossils collected in this bed include: (GSC loc. 26990): Buchia cf. concentrica (Sowerby) s. lato (late forms partly transitional to B. mosquensis s. lato?), Lima (Limea) sp. indet., Pecten (Entolium?) sp. indet. This bed forms the top part of the unit.		
	Bug Creek Formation		
	Upper sandstone member		
1	Sandstone, light grey to buff, weathers buff to rust-coloured, fine grained; massive in appearance; base concealed (cut off by a fault?); visible.	30	30

Section 4

Location: Right side of Bug Creek between lower end of its canyon and a point some 7/8 of a mile upstream therefrom. Lat. 68°04'00" N; Long. 135°25'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Buchia concentrica zone?		
29	Shale, dark grey, soft; exposures poor and only weathered rock seen. Contact with unit 28 not exposed (a 5-6 foot wide covered interval). Top concealed. Visible.	12-15	689
	Bug Creek Formation (Type Section)		
	Upper sandstone member		
28	Sandstone, grey to buff, sometimes lavender-tinged, fine- to medium-grained, clean, quartzose, massive to blocky in appearance but with interbeds of more distinctly bedded sandstone, weathering-resistant, medium hard; interbedded with softer, speckled grey, lavender-tinged, fine-grained sandstone replete with worm burrows; some nests and lenses of sandstone like that of bed (26). No fossils seen. Outcrops intermittent and poor. Base and top concealed.	200 (est.)	674
27	Covered interval at the top of a considerable cataract of Bug Creek (just above its confluence with the first sizable left tributary above the canyon) and in the bed of its left confluent.	20-25 (est.)	474

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Sandstone-siltstone member		
	Zones of Cadoceras spp. and Arctocephalites? (undivided)		
26	Sandstone, blue-grey and speckled when fresh, brownish grey to greenish grey when weathered, otherwise entirely similar to sandstones of beds (22), (20) and (18); minor interbeds of soft and very silty sandstone; becomes hard and colour changes to light grey to lavender grey when fresh and whitish grey and yellow when weathered in the upper 10 feet exposed; above described blue-grey, friable sandstone becomes restricted to partings and minor interbeds in this interval. Contact with bed (25) very sharp but apparently even. Top covered. Visible.	35 (est.)	449
25	Sandstone, dark grey when fresh, weathers buff to rusty, friable to hard, fine-grained, laminated to thinly bedded; interbeds 2'-5' thick of similar but massive to indistinctly bedded buff sandstone; small and large ripple marks abound throughout; some small marcasitic concretions; worm burrows and variously shaped problematical structures abound in softer concretionary weathering sandstone varieties. Rare pelecypods including Pecten (s. lato) and Cardium (s. lato) occur locally (GSC loc. 26897).	50-55 (est.)	414
24	Covered in the bed of a small creek falling into Bug Creek from the south.	5-6	359
23	Siltstone like that of beds (19) and (17), sandy; with interbeds of sandstone like that of beds (20) and (18). Top concealed. Visible.	12-15	353

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
22	Sandstone like that of beds (20) and (18), weathering-resistant.	14-15	338
21	Siltstone, dark-grey, sandy to very sandy, soft, weathers fine conchoidally; interbeds of similar slightly sandy siltstone; grades upward into bed (22).	20-25	323
20	Sandstone, blackish grey when fresh, weathers buff to speckled grey, fine-grained, silty, friable and with a conchoidal texture; grades upward into bed (21).	10-12	298
19	Interbedding of sandy shale, siltstone and fine-grained, silty sandstone; all rock varieties are light grey, soft and shale-like; apparently interbedded with sandstone as in bed (18) as well but exposures are poor; grades upward into bed (20).	6	286
18	Sandstone, buff to light brown-grey, fine-grained, friable, silty, with a conchoidal texture; some nests and lenses of shale and siltstone as in bed (17); sulphur-stained and alkaline testing. Some 2 1/2 to 3 feet above the base a 1/2 foot thick layer is rich in generically indeterminable cadoceratid or arctocephalitid ammonites (GSC loc. 26884; identified by H. Frebold). Grades into bed (19). Lower boundary conformable but abrupt.	8-9	280
17	Shale and siltstone, dark brownish grey, crumbly weathering and concretionary textured, soft, sulphur-stained, sandy; contain abundant crystals of marcasite and those of some alkaline mineral; numerous small nests and lenses of sandstone as in bed (16) are scattered throughout the thickness; fauna as in bed (16).	10-11	271

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
16	Sandstone, brownish grey when fresh, intensively rust coloured and sulphur-stained when weathered, hard, fine-grained; 1-3" thick interbeds of soft, poorly sorted, silty sandstone; in the upper 2 feet sandstone becomes interbedded with shale as in bed (17) and in the uppermost 6 inches it is reduced to nests, lenses and concretions in this shale; this upper part of bed (16) forms a transition to bed (17); Inoceramus ex gr. retrorsus (Keys.), Cylindroteuthis sp. indet. and Arctica? sp. indet. occur rarely throughout the thickness.	6-7	260
	Intermediate sandstone member		
	Zone of Cranocephalites borealis		
15	Sandstone, grey, buff or whitish grey, clean, quartzose, fine-grained, weathering resistant, rare and irregularly shaped iron stains and pyritic concretions; often crossbedded and ripple marked; mostly very thin bedded to laminated but includes considerable interbeds of massive to blocky weathering buff sandstone and interbeds of wine red sandstone. Lower boundary gradational, upper boundary disconformable. Pachyteuthis sp. indet. and Cylindroteuthis sp. indet. as in bed (14) are scattered throughout the thickness of the bed or occur in lenses and nests at various levels.	10-11	253
14	Sandstone, light-grey, buff or more rarely wine-red, thinly bedded and concretionary weathering, clean and quartzose, various colour phases form irregular spots and nests (especially the wine-red one); some dark grey sandstone concretions; some interbeds and nests of coarse-grained,	7	242

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	gritty sandstone. Cranocephalites borealis Spath., C. warreni Frebold (identified by H. Frebold), Pachyteuthis sp. indet. (large stout forms superficially resembling Acroteuthis), Cylindroteuthis sp. indet. and fossil wood occur rarely throughout the thickness of the bed (GSC loc. 26883). Some 3 feet above its base the above mentioned belemnites are accumulated in nests 1-3' long and 2-5" thick within a layer of coarse-grained, gritty sandstone with dispersed small pebbles.		
13	Sandstone, as in unit (15) but without interbeds of massive, to blocky-weathering sandstone. A few Pachyteuthis sp. indet. fragments seen.	5-6	235
	Beds 14 and 13 have been traced downstream along the south side of Bug Creek Canyon to a point about 1/2 mile up from its lower end where the section was resumed.		
12	Sandstone, mostly light grey to buff, with some 3" to 6" interbeds of wine-red sandstone at irregular intervals, fine- to medium-grained, hard to friable, quartzose, flaggy to laminated, often crossbedded and ripple marked; forms a sheer bluff.	70-80	229
11	Sandstone, light grey to buff, often rose-coloured on weathered surface, fine-grained, weathering-resistant, clean and quartzose; partly finely laminated; numerous current or ripple marks; locally interbedded with laminated, wine-red coloured sandstone and/or 3" to 10" beds of silty sandstone as in unit (10). Contact with underlying rocks mostly sharp to very sharp but quite even.	8-9	149

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Grey siltstone member		
	Echioceras (s. lato) sp. indet. zone		
10	Siltstone, medium grey when fresh, weathers brownish grey to tawny, sandy, soft to medium hard, indistinctly bedded, fractures fine conchoidally; interbedded with thin beds of shale-like, grey, fine-grained, silty sandstone. In the upper 6-7 feet this shale-like sandstone predominates and is interbedded with green-grey, medium- to fine-grained harder sandstone. Echioceras (s. lato) sp. indet. collected on the float (GSC loc. 26977) of the lower 10' of the bed; rich fauna of indeterminate pelecypods collected from a 1/2' thick bed of brownish grey, silty sandstone about 3 1/2' below its top. Grades downward into bed (9).	36-37	140
9	Shale, medium grey when fresh, soft, weathers brownish grey and fractures conchoidally; interbedded with shale-like, medium grey, distinctly bedded, sandy siltstones which weather buff and tawny. Echioceras (s. lato) sp. indet. collected on the float and in place (GSC loc. 26976) some 12 to 13 feet below top of the unit.	30-35	103
	Basal sandstone member		
	Arctoasteroceras jeletzkyi zone		
8	Sandstone, much as in bed (3) and rich in indeterminate pelecypods and gastropods preserved as phosphate nodules.	3-4	68

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
7	Interbedding of soft, dull grey, sandy siltstone with fine- to medium-grained sandstone as in beds (3 to 5); some of sandstone interbeds carry dispersed pebbles; abundant clay ironstone or sandstone nodules. Exposures poor and mostly slumped down. Apparently grades into overlying rocks.	18-20	64
6	Covered.	5-6	44
5	Sandstone, much as in (4) but weathers intensively maroon or reddish rusty; rich in indeterminate pelecypods and gastropods mostly preserved as phosphate nodules. Lower boundary gradational, upper boundary covered. Visible.	3-4	38
4	Sandstone much as (3) but without pebbles and weathers speckled grey, drab or rusty. Arctoasteroceras jeletzkyi Frebold and indeterminate gastropods collected loose on the surface (GSC loc. 26975).	10	34
3	Sandstone, dark grey, fine-grained, pebbly; fractures conchoidally to lumpy; contact with (2) sharp and uneven.	12	24
2	Pebble conglomerate, pebbles mostly well to fairly well rounded, loosely cemented by arenaceous to silty matrix; fine pebbles from 1/8" to 1 1/2" in diameter predominate, larger pebbles rare; chert pebbles strongly predominate; they seem to be second or third generation pebbles derived from the Ordovician-Devonian rocks.	1/2	12 1/2
	Permian		
1	Sandstone, rusty red to tawny, fine-grained, medium hard, rich in Spirophyton-like problematical structures and worm burrows. Upper contact sharp and uneven; it is apparently a disconformity. Base concealed. Visible.	12	12

Section 17

Location: East slope of Aklavik Range, Richardson Mountains about 2 3/8 miles south-southeast of Bug Lake and about 1 mile north of Jimmy Creek; only 1/4 of a mile north and across the valley from Section 24; Lat. 68°03'30"; Long. 135°28'.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Bug Creek Formation		
	Intermediate sandstone member		
9	Sandstone, grey to brownish grey, fine grained, soft, weathers crumbly, sulfurtasting; interbeds of hard, grey sandstone otherwise similar to the soft variety; the bed is rather strongly sheared and contorted; top cut off by a fault (thrust?) trending 330°-340° and dipping 65-70° west; contact with underlying unit is sharp and uneven; visible.	12	535
8	Sandstone, light grey when fresh, rust- to buff-weathering, fine grained, thin bedded to laminated, crossbedded and locally ripple marked; interfingers with 2 to 12 inch thick layers and beds of rust red, ferruginous sandstone and soft, grey sandstone containing nests, layers and partings of impure coal; some coaly sandstone and clay ironstone; general strike about S 10° W, and dip 65 to 70° W (overturned); a small concretion containing indeterminate pelecypods and gastropods was found 18 feet below top of the unit (GSC loc. 26981); another small fossiliferous concretion containing indeterminate pelecypods was found 12 to 13 feet above the base (GSC loc. 26982); the basal 9 to 10 feet of the unit include several sandstone beds rich in large Pachyteuthis sp. indet. (Acroteuthis-like) and at least two lenticular layers where these belemnites form regular belemnite	35	523

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	"battle fields" (none collected); contact with underlying bed appears to be abrupt but is poorly exposed.		
7	Pebble conglomerate, fine, consists largely of chert pebbles in rust-coloured sandy and gritty matrix; very strongly sheared, contorted and often regularly squashed; exact measurement impossible but the thickness is probably between.	1/2-1	488
	Grey siltstone member		
	Echioceras s. lato sp. indet. zone		
6	Clay ironstone or silty, fine grained, ferruginous, rust to red-coloured sandstone; hard, rich in small marcasitic concretions near the base; locally fossiliferous but only indeterminate pelecypods were noted (none collected); the bed is mostly completely squashed or badly contorted; whenever less disturbed it strikes N 10 to 20° W and dips 65° to 70° W (overturned).	1/2	487
5	Interbedding of shale and siltstone in beds from 6 inches to 3 feet, alternation of light grey, rust-coloured, yellow and wine-red beds; interfingered with thin layers and 3 to 10 inch thick beds of harder sandy siltstone and silty sandstone of the same coloration; small and large, hard, limy shale and siltstone concretions occur in rows or are irregularly scattered throughout the unit; concretions are often fossiliferous but only indeterminate gastropods and pelecypods have been found at most levels; fossils collected from two rows of rounded concretions 2 to 4 feet in diameter occurring 26 to 32 feet below the top include	75 (approx.)	486

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Echioceras s. lato sp. indet. (GSC loc. 26979); lower 10 to 15 feet built of very sandy siltstone grading into fine grained, silty sandstone; this siltstone becomes more and more rust- to reddish coloured downward; grades imperceptibly in underlying bed.		
	Basal sandstone member		
	Arctoasteroceras jeletzkyi zone		
4	Sandstone, varicoloured, all colour variations are in rust-red gamma; brown, tawny, and intensively rust-red colours alternate more or less irregularly; mostly fine grained but becomes medium to coarse grained, pebbly and gritty in the lower 15 to 17 feet; rich in phosphatic casts of indeterminate pelecypods and gastropods and in calcareous concretions; fossiliferous almost throughout; often limy, weathering-resistant and forms a pronounced hogsback across the highest point of the east-west trending ridge where the section was measured; fossils collected from a 2 1/2 to 3 feet thick bed of grey, intensively rust to red-weathering sandstone with numerous fossiliferous concretions of calcareous sandstone include (GSC loc. 26973); Arctoasteroceras jeletzkyi Frebold, 1961 and variants, Oxynoticeras cf. oxynotum (Quenstedt), Oxynoticeras sp. indet., Nautilus, genus and species indet., gastropods and pelecypods, gen. et spp. indet., the top of this bed occurs 4 to 5 feet below the top of the member; fossils collected from a 2 to 2 1/2 foot thick bed of fine to medium grained, grey, intensively rust or brown weathering	32 (approx)	411

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	sandstone with small rounded phosphatic concretions, rare, small, scattered chert pebbles and rare nests of the same include (GSC loc. 26978): Arctoasteroceras (?) sp. indet., Oxynoticeras (Gleviceras?) sp. indet., pelecypods and gastropods, gen. et spp. indet., fossil wood; the top of this bed is about 10 feet below the base of the previous fossiliferous bed; fossils collected from a 1 1/2 feet thick bed of gritty and pebbly, medium grained, poorly sorted sandstone containing nests of small pebbles include only indeterminate pelecypods of the same general type and preservation as those occurring in younger fossiliferous beds of the unit; this bed occurs 14 to 15 1/2 feet above base of the unit; the unit is less disturbed than the overlying members of Bug Creek Formation, it strikes about north (true) and dips from 60° to 85° west (overturned), dips vary within shortest distances along and across the strike; grades downward into bed 3.		
3	Pebble conglomerate, fine to medium; rust-coloured; in the upper 6 to 10 inches well rounded pebbles 1/8 to 1 inch in diameter are embedded in abundant rust-coloured sandy matrix; in the lower 2 to 3 feet pebbles 1/4 inch to 3 inches in diameter are poorly rounded and tightly packed, and the rock itself is hard; pebbles are mostly of grey to black chert throughout but rare pebbles of grey sandstone and quartz up to 6 inches in diameter occur as well; matrix between pebbles is usually silty or sandy, poorly sorted, grey when fresh but weathers intensively rust-coloured; the bed is badly sheared and faulted, general attitude as in younger beds and units; base nowhere exposed; visible thickness varies strongly within short distances along strike.	1-4	379

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
2	Covered interval; probably harbors a strike fault as large blocks of bed 3 have been noted to occur in the badly broken rock of unit 1.	3-6	375
	Permian or? Upper Carboniferous		
1	Breccia, sedimentary, fine to coarse, intensively rust- to tawny red coloured in weathered state; fresh rock not seen, soft; contains interbeds and inclusions of conglobreccia and poorly rounded, pebble conglomerate; fragments and pebbles almost invariably grey to black chert; interbeds of red, pebbly to gritty shale and siltstone with rose-coloured limestone concretions; attitude as for younger beds; badly broken by faults in places;top covered, visible (barring repetition of beds by faults).	370?	370

Section 22

Location: Measured along north side of main branch of Husky Creek cutting through east slope of Aklavik Range about 5 miles north of the top of Mount Goodenough. Lat. 68°02'00" N; Long. 135°25'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation (type section)		
	Lower member (restricted)		
	Zone of Buchia mosquensis		
	Bed 16 of this section immediately underlies bed 1 of Section 1 (Field No. 22) published by Jeletzky (1958b, pp. 26-27).		
16	Interfingering of shale as that of the overlying bed with siltstone as that of bed 14.	7 (approx.)	364
15	Siltstone, much like that of bed 11, hard, sandy; poorly preserved Buchia cf. mosquensis (Buch) s. lato occur locally (none collected).	3 1/2	356
14	Thin (layers from 1 to 3 inches thick) interfingering of shale, like that of bed (13) and siltstone like that of beds 12 and 11.	6 (approx.)	353
13	Shale, blackish grey, brownish grey weathering, soft, silty, flaky weathering, poorly exposed; similar to shale of beds 3, 5 and 7.	29 (approx.)	346
12	Siltstone, much as that of bed 11 but softer; grades imperceptibly into beds 11 and 13.	12	317
11	Siltstone, lighter grey than that of bed 10, speckled coloured, weathers intensively rust-coloured, hard, fairly to very sandy, interfingered with some softer siltstone similar to that of bed 10; weathers platy and conchoidally and easily crumbles into	12	305

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	small pieces; forms a double hogsback with a trough in the middle along the slope; poorly preserved Buchia cf. mosquensis (Buch) s. lato and other pelecypods apparently identical with those found in bed 9 occur locally (none collected).		
10	Siltstone, grey, weathers rust-coloured, slightly sandy, interbedded with pure siltstone, hardness varies; generally much like that of bed 8.	24	293
9	Siltstone, grey-brownish, weathers rust-coloured, poorly bedded, medium hard, rich in darker-coloured worm burrows, strongly sandy, locally grades into fine grained, very silty, shale-like sandstone; contains huge concretions of dark grey, orange to intensively yellow weathering, flaky and calcareous shale up to 15 feet in diameter; stands out as a sharp hogsback along the slope from its top to the bottom; strikes S 70° W and dips 55 to 60° E; sheared and jointed but not contorted; numerous and variegated fossils occurring in this bed (largely in concretions) include (GSC loc. 26961): Amoeboceras, subgenus et species indet., early forms of Buchia mosquensis (Buch) s. lato and those transitional? to B. concentrica (Sowerby) var. erringtoni (Gabb), Pleuromya sp. indet., Pholadomya sp. indet., Arctica? sp. indet., Modiolus sp. indet., Thracia? sp. indet.; most pelecypod shells preserved with their valves intact or gaping; the bed is 5 to 6 feet thick except where blown up to 8-12 feet by previously described large concretions.	5-6	269
8	Siltstone, dark-grey, weathers brownish grey to rust-coloured, slightly sandy, harder than shale of bed 7.	2	263

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
7	Shale, as that of beds 3 and 5; no concretions seen; apparently unfossiliferous.	45 1/2	261
6	Shale, dark-grey, weathers intensively rust-coloured, harder than shale of bed 5; stands out in relief like a hogsback; carries large, loaf-like or lens-like concretions of weathering rust-coloured, hard, flaky weathering, calcareous, fossiliferous shale; fossils also occur in the non-concretionary shale itself; the rock is strongly jointed and sheared, locally slickensided and cut by several minor faults; the continuity of the section appears to be preserved, however, as the rock is not contorted and has a persistent strike of S 70-75° W and dip 60° E; fossils collected from concretions in the upper 1 1/2 feet of the bed include (GSC loc. 26960): early forms of Buchia mosquensis (Buch) s. lato (common), B. cf. concentrica (Sowerby) s. lato (rare) and indeterminate pelecypods.	5-6	215
	Buchia concentrica zone?		
5	Shale, as that of bed 3; unfossiliferous.	64	209
4	Shale, dark grey, weathers intensively rust-coloured and conchoidally, hard, massive-looking; fossils collected from the whole thickness include (GSC loc. 26951): Buchia aff. kirghisensis (Sokolov) s. lato (transitional between that species and B. mosquensis var. polita Keyserling?), Buchia ex gr. mosquensis (Buch) s. lato?, Astarte sp. indet., Dentalium (s. lato)? sp. indet.	2 1/2	145 1/2
3	Shale, generally similar to that of bed 2 but brownish grey coloured; unfossiliferous; no reliable attitude was observed but the unit appears to be undisturbed by faulting.	42 (approx.)	143

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
2	Shale, blackish grey, weathers brownish grey and flaky, soft, sulphurstained; fissile to laminated in fresh state; appears to be contorted (?) due to slippage along the contact with unit 1 along the boundary between these two units; does not seem to be contorted or faulted elsewhere although no definite attitudes have been seen; unfossiliferous but believed to represent Buchia concentrica zone as representatives of this species group have been found in equivalent beds in other sections of Husky Formation.	81 (approx.)	101
	Bug Creek Formation		
	Upper sandstone member		
1	Sandstone, whitish grey, fine to medium grained, quartzose; pieces of carbonized wood occur immediately below the top; moderately jointed and sheared and cut by closely spaced minor, normal faults; strikes S 85-90°W and dips 45 to 50° S; upper surface very uneven and with numerous hollows and pockets filled out with shale of unit (2); these hollows are separated from each other by protruding knobs; contact with unit 2 is knife-like sharp and suggestive of erosional boundary but no basal conglomerate of any kind was observed there; base covered; visible to the overgrown top of the plateau.	20	20

Section 24

Location: East slope of Aklavik Range, Richardson Mountains, about 2 and 5/8 miles south-southeast of Bug Lake and about 1 mile north of Jimmy Creek; only about 1/4 of a mile south and across the valley from Section 17. Lat. 68°02'00" N; Long. 135°25'00"W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Bug Creek Formation		
	Intermediate sandstone member		
14	Sandstone, whitish grey to buff, interbedded with rose to tawny-red sandstone, usually fine grained, quartzose, clean, mostly laminated to thinly bedded; in lower 35 to 39 feet interbedded with 6 to 12 inches thick beds of rust-weathering clay ironstone and dark grey, coaly shale; rich in poorly preserved belemnites belonging to Cylindroteuthis and Pachyteuthis (including large, Acroteuthis-like representatives of the latter genus) (GSC loc. 25771); also Inceramus sp. indet. and poor indeterminate ammonites have been seen in upper two-thirds of the unit; some fossil wood occurs locally; strongly sheared and jointed and locally contorted; strikes N. 10°-15° W and dips 60 to 65° W (overturned); top cut off by a westerly dipping and northerly trending major thrust; visible.	52	240
13	Sandstone, light grey, mostly fine grained; interbedded with thin layers of coarse grained sandstone and grit.	1-2	188
12	Pebble conglomerate, fine, salt and pepper coloured, rich in gritty and coarse sandy matrix; some clay ironstone interbeds; contact with the underlying bed knife-like sharp but even.	1/2	187
11	Sandstone, whitish grey, fine grained, medium hard.	2	186

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
10	Sandstone as in bed 11 but replete with belemnites of the same genera as in unit 14; these belemnites form a regular belemnite "battle field"; pebbles appear to be absent.	1/4	184
9	Sandstone, light grey with dark grey, irregular partings and inclusions; rich in the same belemnites as those occuring in beds 10 and 14.	4	183
8	Irregular interfingering of pebbly grit and coarse grained sandstone; thickness varies strongly within shortest distances.	1/4 - 1	179
7	Pebble conglomerate, fine, medium grey; rich in sandy matrix and fragmentary, rounded (transformed into pebbles) belemnites apparently of the same general type as those occuring in younger beds; contact with underlying rocks knife-like sharp, uneven and obviously disconformable.	1/4 (approx.)	178
	Grey siltstone member		
	Echioceras s. lato sp. indet. zone		
6	Siltstone, brownish grey, weathers wine-red, hard; indeterminate pelecypods and gastropods occur locally (GSC loc. 25764); lower 10 feet mainly concealed.	11	177
5	Interbedding of shale, siltstone and sandy siltstone; rose-coloured beds alternate with light grey and brownish grey coloured ones, soft; a few interbeds of medium hard, grey, impure limestone; Echioceras? s. lato sp. indet. and indeterminate pelecypods occur commonly in the middle part, the highest limestone interbed carrying Echioceras? s. lato sp. indet. occurs 30 feet below the top of member (GSC loc. 25766).	60	166
4	Covered interval, assumed to represent about 6 feet of the section.	6?	106

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Basal sandstone member		
	Arctoasteroceras jeletzkyi zone		
3	Sandstone, brownish grey, weathers rust-coloured, fine grained, often silty; weathering-resistant and forms a pronounced hogsback along the slope and across the top of the plateau above; locally rich in phosphatic nodules representing poor casts of pelecypods and gastropods; appears to grade downward into bed 2; contain some small chert pebbles and grit particles locally; strikes north to N 5° W and dips 80° to 85° west (overturned); fossils collected from topmost 1 1/2 to 2 feet of the unit include (GSC loc. 25762): Arctoasteroceras jeletzkyi Frebold var., Oxynoticeras sp. indet. (including large forms), Oxynoticeras (Gleviceras) sp. indet., gastropods and pelecypods, genus and spp. indet.; fossils collected from a 1 to 1 1/2 feet thick bed occuring 5 to 6 1/2 feet below the top of the unit include (GSC loc. 25765) Arctoasteroceras jeletzkyi Frebold.	27	100
2	Pebble conglomerate, fine to medium, brown to rust-coloured; pebbles are almost exclusively black to grey lamellated chert, mostly poorly rounded or flat, tightly packed; contact with unit 1 is invariably poorly exposed but appears to be normal in spite of strongly jointed, sheared and often faulted character of units 1-3.	3 1/2	73
	Permian or? Upper Carboniferous		
1	Breccia, sedimentary, fine to coarse, intensively rust- to tawny red-weathered, fresh rock was not seen, soft; interbeds of conglobreccia and poorly rounded pebble conglomerate; fragments and pebbles invariably black to grey chert; attitude as for unit 3; base covered, visible.	70	70

Section 28

Location: East slope of Mount Gifford about 1/4 mile northeast of the top part of Section 1 and across a deep ravine in the slope; Lat. 68°08'35" N; Long. 135°27'15" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Red-weathering shale member		
	Buchia okensis zone		
15	Shale, ash grey to blackish grey; weathers brown to rust-coloured, pure, soft; mostly only weathered rock seen; interbedded with numerous 2 to 14 inches thick, often somewhat concretionary beds and rows of 2 to 5 feet long and 1-2 feet thick, loaf-like to rounded concretions of clay ironstone (often very calcareous and grading into ferruginous and silty limestone) occuring at intervals from 1 to 3 feet; clay ironstone is mostly light to brownish grey when fresh and weathers intensively rust-coloured or wine red; fossils collected 20 to 21 feet below the visible top include (GSC loc. 35630): Buchia okensis (Pavlow) f. typ., B. okensis (Pavlow) var. canadiana (Crickmay, 1930) (including giant forms) and Tollia (Subcraspedites) sp. indet. (resembles T. aff. hoeli Frebold); the same fauna was observed to range almost to the base of the unit (lowermost occurence 2-3 feet above its base); the basal 2-3 feet sandy and? glauconitic; the base is marked by a row of concretions of sandy and glauconitic limestone; top cut off by a strong fault striking N 30-40° W and dipping 80 to 85° E. visible.	35-37	75
	Arenaceous member		
	Craspedites (Taimyroceras?) canadensis zone?		
14	Sand, blackish grey when fresh, weathers medium grey, glauconitic, fine grained, silty; carries scattered pebbles up to	4-5 1/2	40

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	4-5 inches in diameter at the top and base but appears to grade into underlying and overlying beds.		
13	Sandstone, blackish green, fine grained, very rich in glauconite; contains scattered, mostly angular pebbles up to 3 inches in diameter and thin interbeds of loose sand similar to the sandstone; strikes N 10° W and dips 40-45° E.	3/4	36
12	Sand, as in bed 14 but fine grained throughout and more silty; scattered pebbles up to 5 inches long and 2 inches high occur near the contact with bed 13; grades downward into bed 11.	3	35
11	Siltstone, medium grey with yellow streaks, soft, almost completely decomposed, very sandy; grades locally into very silty, fine grained sand; less sandy in the lower 2-3 feet.	5	32 1/4
10	Siltstone, brownish grey when fresh, weathers intensively rust-coloured, ferruginous, sandy.	3/4	27 3/4
9	Sandstone, medium grey when fresh, weathers intensively rust-coloured to maroon, fine grained, very silty, grades into very sandy siltstone; strikes N 5-10° W and dips 40° E.	3/4	27
8	Siltstone, medium grey when fresh, weathers rust-coloured, sandy; harder and blocky weathering layers are intercalated with softer and friable layers.	5-5 1/2	26
7	Shale, medium grey with rust-coloured specks when fresh, ash grey when weathered, slightly silty; fine rubbly 1 to 2 feet below surface; flaky on the weathered surface.	4-4 1/2	21
6	Siltstone, medium grey and blocky when fresh, flaky and ash grey on the surface, fairly sandy.	2 1/2	16 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
5	Clay ironstone (hard) or ferruginous shale (soft), medium grey when fresh, weathers intensively rust-coloured, silty.	1/2	14
	Lower member (restricted)		
	Buchia fischeriana zone		
4	Shale, brownish grey with rust-coloured specks when fresh, ash grey on the surface, fine flaky when completely decomposed, slightly silty; a persistent row of 3-6 feet long and 2-4 inches high, loaf-like or discus-like, septaria-like concretions of hard, medium grey, silty shale with intensively rust-coloured surface (crust) occurs in the middle of the bed; fossils collected from these concretions include (GSC loc. 35622) Buchia fischeriana (d'Orbigny) s. lato; the Jurassic-Cretaceous boundary must, accordingly, occur in the interval between beds 4 and 15; it was placed at the base of bed 15 as no Buchia okensis s. lato were seen below its base.	3 1/2	13
3	Shale, much as that of bed 4 but somewhat darker coloured in fresh state and more silty in places.	4-4 1/2	10
2	Clay ironstone, intensively rust-coloured throughout, concretionary or chunky weathered, hard; only weathered rock seen.	3/4	5 3/4
1	Shale, grey with brown tinge (only weathered rock seen), fine rubbly to flaky, soft, silty; base covered for 100 feet or more; visible.	5	5

Section 41

Location: About 3/4 mile south of the top of Mount Gifford; north bank of the First Creek south of this mountain just below the place where the creek changes its course abruptly from north to east (when looking northward); shown in middle background in Jeletzky (1961b, Fig. 13). Lat. 68°08'30" N; Long. 135°24'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Upper member (basal part)?		
	Buchia uncitoides zone?		
35	Shale, grey to dark grey, soft, flaky weathering, partly ferruginous; occasional, scattered, irregularly shaped clay ironstone concretions up to 9 inches in diameter; no fossils seen; top concealed by top soil and rock debris at the top of the slope; visible.	15 (approx.)	169
	Red-weathering shale member		
	Buchia okensis zone		
34	Shale, grey, similar to that of bed 35; top and base of the bed formed by 6 to 9 inches thick each layer of clay ironstone, red brown, concretionary weathering, hard; the top clay ironstone layer has yielded (GSC loc. 35881): Buchia okensis (Pavlow) s. lato, Buchia uncitoides (Pavlow) s. lato including var. spasskensoides Crickmay, 1930 and Buchia n. sp. aff. volgensis (Lahusen) s. lato; the lower clay ironstone layer has yielded (GSC loc. 35819): Buchia okensis (Pavlow) s. lato.	4 1/2	154
33	Shale, grey, similar to that of bed 34.	3	149
32	Clay ironstone, brownish grey, weathers brown to red brown and partly concretionary; in places grades into ferruginous shale laterally and vertically, hard; fossils include (GSC loc. 35877) Buchia okensis (Pavlow) s. lato (incl. typical forms), B. n. sp. aff. volgensis (Lahusen) (rare) and B. cf. uncitoides (Pavlow) s. lato (rare).	1/2 (approx.)	146

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
31	Shale, grey to red brown, soft, weathers flaky; occasional scattered, irregularly shaped clay ironstone concretions up to 9 inches in diameter; grades into bed 30.	8	145
30	Clay ironstone, similar to that of bed 32; contains (GSC loc. 35829) only a few small (half grown to juvenile) Buchia cf. okensis (Pavlow) s. lato.	9 (approx.)	137
29	Shale, grey, orange-weathering, ferruginous, soft, pure; no fossils seen; grades into bed 28.	6	128
28	Shale, as that of bed 29; top and base of the bed formed by 9 inch thick bands of clay ironstone as that of beds 30 and 32; rare and poorly preserved fossils include (GSC loc. 35882) only indeterminate gastropods and rare Buchia okensis (Pavlow) s. lato and Goniomya? sp. indet.; grades into adjacent beds.	3 1/2	122
27	Shale, grey, similar to that of the overlying beds; contains numerous, scattered, irregularly shaped clay ironstone concretions (GSC loc. 35684) up to 1 foot in diameter; these concretions yielded numerous Buchia okensis (Pavlow) s. lato including giant forms of B. okensis var. canadiana (Crickmay, 1930); grades into underlying bed.	15	118
26	Clay ironstone, brown-grey, weathers orange-brown to red brown and concretionary, hard; contains medium sized B. okensis (Pavlow) f. typ. (GSC loc. 35898).	1/2-3/4	103 3/4
25	Clay ironstone, like that of bed 25 but grades laterally into ferruginous shale with loose clay ironstone inclusions; rare fossils include (GSC loc. 35836): B. okensis (Pavlow) f. typ. and B. okensis var. subokensis (Pavlow).	2 3/4	103
24	Shale, as that of bed 27, ferruginous; contains scattered clay ironstone concretions, some of which are loaf-like and some irregularly-shaped, up to 1 foot in diameter;	15	100

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	fossils collected from these concretions at the level 3 feet below top (GSC loc. 35845) include: B. okensis (Pavlow) f. typ., B. okensis (Pavlow) var. subokensis (Pavlow), B. n. sp. aff. volgensis (Lahusen); grades downward into bed 23.		
23	Clay ironstone, as in overlying beds; forms a row of distinctive, closely spaced, loaf-like concretions up to 2 feet thick, weathers concretionary; intervals between concretions filled out by shale as in beds 24 and 27; grades into bed 22; fossils (GSC loc. 35823, 35730 and 35865) include: B. okensis (Pavlow) s. lato including giant forms, B. n. sp. aff. volgensis (Lahusen), B. cf. uncitoides (Pavlow) s. lato.	1 1/2-2	85
22	Shale, grey, weathers brown and flaky, ferruginous; glauconitic near the base; rare, irregularly shaped clay ironstone concretions scattered throughout the thickness; conformably and apparently gradationally overlies bed 21; no fossils seen.	5	83
	Arenaceous member		
	Craspedites (Taimyroceras?) canadensis zone?		
21	Sandstone, green to brownish green and finely mottled, fine grained, slightly silty, quartzose but glauconitic, poorly sorted with coarse grains of rounded quartz scattered throughout, medium hard.	1	78
20	Mostly covered with top soil; probably underlain by sandy and glauconitic rock at the top; this seems to grade downward into clayey, feruginous and silty rock; assumed to correspond to 3 feet of section.	3?	77
19	Clay ironstone, grey yellow when fresh, weathers red-brown or buff, silty and sandy; grades into ferruginous siltstone in part; only indeterminate pelecypod fragments found (GSC loc. 35825); grades into bed 18.	3	74

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
18	Siltstone, grey, weathers brown, ferruginous; outcrops very poor and intermittent.	3	71
17	Clay ironstone, grey to buff, weathers red brown, silty and generally similar to that of bed 19.	3/4	68
16	Shale, brownish grey, weathers red brown, ferruginous, soft but grades locally into hard clay ironstone.	6	67
15	Clay ironstone, generally similar to that of bed 17 but somewhat more sandy and more often grey in colour; Beds 17, 16 and 15 contain occasional rounded, 1/2 to 1 inch in diameter pebbles of chert and quartz; worm burrows are abundant in all three.	3/4	61
14	Shale, grey to dark grey, ferruginous in part, weathers flaky; grades into bed 13.	4	60
13	Clay ironstone, grey, weathers red-brown, hard and brittle, silty; some concretionary weathering; very rare, scattered pebbles as in beds 15 to 17 inclusive; very rare fossils include (GSC loc. 35871): Pleuromya cf. vancouverensis Whiteaves, pelecypods, genus and species indet., gastropods, genus and species indet.	1/2-3/4	56 3/4
12	Shale, light to dark grey, weathers mottled red brown, partly ferruginous, weathers flaky, soft; grades into bed 11.	8	56
	Lower member (restricted)		
11	Shale, ferruginous, brown grey, weathers red brown, hard and brittle, somewhat calcareous, slightly silty, weathers concretionary; capped by a 3-6 inch band of clay ironstone as in bed 13, which only rarely grades into soft, ferruginous shale; large, loaf-like concretions of grey, lithographic to very finely crystalline limestone 1 to 3 feet in diameter occur at irregular intervals; this limestone is very hard, slightly	5	48

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	ferruginous in partings and is buff to cream-coloured on weathered surface; no fossils found.		
	Buchia fischeriana zone		
10	Shale, grey to red brown, ferruginous, soft, weathers flaky; outcrops poor and partly obscured by soil and debris; grades into underlying bed; a row of clay ironstone concretions, irregularly shaped, 6 to 9 inches thick, red brown, concretionary weathering, hard, slightly silty, forms the base of the bed; fossils collected from these concretions include (GSC loc. 35822): Buchia fischeriana (d'Orbigny) s. lato, Buchia piochii (Gabb) s. lato and Lima (Pseudolimea) cf. blackei Cox.	6	43
9	Shale, grey to red brown, ferruginous, soft, weathers flaky; some irregularly shaped, clay ironstone concretions up to 6 inches in diameter were observed locally but may not be in place; grades into bed 8; outcrops partly poor and obscured by rock debris and soil.	15	37
8	Clay ironstone, red brown, hard; grades laterally and vertically into ferruginous shale similar to that of the overlying bed; no fossils seen.	1/2	22
7	Shale, grey to red brown, ferruginous, soft; grades into the underlying bed.	1 1/2	21 1/2
6	Siltstone, medium hard, red brown to yellowish grey, weathers concretionary in part and grades locally in softer ferruginous siltstone; often gypseous; fossils collected include (GSC loc. 35872): Buchia sp. indet., Turritella (s. lato) sp. indet., pelecypod, genus and species indet.	1	20
5	Shale, grey, ferruginous, soft, weathers flaky, grades in overlying and underlying beds.	10	19

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
4	Clay ironstone, red brown, silty (especially at the top), soft, only strongly weathered rock seen; rarely shows concretionary weathering; contains occasional rounded pebbles of claystone 1/8 to 1/2 inch in diameter; grades into underlying bed.	1 1/2	9
3	Siltstone, grey, clayey, medium hard; locally grades into red brown, silty clay ironstone; gypseous, containing frequent rounded claystone pebbles 1/8 to 1/2 inch in diameter and small (about the same size as pebbles) rounded concretions of clay ironstone; worm tracks occur in places; unfossiliferous.	3/4 - 1	7 1/2
2	Shale, grey to red brown, ferruginous, soft, weathers flaky, only strongly weathered rock seen; an irregular row of rounded clay ironstone concretions occurs 2 feet below top, this row has yielded (GSC loc. 35827): Buchia fischeriana (Pavlow) s. lato and B. cf. piochii (Gabb) s. lato; grades downward into bed 1.	5	6 1/2
1	Siltstone, grey, weathers brownish grey and blocky, very sandy and grades into very fine grained, silty sandstone; occasional 1/8 to 1/2 inch in diameter poorly rounded to flat pebbles of black claystone or chert; medium hard; fossils include (GSC loc. 35838): Phylloceras s. lato sp. indet., Pleuromya cf. vancouverensis Whiteaves, "Turbo" cf. ferniensis Frebold; base concealed at the lower part of the slope; visible.	1 1/2	1 1/2

Section 72

Location: Rocky promontory in the southwestern wall of Treeless Creek canyon about 3/4 of a mile up from its second forks within the Aklavik Range and on the southeastern side of its 3rd westerly confluent. Lat. 67°50'30" N; Long. 135°34'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper shale-siltstone division		
60	Shale or siltstone, brownish grey; only seen from a distance; top concealed beneath the overgrown rim of the plateau; visible.	10-15 (est.)	603
	Lower sandstone division		
59	Sandstone, dirty white, buff to yellowish grey weathering; only seen from a distance; contact with bed 60 appears to be sharp and uneven.	15-20 (est.)	588
	Husky Formation		
	Upper member		
	Buchia volgensis zone?		
58	Siltstone?, brownish grey to dark grey, artly sandy?; only seen from a distance.	40-45 (est.)	568
57	Shale, brownish grey, wine-red tinged, weathers dark-brown with wine-red tinge, numerous yellow specks of sulphur and rust-coloured spots in places; very strongly sulphur-stained; numerous peculiar "hedge-hog" like concretions as in bed 56 occur in rows at irregular intervals in the lower 6-7 feet and apparently higher up in the unit as well; the attitude as in underlying beds; the rocks of this unit are, however, markedly sheared and jointed. Only the basal 6-7 feet of this unit have been ascended, its higher part was only seen from a distance. Beds 57 to 60 inclusive mostly form a shear bluff in the upper part of the canyon's wall; they were not ascended in	45 (est.)	523

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	this section, except for the basal part of unit 57. For details of their stratigraphy see Jeletzky (1960, p. 6).		
	Red-weathering shale member		
	Buchia okensis zone		
56	Shale, light brownish grey when fresh, weathers flaky and rust-coloured to brown grey, often laminated with brown grey and whitish laminae alternating, soft; a 6 inch thick rust-coloured bed of hard clay ironstone occuring 2 to 2 1/2 feet above base has yielded (GSC loc. 35640) Buchia okensis (Pavlow) s. lato and Tollia (Subcraspedites) aff. suprasubditus (Bogoslovsky); no clay ironstone interbeds or concretions have been seen higher up; peculiar "hedge-hog" like, ferruginous, rounded concretions 1-3 inches in diameter covered with carbonate? crystals on the surface occur in the upper 15 to 20 feet; a small lens of poorly preserved Buchia shells occurs 3 1/2 to 4 feet below top, it has yielded (GSC loc. 35676): Buchia cf. okensis (Pavlow) s. lato, B. cf. uncitoides (Pavlow) var. spasskensoides (Crickmay)?.	55-60	478
	Arenaceous member		
	Upper Tithonian (= Upper Volgian)?		
	Craspedites (Taimyroceras? canadensis zone		
55	Siltstone, as that of beds 49, 51 and 52 but weathers rust-coloured; grades into bed 56.	6	418
54	Sandstone, as that of bed 44; carries some scattered pebbles similar to those occuring in underlying beds and is interbedded with siltstone, as that of beds 49, 51 and 52.	4	412
53	Siltstone, ferruginous; otherwise as that of bed 48.	1/4	408 1/4

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
52	Siltstone as in beds 49 and 51 but with several interbeds of harder and sandier siltstone 3 to 8 inches thick occuring at intervals from 10 inches to 2 1/2 feet; a few thin interbeds of fine grained sandstone at the top.	6	408
51	Siltstone, as in bed 49.	4	402
50	Sandstone, whitish grey with brownish tinge, fine grained, silty, medium hard, weathers rubbly; carries some scattered pebbles similar to those occuring in older beds.	1/2	398
49	Siltstone, much as in bed 47 but brownish grey coloured.	1	397
48	Siltstone, brown-grey when fresh, weathers wine-red to intensively rust-coloured, hard, ferruginous (clay ironstone?).	1/2	396
47	Siltstone, dull grey, sandy to very sandy, medium hard, weathers rubbly.	1 1/2	395
46	Siltstone dull grey, somewhat sandy, very soft.	3-4	394
45	Sandstone, green-grey to dull green (possibly glauconitic), fine grained and silty but carries scattered chert pebbles 1/8 to 1/4 of an inch in places, very soft and often almost unconsolidated (grades into sand).	2	390
44	Sandstone, brownish grey when fresh with rust-coloured specks, fine grained, silty, soft; poorly exposed.	2	388
43	Sandstone, light grey to brownish light grey with lavender tinge, weathers lavender grey with rust-coloured specks; medium hard, fine grained but contains numerous scattered 1/8 to 1/2 inch chert pebbles and grit particles which are most numerous (concentrated) at the upper boundary.	2	386

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
42	Siltstone, dark brown when fresh, weathers orange to intensively rust coloured, hard, somewhat sandy; grades into adjacent beds.	1 1/2	384
41	Siltstone, brown-grey when fresh, weathers light brown or brown-grey with rust-coloured specks; very sandy and grades into similar, very silty, fine grained sandstone; carries nests and layers of the same sandstone; soft and friable; weathers into sand; a few scattered pebbles in the upper 1 1/2 feet.	3	382
40	Sandstone, light grey, brownish tinged when fresh and strongly speckled-coloured, weathers whitish grey with bluish tinge and speckled coloured, fine grained, silty, many worm burrows; locally contains 1/8 to 1/4 inch, scattered pebbles; appears to grade in underlying and overlying beds.	2-3	379
39	Siltstone, light to whitish grey, speckled coloured, weathers whitish grey, contains many worm burrows, very sandy and grades into very silty, fine grained sand-stone; harder than the siltstone of bed 38.	2 1/2	376
38	Siltstone, medium to brownish grey when fresh, weathers ash-grey and rubbly, slightly sandy but the amount of sand gradually increases upward.	4 1/2	374
	Lower member (restricted)		
	Buchia fischeriana and Buchia piochii zones (undivided)		
37	Siltstone, generally as that of beds 28, 31 and 33, more or less sandy; appears to carry some scattered, small pebbles in places; a row of characteristic (as in Section 28), huge (6-12 feet long and 3-5 feet high), loaf-like concretions of very limy shale or argillaceous limestone occur in the bed; their rock is grey and cryptocrystalline inside but weathers wine-red to orange; the individual concretions are almost in contact; they can be traced	3 1/2	369

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	right across the promontory; advanced forms of Buchia fischeriana (d'Orbigny) s. lato occur in the upper part of these concretions (GSC loc. 35642).		
36	Shale, grey, weathers ash-grey with intensively rusty specks and hackly, pure to slightly silty, soft.	6	366
35	Clay ironstone, intensively rust-coloured in weathered state; weathers conchoidally to spheroidally.	1/2	360
34	Shale, medium grey, silty, soft, weathers rubbly, very poorly exposed.	7	359
33	Siltstone, as that of beds 21 and 31.	4	352
32	Sandstone, dull grey, fine grained, silty but with considerable admixture of medium grained sandstone and grit; includes some scattered, 1/8 to 1/2 inch pebbles, soft; both contacts appear to be gradational.	3/4 (approx.)	348
31	Siltstone, as that of bed 28 but weathers rust-coloured.	1 1/2	347
30	Sandstone, as that of bed 26 and pebbly as this latter.	1/2	346
29	Shale, brownish grey, laminated, rust-coloured to brown laminae alternating with grey ones, pure to almost pure, soft flaky weathering.	4	345
28	Siltstone, much as that of bed 27 but softer and more sandy; grades into very silty, fine grained sandstone in places; pebbly as the bed 27; a row of loaf-like siltstone concretions 2-5 feet long and 1-2 feet high occurs near the top; a 6 inches thick bed of pebbly sandstone forming the top of bed 28 occurs just above these concretions.	7	341
27	Siltstone, dull grey in fresh and weathered state, more or less sandy, includes inter-beds of rust-weathering siltstone; medium	25	334

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	hard, weathers hackly; scattered pebbles as in the underlying beds occur in the lower part, these seem to be restricted to the lower 3-4 feet of the unit.		
26	Sandstone, medium to ash grey, fine grained, silty; carries scattered pebbles as those occuring in the underlying beds; these pebbles seem to be confined to the lower 6-8 inches of the bed where the sandstone itself is somewhat coarser and less silty.	3	309
25	Siltstone, dull to brown-grey, sometimes somewhat sandy, medium hard, weathers rubbly; very poorly exposed; grades upward into bed 26.	12-14 (est.)	306
24	Shale, grey to brownish grey, pure, soft, weathers earthy; numerous rounded and loaf-like 3 to 5 inches in diameter concretions of rust-red weathering clay ironstone occur in rows in the lower 10 to 15 feet of the unit; very poorly exposed (gentle slope).	25-30 (est.)	292
23	Sandstone, superficially indistinguishable from the siltstone of bed 22 and likewise carries scattered pebbles, fine grained, silty to very silty; grades locally into siltstone as that of bed 22; strikes N. 30° to 35° E and dips 17° to 18° west (reliable attitude).	16	262 1/2
22	Siltstone, speckled brownish grey to whitish grey; weathers rust-coloured and speckled or yellowish grey, very sandy and contains scattered pebbles as those occuring in bed 20 at several levels; may grade laterally and vertically into silty sandstone. Beds 22 and 23 form a bold bluff across the promontory.	14	246 1/2
21	Clay ironstone, brownish grey when fresh, weathers rust-coloured; sandy and silty, hard.	1/2	232 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
20	Sandstone, dull-grey, fine grained, friable, silty but carries scattered 1/8 to 1/2 inch pebbles of black chert and quartz at several levels; these pebbles can form 1-2 inches thick nests and/or strings several inches long; irregular inclusions and lenses of hard, fine grained, pebbly, rust-weathering sandstone.	6	232
19	Siltstone, medium grey, weathers ash-grey and rubbly; sandy to very sandy, soft.	6	226
18	Siltstone, as that of bed (16); clay ironstone or ferruginous siltstone bands 4 to 10 inches thick occur at several levels; medium hard and weathering-resistant; stands out as a wall in the upper 12-14 feet.	22	220
17	Shale, as that of bed 15, very soft and poorly exposed; some clay ironstone.	18	198
16	Siltstone, brownish grey, rust-coloured and speckled on weathered surface; medium hard, weathers spheroidally and/or hackly.	3 1/2	180
15	Shale, dark grey, weathers whitish grey and fine flaky, soft, pure, sulphur- and alum-stained on the surface.	6	176 1/2
14	Siltstone, much as in bed 9 but often with better defined, very thin bedding; strikes N 20° E, and dips 17° W.	5	170 1/2
	Buchia mosquensis zone		
13	Clay ironstone, brownish grey when fresh, weathers wine-red to orange, bed is concretionary in nature with inclusions and intervals of soft, ferruginous shale alternating with hard clay ironstone at irregular intervals; rich but indifferently preserved fossils include (GSC loc. 35646): Buchia cf. mosquensis (Buch) s. lato (numerous), B. cf. piochii (Gabb) var. russiensis (Pavlow) (rather rare), Buchia aff. fischeriana (d'Orbigny) s. lato (early forms?, rare); Thracia sp. indet. This	1 1/2	165 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Buchia fauna is suggestive of the top part of Buchia mosquensis zone.		
12	Siltstone, much as that of bed 10 but with some clay ironstone concretions.	16-17	164
11	Siltstone, medium grey, soft, weathers flaky, some nests and lenses of clay ironstone; poorly exposed.	15-16	147
10	Siltstone, similar to that of bed 9 but softer and without any interbeds, lenses and nests of harder, very sandy siltstone and silty, fine grained sandstone.	7	131
9	Siltstone, dark to brownish grey, weathers dark brown to brown-grey with rusty specks and rubbly; more or less sandy, especially near the base; bedding imperfect or absent; 1 to 3 inch thick interbeds, lenses and nests of yellowish grey, very sandy siltstone and similar very silty, fine grained sandstone; concretions, persistent interbeds and lenses of weathering intensively rusty, hard, ferruginous siltstone or clay ironstone 6-18 inches thick occur at several levels; fossils, including Buchia mosquensis (Buch) s. lato or/and Buchia forms comparable with this species have been observed at several levels (none collected).	40-45 (est.)	124
8	Sandstone, whitish grey, hard, fine to medium grained but silty and pebbly at the same time; includes numerous interbeds of softer, siltier, darker grey sandstone without pebbles and of superficially similar, very sandy siltstone; scattered pebbles are poorly sorted according to size, poorly rounded and are built almost exclusively of black chert; pebbles from 1/8 to 1/2 inch in diameter are most common; pebbles may locally form nests in the harder sandstone.	2-2 1/2	79
7	Sandstone, greenish- to yellowish-grey, fine grained, silty, soft, strongly sulphur-stained.	1	76

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
6	Sandstone, yellowish grey to brownish grey and speckled, weathers rust-coloured with white specks; fine grained, silty to pure, hard, locally rich in worm burrows; forms four 1 to 4 feet thick beds separated from each other by 6 inches to 1 1/2 feet thick beds of soft, mottled grey to whitish grey, fine grained, silty sandstone; scattered small pebbles occur in top part where also poorly preserved Buchia cf. mosquensis (Buch) s. lato and large Pecten (Entolium?) sp. indet. have been noted (none collected); forms a precipitous bluff across the promontory.	13	75
5	Shale, medium grey, weathers brownish grey and earthy, soft, more or less silty and sandy at the base and at the top, often sulphur-stained; contains numerous lamellae and lenticular layers of rust-coloured (in weathered state), harder and sandier shale and siltstone; grades into bed 6. All underlying beds have been measured on the northern side of a minor fault which cuts into bed 4. This fault strikes about S 90° W and dips about 90°; it has a displacement of about 20 feet. Bed 4 was traced across the fault plane.	16	62
4	Clay ironstone, speckled dark to light brown when fresh, weathers orange to light rust-coloured; forms a persistent row of closely spaced loaf-like to lens-like, 1 to 1 1/2 feet thick and 5 to 15 feet long concretions surrounded by soft, intensively rust-coloured (when weathered) shale; fossils collected from this bed include (GSC loc. 35643) numerous Buchia mosquensis (Buch) s. lato.	1-1 1/2	46 1/2
3	Shale, blackish grey when fresh, weathers light grey or yellowish grey, very soft, weathers fine flaky, only decomposed rock seen.	12-13	45
2	Shale much as in bed 1 but softer, more pure, weathers rust-coloured; sandstone	13-14	32

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	and siltstone nests and lenses are almost absent; no clay ironstone concretions noted.		
1	Shale, brownish grey to blackish grey when fresh, weathers ash grey and flaky, mostly pure but contains some more or less silty interbeds; bedding often imperfect or masked by the conchoidal weathering surfaces; irregular lenses and nests of lighter grey to grey-yellow, very sandy siltstone and silty, fine grained sandstone occur at intervals of 1 to 3 feet, they are mostly 1 to 3 inches thick and 1 to 3 feet long; rows of concretions, bands and isolated lenses of hard clay ironstone (medium gray when fresh, wine-red to light rust-coloured when weathered) occur at irregular intervals; they are mostly 6 inches to 1 1/2 feet thick; strike N 25° E, dips 8° W; base concealed beneath debris 12 to 13 feet above the flood plain of Treeless Creek; visible.	18	18

Section 72a

Location: Headwaters of the right confluents of Treeless Creek about 6 1/2 miles northwest of Section 72 and on the eastern slope of Bear Creek dome (Jeletzky, 1961b, p. 570). Lat. 67°56'30" N; Long. 135°44'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Bug Creek Formation		
	Upper sandstone member		
	(Upper Callovian to Upper Oxfordian?)		
9	Sandstone, light grey to buff, fine grained, quartzose, clean, medium hard to hard, and quartzite-like locally, thick bedded to massive looking, blocky jointed; weathering-resistant and forms steep escarpments or cliffs; top not exposed, visible.	120	573
	Sandstone-siltstone member		
	Cadoceras spp. and Arctocephalites zones?		
8	Sandstone, dark grey, fine to very fine grained and often more or less silty; thinly bedded to laminated or indistinctly bedded, mostly friable.	20	453
7	Siltstone, dark grey to blackish grey, sandy, mostly indistinctly bedded; some interbeds of sandstone as in unit 8; soft and weathers recessively; outcrops poor.	30	433
	Intermediate sandstone member		
	Cranocephalites borealis zone ?		
6	Sandstone, grey to buff, weathers yellow, some green to rose coloured bands, fine grained, quartzose, mostly clean, medium hard to hard, sometimes dense and quartzite-like, otherwise good porosity; thin bedded, weathers platy, fractures conchoidally and often shows ripple marks and cross-bedding.	45	403

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
5	Sandstone, as in unit 9 but with considerable interbeds of sandstones as in units 8 and 6.	48	358
4	Interbedding of dark grey, sandy, mostly soft siltstone with almost equal amount of dark grey to buff or yellow, very fine grained, silty to very silty, poorly but thinly bedded, occasionally laminated, mostly hard, occasionally dense and quartzite-like sandstone; both rock varieties occur in interfingering, often lenticular, beds from 3 inches to 2 feet thick; some Pachyteuthis-like belemnites and indeterminate pelecypods seen on the float in the lower part of the unit; base covered; visible.	80 (approx.)	310
3	Covered interval; may be underlain either by the coaly shales of Rat River Gorge or (less likely) by the upper part of the Brat Creek conglomerate; assumed to correspond to about 85 feet of the section.	85?	230
	Triassic?		
	Brat Creek Formation		
2	Pebble conglomerate, fine to medium, pebbles from 1/4 to 1 inch in diameter seem to predominate; dark brown to rust-brown when fresh, weathers red-brown to maroon; pebbles mostly rounded but with some angular to flat pebbles present, mostly built of chert of different colours and of jasper; abundant fine to coarse grained, red to brown-weathered sandy matrix; overlies unit 1 with a knife-like sharp, uneven, obviously erosional contact; no angular discordance was noted, however; top concealed; visible.	65	145
	Permian		
1	Sandstone yellow to light yellow brown or maroon, fine grained, quartzose, mostly clean, thick to medium and often indistinctly bedded; Spirophyton-like whorls common locally; some brachiopods of	80	80

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	general late Palaeozoic type, plant stems and fragments occur locally (none collected); base not reached; visible.		

Section 115

Location: Southeastern shoulder of Mount Toughenough overlooking the north bank of Stony Creek at the point about 6 miles upstream from the 2nd (upper) forks of Stony Creek. Lat. 67°23'00" N; Long. 135°40'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation (arenaceous facies)		
12	Sandstone, grey to buff, hard, often quartzite-like, fine-grained, thinly bedded; top covered atop of the north-trending ridge extending from the mountain's top; farther north the crest of the ridge seems to be built of the same sandstones interbedded with siltstones as in unit 11; strongly jointed, sheared and apparently contorted at the mountain's top; strike N 60° E, dip 40-45° W; base covered; visible.	50	898
11	Irregular interbedding of sandstone, as in bed 12, and dark grey, medium hard shale and siltstone with worm burrows; siltstone and shale seem to predominate over the sandstone but outcrops are poor and intermittent; softer rocks are mostly covered by debris of harder sandstone varieties; strike N 50° E, dip 30-35° W; both contacts covered; forms a marked saddle across the mountain's slope; visible.	50	848
10	Pebble conglomerate fine to medium; top concealed; contact with bed 9 apparently gradational; pebbles from 1/8" to 3" in diameter predominate and larger pebbles are rare; visible.	2 1/2	798
9	Sandstone, dark grey to buff, hard, quartzite-like in appearance, fine-grained; scattered pebbles occur in the uppermost part of the unit; appears to grade downward into unit 8.	50	795
	Beds 9 and 10 form a pronounced hogsback across the mountain's slope.		

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
8	Sandstone, as in unit 9 but interbedded with considerable dark grey siltstone and shale; both contacts obscured by debris; visible.	50	745
7	An almost covered interval; some patches of brownish grey to chocolate-brown, sandy siltstone with nests of quartzite as above; probably underlain by these siltstones throughout.	70-80 (ass.)	695
6	Quartzite, much as in unit 9 except in its being true quartzite; general attitude variable, strike N 50° E, dip 12-13° W; both contacts covered; forms a second pronounced hogsback across the mountain's slope; visible.	80-85	615
5	Quartzite, as in unit 6 but interbedded with thin layers and 6-10" thick beds of grit and fine to medium pebble conglomerate; some beds of grey, sandy siltstone also occur in this unit. Buchia mosquensis (Buch) (late forms?) (GSC loc. 38746 and 38765) occurs in several thin layers of hard quartzite and siltstone some 200 to 250 feet below top of the unit; the rocks of this interval, and those for 50-60 feet below it, are characterized by intensive rust-weathering; base covered; visible.	350	530
4	Almost covered interval; patches of dark grey shale here and there; probably underlain by shales as in the unit 3 throughout.	60-70 (ass.)	180
3	Shale, blackish grey, silty and sandy, micaceous; upper contact covered; visible.	10	110
	Bug Creek Formation		
2	Sandstone, grey, weathers dirty white to whitish grey with rose and buff streaks, quartzose, clean, hard, nonporous and quartzite-like, indistinctly and medium to heavily bedded, contact with bed 3, which appears to be the shale tongue of	100	100

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation, seems to be abrupt and sharp; it is, however, very imperfectly exposed; base concealed beneath the debris some 500 to 600 feet above southern base of Mount Toughenough; strike N 80-90° E, dip 28° N.		
	? Palaeozoic to? Jurassic shale division		
1	Almost covered for some 500 to 600 feet downslope from the visible base of unit 2; considerable patches of brownish grey, micaceous shale occur here and there, attitude uncertain; possibly underlain by the above shale throughout, base is presumably cut off by a major fault, contact with unit 2 covered and may also be a fault.		

Section 117

Location: North Branch of Vittrekwa River. An amphitheater-like widening of the valley just above the first (lower) gorge of the branch. Measured in the northern slope of the valley along and between the two gulleys situated respectively 250 and 400 yards above the upper end of the first gorge. The section is situated about 6 miles up from the mouth of North Branch. Lat. 67°05'30" N; Long. 135°44'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	The top of the section is closely below the rim of the plateau in the northwest bank of the lower gulley some 250 yards to northwest of the upper end of the gorge.		
	North Branch Formation		
7	Quartzite, grey, yellowish-orange weathering, hard, fine-grained, heavily to medium bedded; some interbeds of grey siltstone and shale. Buchia mosquensis (Buch) late forms, B. ex gr. plochii (Gabb) s. lato and Aucellina? ex gr. schmidti Sokolov found in fresh slabs of these quartzites at the base of the cliff (GSC loc. 38756); top not reached; contact with bed 6 conformable. Visible to the rim of the plateau.	60 (est.)	564
6	Pebble conglomerate, fine, mainly built of chert pebbles (black to apple green) 1/8" to 1 1/2" in diameter; some interbeds of sandstone and shale and some coal specks occur locally; base concealed; visible.	15	504
5	Covered interval, across the general strike.	35-70	489
	? Palaeozoic to ? Jurassic shale division		
4	Same shale as in unit 3 but interbedded with hard, grey siltstone beds 3-6" thick, rust-weathering; scattered clay ironstone concretions as below; up to 169' level siltstone interbeds are common; higher up they are almost absent to 192' level; above 192' level they become very common and closely spaced;	271	419

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	discus-like clay ironstone concretions also reappear above 192' level; poor carbonaceous fragments were noted in the siltstone interbeds; siltstone interbeds disappear again at 213' level; numerous bands and discus-like concretions of clay ironstone replace them higher up to 231' level; attitude at the latter level N 20° W, dip 37° E; higher shale becomes softer, less rust-coloured when weathered and ash-grey when fresh; hardly any siltstone beds or clay ironstone concretions therefrom to the outcrop's top; poor Pecten-like pelecypod? fragment collected at 233' level (GSC loc. 38747); top concealed; visible.		
3	Shale much as in unit 1; it is, however, softer and more ferruginous; a hard, grey siltstone interbed 5" thick occurs at 26' level; strike N 10° W, dip 37° NE.	55	148
2	Covered interval, across the strike.	10	93
1	Shale, brownish grey, rust-weathering, slightly silty, thin bedded to laminated; rows of 2-6' long, discus-like, hard, shale concretions; base concealed 300' up from gulley's mouth; strike N 10° W, dip 42° NE; closely spaced rows of discus-like shaped clay ironstone concretions begin at 35' level and shale becomes richly concretionary at 53' level; clay ironstone concretions and bands reappear at 68' level; rock is somewhat contorted above 68' level; visible.	83	83

Section 118

Location: Measured along the north side of the first (lower) gorge of North Branch of Vittrekwa River about 6 miles up from the mouth of North Branch and some 250 to 600 yards downstream of the top of Section 117. The top of the section is on a sharp point of the north bank immediately below the first gordge. Lat. 67°05'30" N; Long. 135°44'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper shale-siltstone division		
	Lower member		
41	Siltstone, grey, soft, rubbly-weathering; numerous bands of orange-weathering, hard, ferruginous sandstone and siltstone ("clay ironstone") 5 to 10" thick occur at several feet wide intervals; occasional chert pebbles 1/4" to 1/2" in diameter or nests of them occur just above the contact with bed 40; no regular pebble conglomerate was, however, observed at this regional unconformity (paraconformity); characteristic pelecypod fauna including Pecten (Entolium) cf. orbicularis (Sowerby) occurs in the lowermost two hard bands respectively 3' and 5' above base (GSC loc. 38759). Top concealed at the fringe of the forest; visible.	30	628
	North Branch Formation		
	(Type section)		
	Glauconitic member		
40	Sandstone, brownish grey, very fine-grained, rather silty, feebly glauconitic, indistinctly bedded, friable; contact with overlying unit abrupt and somewhat uneven.	41	598
39	Sandstone, mostly green to yellow greenish when fresh, weathers yellow-green with rusty specks; grain size ranges from fine to coarse, gritty in part and contains nests of grit; coarse-grained sandstone predominates over all other varieties; crossbedded at many levels; rich in	30	557

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	glauconite; lenticular beds of clay ironstone and intensively rusty, ferruginous sandstone occur at irregular intervals throughout the sequence; contact with the overlying bed gradational.		
38	Pebble conglomerate, fine; rich in rust-coloured, sandy matrix and grades locally into pebbly sandstone; overlies bed 37 with a sharp and uneven, obviously erosional contact.	1/4-3/4 (3-10 inches)	527
	Sandstone-conglomerate member		
37	Shale, brownish grey, intensively rust-weathering, flaky, soft, only slightly silty except in the upper 4 feet where it becomes rather silty; clay ironstone concretions and lenses; outcrops are very poor in the middle part; contact with overlying unit uneven and sharp.	38	526
36	Grit, as that of bed 34 but with interbeds of sandstone to 468' level; grades into fine pebble conglomerate between 468' and 472' level; sharp and uneven (erosional)? contact between conglomerate below and grit (as before) at 472' level; interbedded with a considerable amount of sandstone again between 472 and 483' levels; a 2' thick bed of fine pebble conglomerate occurs in grit between 483' and 488' level; contact with overlying bed sharp and uneven.	26	468
35	Sandstone, much as that of bed 32 but less distinctly bedded and intensively rust-weathered in part; interbedded with lenticular beds of coarse grit 3" to 10" thick; also with interbeds of clay ironstone; Buchia okensis (Pavlow) s. lato and B. n. sp. aff. volgensis (Lahusen) collected on fresh locally derived float (GSC loc. 39389).	7	462
34	Grit, whitish grey, coarse, hard; interbeds of rust-weathering clay ironstone.	15	455

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
33	Pebble conglomerate, light grey, weathers dirty white to buff, fine; interbedded with coarse grit.	3	440
32	Sandstone, much as that of bed 31 but lacking honeycombed weathering and generally thin to medium bedded; rich in worm burrows at 420' level.	24	437
31	Sandstone, dirty white, weathers bright yellow with rusty specks; fine-grained, clean, quartzose, somewhat calcareous, honeycomb weathered on the surface; bedding imperfect or absent, interbeds of harder, laminated sandstone; clay ironstone inclusions and coaly specks occur locally; becomes pebbly and gritty between 391' and 403' levels; interbeds of grey silty sandstone and sandy siltstone between 403' and 413" levels; a 5" thick bed of fine to coarse pebble conglomerate occurs at 411'-411 1/2' level; a few Dentalium? sp. indet. occur locally.	55	413
30	Sandstone, brownish grey, weathers light brown, very fine-grained, silty, pebbly and gritty; minor interbeds of grit and siltstone at 295' level; 1' bed of grit at 319'-320' level; interbedding of hard, clean sandstone and grit between 339' and 344' levels; Dentalium? sp. indet. and indeterminate marine pelecypods occur locally.	70	358
29	Siltstone, brownish grey, sandy, friable, indistinctly bedded; inclusions and lenses of clay ironstone.	5	288
28	Grit, speckled rose-green coloured; rich in chert and glauconite grains; interbeds of sandstone and sandy siltstone.	10	283
27	Sandstone, light grey, buff-weathering, fine-grained; occasional interbeds and nests of grit; interbeds of clay ironstone; carbonaceous partings and nests occur locally; indeterminate marine pelecypods occur locally.	13	273

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
26	Grit grading into fine pebble conglomerate, brown to grey, weathers dusty brown, mainly consists of chert fragments, glauconitic; interbeds of sandstone.	4	260
25	Sandstone, grey, weathers buff to light brownish grey, fine-grained, thin to medium bedded; hard, occasional interbeds and partings of coarse-grained sandstone, grit and sandy siltstone.	6 1/2	256
24	Sandstone, brownish grey when fresh, weathers dirty brown, silty, pebbly and gritty, most variable in composition and may grade into siltstone, grit and fine pebble conglomerate locally.	4 1/2	249 1/2
23	Sandy siltstone as in bed 13; grades into very silty sandstone locally.	4	245
22	Sandstone, brownish grey, weathers dusty-brown, fine- to coarse-grained, some grit in places.	10	241
21	Sandy siltstone, dark brownish grey when fresh, weathers chocolate brown.	2	231
20	Sandstone, light grey to light brownish grey, with dark-grey inclusions, friable to hard; colour and hardness vary strongly within the bed; thin to medium and often conchoidally bedded; some concretions of hard, grey siltstone; fossil wood occurs locally.	6	229
19	Sandstone, light greyish-brown, very fine-grained, silty, friable, indistinctly bedded.	6	223
18	Pebble conglomerate, brownish grey, fine, consists of chert pebbles, markedly lenticular and grades locally into pebbly sandstone.	1/2-2 1/2	217
17	Sandstone, brownish grey, soft, very fine-grained, laminated to thinly bedded.	4 1/2-6	215
16	Siltstone, sandy, much as in bed 13, inclusions and interbeds (up to 1 1/2' thick) of sandstone as in bed 10 .	14 1/2	209 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
15	Sandstone, grey to brown, weathers buff to orange and speckled, fine-grained, clean, hard, dense, quartzite-like; interbeds and lenses of grey, sandy siltstone up to 4' thick.	20	195
14	Sandstone, much as in beds 10 and 11, occurs in beds 1-3' thick interbedded with siltstone beds of about the same thickness and like that of bed 13.	16	175
13	Siltstone, brownish grey, weathers earthy, soft, very sandy, often laminated; inclusions and 3"-16" thick interbeds of hard sandstone as in beds 10 and 11; base concealed; visible.	40	159
12	Covered, across general strike.	7	119
11	Sandstone, brownish grey to brown when fresh, weathers intensively rust-coloured, fine- to medium-grained, hard, ferruginous, medium to heavily bedded; numerous interbeds and partings of grey siltstone or shale between beds of sandstone up to 1 1/2 feet thick; outcrops very poor throughout.	9	112
10	Sandstone, light grey, weathers whitish grey, fine-grained, thin bedded; inclusions of rust-coloured, ferruginous sandstone.	5	103
9	Covered, across general strike.	13 1/2	98
8	Cobble conglomerate; cobbles predominate and range up to 1 1/2 feet in diameter; coarse and medium pebbles occur, however, in considerable numbers; sandy and gritty matrix occurs locally; interbeds and nests of sandstone as in bed 7 and of fine pebble conglomerate as in bed 6.	18	84
7	Sandstone, white, weathers yellow to rust-coloured, hard, mostly fine-grained but includes some interbeds of medium-grained sandstone, quartzose, feebly glauconitic; pebbly and gritty in lower 2 1/2 feet; coarse-grained, gritty, more glauconitic and more friable in the top 3 1/2 feet; ripple-marked at the top.	11 1/2	65 1/2

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
6	Pebble conglomerate, light grey, weathers whitish grey, fine, pebbles 1/8" to 1/4" in diameter predominate, mostly tightly packed; feebly glauconitic in places; thin interbeds of grit and light grey sandstone; some papery grey shale near the base.	5 1/2	54
5	Covered across general strike; assumed to be underlain by soft, dark grey shale.	13	48 1/2
4	Interbedding of pebbly grit and pebble conglomerate, light grey to whitish grey, locally glauconitic, dark minerals locally abundant in grit, medium hard; coarse- to medium- grained, sandy matrix abounds throughout; conglomerate mainly occurs in 3"-10" layers and beds separated by 1/2-1 1/2' thick grit beds.	8 1/2	35 1/2
3	Sandstone, light grey, fine-grained, clean, dense, medium hard, indistinctly and medium to thin bedded; layers and partings of dark grey shale occur between beds, some of these appear to be carbonaceous; grades upward into bed 4; base covered; visible.	19 1/2	27
2	Covered across general strike; probably is underlain by grey shale.	2	7 1/2
1	Pebble conglomerate, fine- to medium, pebbles vary in size from 1/16" to 1 1/2", intensively rust-coloured; consists of many types of pebbles including sandstone, shale, and limestone; chert pebbles strongly predominate, however; sandy, ferruginous matrix abundant throughout, its amount increases upward so that the conglomerate becomes a pebbly, richly glauconitic, ferruginous sandstone in the top foot or so; strike N 55° W, dip 44° NE; base concealed beneath debris at the upper end of the gorge; visible.	5 1/2	5 1/2

Section 119

Location: North Branch of Vittrekwa River. Western part of an amphitheater-like widening of the valley just above the first (lower) gorge of the Branch. Measured along the north slope of the valley between the second gulley (400 yards northwest of the gorge) and third gulley (about 3/4 mile northwest of the gorge) upstream of the gorge. The section is situated some 6 to 6 1/2 miles up from the mouth of North Branch. Lat. 67°05'30" N; Long. 135°44'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Quaternary		
9	Pleistocene gravels; visible at the rim of the plateau on the west side of 2nd gulley near its head.	1-2	705
	? Palaeozoic to ? Jurassic shale division		
8	Shale, light grey with brownish tinge when fresh and whitish grey with bluish tinge when weathered, soft, weathers earthy; numerous bands of orange-weathering clay ironstone 3-14 inch thick and rows of discus-like clay ironstone concretions 3-5 inches in diameter and 2-3 inches thick; poor plant remains occur locally; outcrops poor throughout; strike N 20° E, dip 40° SE; near the visible top; this bed is the continuation of bed 1 of Section 117.	95	703
7	Grit and gritty sandstone grading into very fine pebble conglomerate in the top 2 feet; lower 3 1/2 to 4 feet consist predominantly of coarse- to medium-grained, grey, hard, thinly bedded, locally ripple-marked sandstone with interbeds of fine grit; strike N 5° E, dip 30° SE; base concealed; visible.	8	608
6	Covered, across general strike and presumably underlain by grit and gritty sandstone representing the downward extension of bed 7 as its equivalent is at least 25-30 feet thick (base covered) in the basal part of the 2nd Gulley.	38-40 (ass.)	600
5	Thin interbedding of shale as in bed 8 with 2"-10" thick layers and beds of grey, hard very fine-grained sandstone and sandy	60	560

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	siltstone weathering intensively rusty; clay ironstone bands and rows of concretions of the same also occur; soft shale occurs in thin layers and 2"-15" thick beds between the above discussed harder rock varieties; coal nests and those of black, coaly shale occur some 10 feet above base; some poor plant remains found in these nests are, however, indeterminate according to Dr. C. MacGregor and no plant microfossils have been found in the coal; strike N 10° W, dip 37° NE.		
4	Shale, somewhat darker grey than that of bed 5, soft; only a few interbeds of harder, red-weathering siltstone and clay ironstone (as in bed 5); outcrops poor throughout.	80	500
3	Interbedding of shale, soft, medium grey when fresh, weathering brownish-grey with hard, grey, rust-weathering siltstone and clay ironstone; interbedding is similar to that of bed 5; outcrops very poor throughout.	60-70	420
2	Shale, much as that of bed 4; outcrops very poor or slumped.	200	350
1	Shale or siltstone, grey, weathers reddish-grey; very rich in clay ironstone bands and concretions; dips (overturned?) at 70°-80° W (toward the fault plane); base cut off by a major fault running along the bed of the 3rd gulley; seen only from the distance except for the top part; contact with bed 2 concealed; visible.	150	150

Section 122

Location: Southern shoulder (and auxilliary summit) of Teeweechee Mountain (= Sheep Mountain) between points about 9 1/2 and 11 miles south-southwest of southern end of Barrier Ridge (on Stony Creek) in headwaters of southwestern confluents of Stony Creek. The base of section is situated on the north side of the southwesternmost branch of Stony Creek at its head some 11 miles south-southwest of southern end of Barrier Ridge. Lat. 67°18' 00" N; Long. 136°07'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Lower sandstone division		
	Buchia volgensis zone?		
14	Sandstone, light grey, buff to rust-weathering, clean, quartzose, fine-grained, laminated to thinly bedded. Large poorly preserved Buchia cf. B. volgensis (Lahusen) or? B. okensis (Pavlow) occur occasionally (GSC loc. 38733); top not reached at the top of the auxilliary summit situated about 1 mile south of the top of Teeweechee Mountain; visible.	150-170	1,280
	Husky Formation		
	(arenaceous facies)		
13	Siltstone, mottled grey, often rust-weathering, poorly and conchoidally bedded, medium hard, sandy; interbedded with grey, buff to grey-weathering, fine-grained, slabby to laminated sandstone.	120 (est.)	1,110
12	Interbedding of: 1) Yellow-weathering quartzose sandstone, 2) glauconitic grit; and 3) fine pebble conglomerate; outcrops very poor throughout; so far as it can be ascertained all these rock types are identical with those observed in North Branch Formation in First Gorge of North Branch of Vittrekwa River. Contacts covered.	50 (est.)	990
11	Interbedding of coarse, locally glauconitic, grit and pebble conglomerate; the conglomerate carries peculiar pebbles of (?)	15-18 (est.)	940

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	clay ironstone; all beds intensively rust-weathering; interbeds and nests of wine-red to orange clay ironstone; rocks are identical with those of the Vittrekwa River sections of North Branch Formation.		
10	Covered across general strike.	12	922
9	Sandstone, dark grey, dark-rust-weathering, ferruginous, fine-grained, medium hard, replete with late forms of Buchia mosquensis (Buch) (GSC loc. 38760); top and base covered; visible.	3	910
8	Covered across general strike.	20-25	907
7	Shale, dark grey, soft, chippy-weathering, only weathered rock seen.	20-25	882
	Bug Creek Formation		
6	Sandstone, white to light grey, buff to orange-weathering, fine-grained, medium hard; badly sheared and jointed in basal 45-50 feet; attitude in the top 50-60 feet: strike N 45° W, dip 13° NE; outcrops intermittent and mostly poor, both contacts covered; visible.	300 (approx.)	857
	Palaeozoic		
	Permian? or older		
5	Limestone, grey, fine-grained, dense; interbedded with coarse-grained calcarenites; mostly badly sheared and contorted; poor, indeterminate brachiopods of? Palaeozoic affinities occur rarely (none collected); contacts with beds 4 and 6 concealed and could be faults; visible.	30 (est.)	557
4	Sandstone grey, fine-grained, thin bedded to laminated; badly sheared and jointed, often contorted.	60-70?	527
3	Sandstone, orange to yellow coloured, fine-grained, clean, mostly friable, thin bedded, grades into loose orange sands.	50 (est.)	457

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
2	Pebble conglomerate, coarse; pebbles mostly consist of white and grey chert; contacts with 1 and 3 covered; visible.	6-7	407
1	Sandstone, grey to dark grey, rust weathering, fine-grained; thin bedded; interbedded with blackish grey, sandy siltstone; regional dip to NE at 20-25°, strike to NW; base concealed beneath the debris on the lwer slopes of southwestern-most branch of Stony Creek; visible.	400 (est.)	400

Section 122a

Location: Central part of southern Richardson Mountains, about 6 miles south-southeast of Section 122 and on the east side of Stony Creek near its head, N.W.T. Lat. 67°14'00" N; Long. 136°01'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper shale-siltstone division?		
26	Sandstone, light grey, fine to medium grained; to the top of the slope visible.	300 (est.)	2,833
25	Shale, dark grey to black, mostly poorly exposed.	300 (est.)	2,533
24	Sandstone, light grey, fine grained, clayey in the lower part; thin bedded, platy, cross-bedded in part; poor casts of long ranging pelecypods resembling Arctica, Inoceramus and Tellina seen at several levels (none collected). No Buchia or Aucellina seen.	400 (est.)	2,233
23	Shale, dark grey to black with interbedded laminae of siltstone and interbeds of sandstone; poor casts of the same long ranging pelecypods as in unit 24 seen at several levels (none collected).	180	1,833
22	Sandstone, medium grey, fine to medium grained; some coarse grained, light sandstone near the top.	14	1,653
21	Interbedding of grey shale, siltstone, and shale-like, fine grained sandstone; outcrops very poor and most part of the slope covered with rubble.	60	1,639
20	Covered interval; assumed to correspond to 15 feet of the section.	15?	1,579
	Lower sandstone division?		
19	Sandstone, medium grey, weathers greyish brown, fine to medium grained, quartzose, carbonaceous to coaly and contains some indeterminate plant fragments, thin to medium bedded, moderately hard and weathering-resistant; forms cliffs and ridges.	80	1,564

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
18	Interbedding of dark grey to black, soft shale and siltstone; outcrops poor and patchy; greater part of the slope is talus covered.	20 (est.)	1,484
17	Sandstone, medium grey, weathers brownish grey with the surfaces often differentially weathered, calcareous, fine grained, quartzose; can be thin, medium or thick bedded in places, bedding surfaces irregular;hard and weathering-resistant; mostly forms cliff faces.	168	1,464
	Husky Formation (arenaceous facies)		
16	Shale, dark grey; contains thin interbeds of crossbedded sandstone and siltstone; sandstone is medium grey, fine grained, pebbly and locally grades into pebble conglomerate; outcrops are poor and mostly rubble-covered.	330	1,296
15	Pebble conglomerate, brown-grey, fine to medium and with very coarse grained, argillaceous sandstone matrix; pebbles mostly consist of limestone and grey to black chert; weathering resistant and hogsback-forming.	18	966
14	Interbedding od dark grey shale and medium grey, fine grained, clayey, soft sandstone; outcrops poor throughout and the slope is mostly covered by debris. Assumed to correspond to 25 feet of the section.	25?	948
13	Sandstone, light to medium grey, coarse to medium grained and pebbly; fine to medium sized pebbles of chert, sandstone and limestone are buried in sandy matrix; weathering-resistant and hogsback-forming.	10	923
12	Covered interval; assumed to correspond to about 50 feet of section; probably underlain by soft grey shale and fine grained, soft, argillaceous sandstone.	50	913

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Buchia mosquensis zone?		
11	Sandstone, grey to brownish grey, very fine grained, silty, quartzite-like, very hard and brittle, very little or no porosity; thin and platy to medium bedded; poor casts of Buchia cf. mosquensis (Buch) s. lato occur locally (none collected).	170	863
10	Shale, blackish grey to black, silty; very thin bedded to laminated, relatively soft.	8	693
9	Sandstone, medium to dull grey, very fine grained and silty, siliceous, very hard and quartzite-like, little or no porosity (may be a true quartzite); thin bedded and platy, ripple marked; contains a few carbonaceous partings and inclusions; forms a hogsback in upper part; outcrops are intermittent and poor in the middle part.	250 (est.)	685
8	Sandstone, very dark grey, very fine grained and silty, siliceous and quartzite-like, thin bedded; interbedded with almost equal amount of dark grey, very thin bedded to laminated, platy shale.	70	435
7	Sandstone, light grey, fine grained, medium hard to friable, porous, thin bedded, weathers rubbly; contains partings of dark grey shale; poor casts of Buchia cf. mosquensis (Buch) s. lato occur locally (none collected).	35	365
6	Sandstone, light to medium grey, weathers brown-grey, fine grained, quartzite-like, very hard, little or no porosity; thinly bedded and weathers blocky; exposures poor.	25	330
5	Shale, blackish grey to dark grey, soft, interbedded with almost equal amount of very fine grained, silty sandstone and siltstone except near the base where shale and siltstone predominate; thin bedded; exposures poor; poor, rapidly disintegrating imprints of Buchia cf. mosquensis (Buch) s. lato occur in the upper 10 feet (none collected).	50	305

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
4	Sandstone, medium to light grey or medium brown and mottled coloured; weathers light to medium grey, fine to medium grained, quartzose, siliceous and quartzite-like in places, non-porous to porous, hard to somewhat friable, thin to medium bedded; generally more harder and weathering-resistant in the upper part.	20	255
3	Shale, blackish grey to black, very thin bedded to fissile; interbeds of very dark-grey, very fine grained, silty, siliceous, thin-bedded, hard, quartzite-like sandstone; soft to medium hard.	35	235
	Bug Creek Formation		
	Oxfordian and (?) Callovian only		
2	Sandstone, light to medium grey, very fine grained to fine grained, quartzose, siliceous, well sorted, dense to quartzite-like; mostly thin bedded but with interbeds of indistinctly bedded to massive sandstone; outcrops are poor and intermittent near the top and base of the unit where the slope is mostly covered with sandstone rubble.	200	200
	Upper Devonian?		
1	Interbedding of grey sandstone and shales similar to those of Bug Creek Formation; thickness not measured; contact with unit 2 concealed for a few feet but believed to be a gentle angular unconformity.		

Section 153

Location: Measured along the bluffy, right (southeast) bank of Brat Creek at the point about 1/4 mile above its confluence with Rat River; the mouth of Brat Creek is situated about 1 mile upstream from the mouth of Barrier River. Lat. 67°39'30" N; Long. 135°32'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Lower member (restricted)		
	Buchia mosquensis zone		
12	Siltstone, grey, brownish tinged, weathers chocolate brown, very sandy, poorly and indistinctly bedded and conchoidally weathered, soft, weathers fine rubbly to earthy; numerous 1 to 3 inches thick nests and interbeds of light grey, medium hard, carbonaceous or clean, quartzose, fine grained sandstone similar to that of unit 11; rows of clay ironstone concretions 3-4 inches thick and 3-5 feet long (irregularly shaped) occur at 3 to 5 feet intervals; early forms of Buchia mosquensis (Buch) s. lato (probably transitional to B. volongensis Sokolov, 1908), such as occur in mid-Kimmeridgian rocks, collected some 15 feet above base (GSC loc. 38802); top concealed; visible.	20	1,007
	Bug Creek Formation		
11	Sandstone, light grey to buff with a distinct lavender tinge, fine grained, quartzose but contains some feldspathic grains, friable, porous; some lenses of medium hard sandstone; some carbonaceous inclusions and nests; mostly heavily and indistinctly bedded but with interbeds of medium to thinly bedded sandstone; contact with Husky Formation (unit 12) abrupt and uneven but neither a basal conglomerate nor a pebbly or gritty layer was noted at the contact; base covered; visible.	150 (est.)	987
10	Covered interval probably underlain by sandstone similar to that of unit 11.	70-80	837

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
9	Sandstone, light grey, lavender tinged, or orange, fine grained, clean, quartzose, porous, friable; top and base covered; visible.	6-7	757
8	Covered interval or a scree of large sandstone blocks lithologically similar to that of units 9 and 11.	25-30 (est.)	750
7	Sandstone, brown grey, lavender tinged, fine grained; interbedded with similarly coloured, coarse grained sandstone and some grit; top and base covered; visible.	7-8	720
6	Almost covered by scree of sandstone blocks lithologically similar to that of units 9 and 7; some scattered outcrops of slabby, thin bedded, brown sandstone weathering white or buff in the lower part of the interval.	50 (est.)	712
	Triassic (?)		
	Coaly shale division		
5	Shale, light grey, bluish tinged, soft, almost unconsolidated.	6-7	662
4	Shale, dark grey to black, soft, coaly; contains nests and lenses of impure coal; outcrops poor, discontinuous and mostly slumped down; top and base covered; the rock is rich in spores and pollen (GSC loc. 5279). The following forms have been identified by D.C. McGregor: Acanthotriletes cf. A. ramosus B. & H., Calamospora sp., ?Classopollis torosus (Reis.) Balme, Deltoidospora (Leiotriletes) sp., ?Eucommiidites troedssoni Erdtman, cf. Ginkgo, Granulatisporites micronodosus B. & H., Granulatisporites sp., Lophotriletes cf. L. triassicus (Mal.) K.-M., Monoletella fabarielliformis Mal. & Donsk., Monosulcites cf. M. carpentieri Del. & Sprum., Monosulcites cf. M. subgranulosis Couper, Ovalipollis sp., Platysaccus sp., cf. Pteruchipollenites microsaccus Couper, Punctatisporites sp., Reticulatisporites sp., Striatites sp. (sensu Jansonius),	50-55 (est.)	655

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Vittatina ?hiltonensis Chal. & Clarke, Vittatina sp. (Marsupipollenites B. & H. in part?).		
3	Completely covered and slumped down interval representing either the slumped down shales of units 4 and 5 covering coarse sandstones similar to unit 2 of section 154 or a strike fault; width across the general strike about.	100	600
	Brat Creek Formation		
2	Slumped down and very poorly exposed beds of coarse, grey sandstone with interbeds of clay ironstone and grey shale.	-	-
1	Pebble conglomerate, fine to medium, light to whitish grey, thinly bedded or layered, mostly friable to almost unconsolidated; interbeds of harder, orange to rust-weathering, strongly ferruginous conglomerate; beds built of 1 to 3 inch pebbles alternate with those built of finer pebbles and those of coarse, pebbly grit; pebbles are commonly oriented with their long axes along bedding planes; abundant coarse sandy and gritty matrix; interbeds of coarse grained, arkosic, gritty, whitish grey sandstone; variously coloured chert pebbles strongly predominate but pebbles of grey, coarse to fine grained sandstone and those of grey, hard shale are also common; red jasper pebbles have also been noted; in the top 10-15 feet conglomerate strikes N 20° W and dips at 38° toward east, it is not clear whether this attitude is caused by slumping or reflects a synclinal bend of conglomerate unit caused by faulting (see under unit 3); lower beds of the conglomerate unit strike persistently N 25° E and dip at 42° toward west; top and base concealed; exposed (assuming that the unit is not synclinally bent or repeated).	500?	500

Section 154

Location: High bluff in the right (south) bank of Rat River Gorge 200 yards above its lower end and about 1 mile upstream (straight line) from the mouth of Barrier River. Lat. 67°40'30" N; Long. 135°34'00"W

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Quaternary		
14	Unconsolidated alluvial gravel and sand; visible to the top of the slope beneath the overgrown rim of the plateau.	40 (est.)	499
	Jurassic		
	Husky Formation		
	Lower member (restricted)		
	Buchia mosquensis zone		
13	Interbedding of dark grey shale, similar siltstone and fine grained, grey, silty sandstone in beds 1 to 10 inches thick; rocks have the same appearance as those of unit 12; Buchia mosquensis (Buch) s. lato, Cylindroteuthis sp. indet. and indetermined pelecypods occur locally (GSC loc. 39376); contact with unit 14 is unconformable.	20	459
12	Interbedding of dark grey sandstone, fine grained, silty with shale and siltstone, dark grey, weathering olive grey, thinly bedded, chunky fractured, recessively weathering; strike N 5° W, dip 35° W.	10	439
11	Sandstone, dark grey, very finely grained, friable; weathers rust-coloured; poor imprints of Buchia cf. mosquensis (Buch) s. lato found on the scree (none collected).	2	429
	Bug Creek Formation		
10	An almost covered interval of the slope; scree composed of slabs of grey, massive looking, fine grained sandstone; small patches of this sandstone outcropping here	80	427

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	and there make it obvious that this interval is mostly or completely underlain by such rock; at the level about 35 feet above base the exposure of sandstone is crossed by a rust-coloured zone 5 feet wide in which sandstone slabs are slickensided and carry calcitic veinlets; this zone appears to be the site of a minor east-west trending fault.		
9	A completely covered interval, probably underlain by the same sandstone as in unit 8.	30	347
8	Sandstone, greyish brown, often lavender tinged, fine grained, quartzose, grains sub-angular, some kaolinitic or white chert? grains; indistinctly and heavily bedded; weathering-resistant; contains rare indeterminate pelecypods in places (none collected); forms vertical cliffs; strike N 5° W, dip 25° SW.	40	317
7	Completely covered interval.	40	277
	Triassic(?)		
	Coaly shale division		
6	Shale, black, bituminous or coaly(?), sulphur-stained, contains thin pyritic bands and small, unidentifiable carbonaceous (plant?) films; soft, exposures poor and the unit is mostly talus-covered.	37	237
5	Siltstone, dark grey when fresh, weathers rust-coloured, soft; abundant pyrite inclusions; abundant but poorly preserved imprints of pecopterid ferns (none collected); the unit is mostly talus-covered.	20	200
4	Shale, black to dark grey, coaly in places, weathers dark to light grey, friable, small nests and thin interbeds of impure coal; interbeds of shale as in unit 3; outcrops poor and often talus-covered.	28-30	180
3	Shale, pure, creamy white to beige-coloured, soft; seems to grade upward into unit 4.	3-10 (varies)	150

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Brat Creek Formation		
2	Sandstone, light grey, coarse to very coarse grained, gritty and pebbly in places, poorly sorted, arkosic; contains lenses and nests of fine pebble conglomerate and coarse grit as in unit 1; pebbles and grit particles in these lenses are mostly built of quartz; contact with unit 3 uneven and sharp with 6 to 8 inch deep depressions in the surface of sandstone 2 filled out by shale of unit 3; sandstone and shale at the contact are rich in sulphur and stained bright yellow for a few inches either way; no trace of a conglomerate, or for that matter of a pebble and/or grit layer was, however, observed at the contact.	40	140
1	Conglomerate, pebble, medium-sized, grey; most pebbles are less than 3 inches in diameter; they range from 9 inches to the 1/8 of an inch in diameter, however; poorly sorted, matrix abundant, gritty to coarse sandy, grey, arkosic; size of pebbles appears generally speaking to decrease upwards so that unit 1 grades into unit 2; pebbles mainly chert (some 90%) but those built of sandstone and quartz also occur; base concealed beneath the debris at the river's level; visible.	100 (approx.)	100

Section 154a

Location: Deep ravine in the southern wall of Rat River Gorge about 1 1/2 miles west of Section 153. Lat. 67°41'00" N; Long. 135°45'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Husky Formation		
	Lower member (restricted)		
	Buchia mosquensis zone		
7	Shale, dark grey to brownish grey or dark brown, silty, often micaceous; some interbeds of similar sandy siltstone; soft to medium hard, top concealed; visible.	43	359
6	Siltstone, medium grey to brown, sandy to very sandy and interbedded with similar, fine grained, silty sandstone; crossbedded in places; medium hard to soft; some scattered concretions of hard, glauconitic, sandy siltstone containing poor imprints of Buchia cf. mosquensis (Buch) s. lato and other indeterminate pelecypods (none collected) occur in the middle part of the bed; some carbonized plant fragments occur locally.	11	316
5	Shale, blackish grey, medium hard, micaceous; base covered; visible.	20	305
4	Interbedding of shale, siltstone and sandstone; all rock types seen are similar to those of the overlying beds; outcrops poor and intermittent and the slope is mostly covered by debris and soil; poor imprints of early forms(?) of Buchia mosquensis (Buch) s. lato seen on the float in the middle part of the unit (none collected).	110 (approx.)	285
3	Sandstone, light to medium grey, weathers light grey to buff, fine grained, quartzose, mostly clean; some nests and lamellae of dark grey, carbonaceous sandstone.	35	175
2	Interbedding of dark grey shale, similar siltstone and fine grained, grey to dark grey, silty sandstone in beds from 1 to 10 inches thick; all rocks are similar to	80 (approx.)	140

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	those of units 12-13 of Section 154; weathering-resistant and forms vertical cliffs; part of the section was only seen from the distance; contains interbeds of carbonaceous to coaly shale and siltstone with small nests and lenses of impure, black coal in the lower 10-12 feet; contact with unit 1 appears to be abrupt and sharp but even.		
	Bug Creek Formation		
1	Sandstone, grey to brownish grey or brown, weathers buff to rust-brown, mostly fine grained but with some interbeds of medium grained sandstone, mostly quartzose and clean but with some interbeds and nests of carbonaceous, dark grey sandstone; mostly massive looking and fractures blocky; interbeds and nests of thin bedded, crossbedded and ripple marked sandstone, medium hard to soft; mostly weathering-resistant and cliff-forming; some indeterminate marine pelecypods noted on the float (none collected); base concealed in the lower part of the slope; visible.	60	60

Section 155

Location: Central Richardson Mountains south of McDougall Pass; on the north facing slope of a mountain at Lat. 67°32'00" N and Long. 136°28'00" W, closer to west slope of Richardson Mountains.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper and Middle Jurassic		
	(Oxfordian to Bajocian?)		
	Bug Creek Formation		
7	Sandstone, medium grey, weathers dark grey with rust-coloured patches, very fine to fine grained; quartzose with siliceous cement, well sorted; medium bedded, mostly hard and weathering resistant; forms precipitous slopes and cliffs; only fragmentary belemnites probably belonging to Cylindroteuthis sp. indet. were noted; these occur rarely through the whole thickness (none collected); top concealed; visible.	150 (est.)	267
6	Siltstone, blackish grey, weathers black, grades into shale, very thin to platy bedded, soft.	7	117
5	Sandstone, medium grey, weathers light grey, fine grained, quartzose; thick and indistinctly bedded to massive looking; weathering-resistant and forms vertical cliffs.	45	110
4	Sandstone, dark grey to blackish grey, very fine grained and silty, calcareous?, relatively soft.	30	65
3	Sandstone, much as that of unit 4 but thin to medium bedded throughout and apparently silty in the upper part; outcrops poor.	20	35
2	Sandstone, grey brown, medium to very finely grained, quartzose, clacareous; rich in indeterminate pelecypods and fragmentary belemnites apparently belonging to the Pachyteuthis sp. indet.; often coquinoid: contact with unit 1 knife-like sharp, uneven	5	15

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	and obviously erosionally disconformable; no regular conglomerate was observed, however, and no angular disconformity.		
	Permian		
1	Sandstone, dark grey, very fine grained, silty, dense, impure, calcareous; thin to medium and imperfectly bedded; no fossils seen except for the Spirophyton-like problematica.	10	10

Section 155a

Location: East flank of Martin Creek anticline; headwaters of Boneyplum Creek. Lat. 68°00'00" N, Long. 135°46'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Bug Creek Formation		
	Upper sandstone member		
11	Sandstone, grey buff to dark yellow brown when fresh, weathers buff or green grey; fine to medium grained, mostly well sorted, quartzose, mostly clean; mostly massive-looking to thick and indistinctly bedded; blocky jointed; medium hard to hard with some interbeds of fairly friable sandstone; weathering-resistant and ridge-forming; top not reached at the top of the ridge; visible.	235 (approx.)	738
	Sandstone-siltstone member		
10	Sandstone, mostly medium grey or grey brown, weathers buff or green grey; fine grained, partly silty; thin to thick bedded, platy to irregularly flaggy weathering.	60	503
9	Covered interval; probably underlain by softer, dark grey sandstone or sandy siltstone judging by the float and small patches of weathered rock occuring within this interval; assumed to correspond to about 200 feet of the section.	200?	443
	Intermediate sandstone member		
8	Sandstone, mostly medium grey to buff; weathers buff or dull green; interbeds and nests of rose-coloured and green sandstone; mostly thin bedded; some cross-bedding and ripple marks; fractures platy to irregularly flaggy; top and base covered; visible.	23	243
7	Covered interval, assumed to represent about 30 feet of the section.	30?	220

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Conglomerate member		
6	Pebble conglomerate, fine; 1/8 to 1/2 inch pebbles of black chert predominate; abundant gritty and coarse sandy matrix; brownish grey, weathers dark brown, top covered; visible.	30	190
	Basal sandstone member		
5	Sandstone, medium grey to grey brown, weathers brown to rust-coloured or green grey, fine to medium grained, sometimes pebbly and gritty; thin to thick and mostly irregularly bedded; base covered; visible.	45	160
4	Covered interval; assumed to correspond to about 55 feet of the section.	55?	115
3	Sandstone, as in unit 5; top covered; visible.	6	60 1/2
2	Pebble conglomerate, as in unit 6; upper and lower boundaries appear to be sharp, uneven and erosional in nature.	4 1/2	54 1/2
	Permian		
1	Sandstone, yellowish grey to buff, fine grained, locally silty, hard and dense; indistinctly and irregularly bedded; some Spyrophyton-like whorls noted locally otherwise no fossils found; base not reached.	50	50

Section 155b

Location: About 3 1/2 miles northeast of Summit Lake. Lat. 67°45'00" N, Long. 136°24'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper Jurassic		
	Bug Creek Formation		
6	Sandstone, dark grey, weathers light grey to rust-grey, very fine grained, quartzose, massive in appearance but thinly laminated in part; much jointed; forms a vertical cliff for the most part; top concealed; visible.	178	703
5	Sandstone, dark grey, weathers rust grey, very fine grained; mostly laminated to thin bedded or medium bedded; interbedded with some beds of massive-looking, fine grained sandstone; outcrops intermittent and poor, most of the slope is talus-covered.	175	525
4	Almost completely covered interval; in upper 85 feet is largely covered by talus and blocks of and probably underlain by medium gray, thick bedded, fine grained sandstone; in the lower 15 to 20 feet is largely covered by talus and blocks and probably underlain by thin bedded, dark grey, very fine grained and clayey siltstone.	105 (approx.)	350
	Middle Jurassic		
3	Sandstone, light grey, weathers light olive grey, fine grained, generally thick bedded; some cross-bedding in places; indeterminate ammonites, belemnites belonging to the genus Pachyteuthis and pelecypods seen (none collected) 10 to 15 feet above visible base; top and base covered; visible.	70	245
2	Covered interval, assumed to correspond to 15 feet of the section.	15?	175
1	Siltstone, greyish-white to light grey, sandy, thick bedded to massive looking, strongly jointed, weathering-resistant and	160	160

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	cliff-forming; fossils collected about 55 feet above visible base include: Arctocephalites sp. indet., indeterminable belemnoids and pelecypods (GSC loc. 39372); base and top concealed; visible.		

Section 165

Location: Central Richardson Mountains, southwest face of an unnamed, long, northwest trending mountain situated about twenty-one miles northwest of Horn (= Elizabeth) Lake and on the east flank of White Mountains. Lat. 68°00'00" N; Long. 136°29'00" W.

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper Jurassic		
	Bug Creek Formation		
	Upper sandstone member		
14	Sandstone, medium grey, silty, siliceous, hard and quartzite-like, massive-looking but with thin platy bedding in places; weathering-resistant.	140	1,941
13	Partly covered, poor and scattered patches of dark grey, fine grained, soft, silty sandstone; probably underlain by this sandstone throughout; assumed to represent about 370 feet of the section.	370	1,801
12	Sandstone, light grey, weathers buff to orange, calcareous, fine grained, slightly silty and clayey; very fossiliferous in part but fossils include only indeterminate belemnites and pelecypods.	130	1,431
11	Sandstone, grey to medium brown, fine grained, crossbedded in places, very silty and clayey, carbonaceous; interbeds and nests of light grey, quartzose and clean, hard, fine grained sandstone; some indeterminate belemnites occur in places.	60	1,301
10	Sandstone, light grey, fine grained, cross-bedded, hard, massive looking and weathering resistant; contains numerous shale partings in the lower 10-15 feet; some indeterminate belemnites occur in the lower part of the unit.	80	1,241
9	Sandstone, grey, weathers rust-coloured, fine to very fine grained, silty and clayey; grades into sandy siltstone and/or shale;	140	1,161

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	medium hard and moderately weathering-resistant; some poor belemnoid guards seen (none collected).		
	Middle Jurassic?		
8	Sandstone, white to light grey, fine grained, dark specks and small inclusions of carbonaceous? material; scattered clay ironstone concretions weathering rust-coloured; massive looking and weathering-resistant; a 5 to 6 feet thick bed of orange to rust-coloured clay ironstone forms the base of the unit; fossils occurring about 45 to 50 feet above base include: large Pachyteuthis sp. indet. of Middle Jurassic? affinities and Inoceramus sp. indet.(none collected).	110	1,021
	Equivalent of Sandstone-siltstone member?		
7	Shale, medium grey, soft, fissile, scattered clay ironstone concretions up to 1 foot in diameter; a few stringers and lenses of grey, fine grained sandstone up to 2 feet in diameter; a 2 to 4 inch thick belemnite battlefield consisting of Pachyteuthis sp. indet.? (none collected) is associated with one of these lenses at the level 42 feet above base; indeterminate fragments of ammonites and belemnites occur at the level about 20 feet above the base (none collected).	140	911
	Intermediate sandstone member		
6	Sandstone, light grey to medium grey, fine grained, silty and clayey, soft, rich in worm burrows; a few, small clay ironstone concretions are scattered through the unit.	20	771
5	Sandstone, green and red-coloured, weathers more intensively green with thin rust-coloured bands; fine grained, more or less clean and quartzose, siliceous, medium hard; disorderly scattered clay ironstone concretions up to 1 foot in diameter; indeterminate large pelecypods	276	751

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	and large belemnoids probably belonging to Pachyteuthis sp. indet. occur on the float (none collected).		
4	Sandstone, light greyish green, weathers light green and red, fine to very fine grained, very silty and clayey; feebly crossbedded in places; medium hard and weathering-resistant; some interbeds of grey, silty shale up to 6 inches thick; scattered clay ironstone concretions in some parts of the unit.	75	475
	Basal shale member		
3	Shale, medium grey, weathers rust-coloured, somewhat silty, soft; numerous rows of clay ironstone concretions up to 1 foot in diameter occur at irregular intervals; weathers hackly.	147	400
2	Pebble conglomerate, dark grey, consists of black to grey, reasonably well rounded chert pebbles 1/4 to 1/2 inch in diameter buried in sandy and gritty matrix; numerous fragments of indeterminate pelecypods.	3	253
	Permian		
1	Sandstone, light grey, weathers purplish or orange grey, very fine grained, silty, moderately hard; bedding irregular and ill defined (often conchoidal); some Spirophyton-like problematica occur scattered through the thickness of the unit; these problematica become numerous in the top twenty or thirty feet; contact with bed 2 is sharp and uneven; it obviously is at least disconformable and probably reginally unconformable.	250	250

Section H-W-90

Location: On the crest of Snafu Mountain, central Richardson Mountains, about 10 miles southwest of Horn Lake; Lat. 67°40'00" N; Long. 136°23'00" W. (Based on information supplied by D. Bruce Bullock and Associates Ltd, 1959.)

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	Upper Jurassic		
	Husky Formation		
13	Shale, dark grey, silty, soft, weathers earthy.	100	3,620
12	Shale, silty and siltstone, clayey, dark grey, medium hard and weathering resistant; weathers rubbly.	70	3,520
11	Shale, silty, more or less as in unit 13.	210	3,450
10	Shale, silty, more or less as in overlying unit but weathering-resistant and hogsback-forming.	25	3,240
9	Shale, dark grey, weathers black, very silty and grades into siltstone, hard, weathers blocky; several 6 inch thick layers of orange-weathering clay ironstone occur at intervals; a few worm burrows noted.	300	3,215
8	Sandstone, grey, weathers rust coloured, fine grained, largely quartzose but includes considerable amount of rust-weathering feldspar? grains and a small amount of dark minerals.	200	2,915
7	Covered interval, probably underlain by dark grey shale judging from some scattered patches of weathered bedrock; assumed to represent about 1,200 feet of the section.	1,200?	2,715
	Bug Creek Formation		
6	Sandstone, dull grey, fine grained, largely quartzose but contains some rust-coloured feldspar? grains and some grains of dark	110	1,515

Bed or Unit	Description	Thickness (feet)	Height Above Base (feet)
	mineral, cement siliceous, heavily bedded (3 to 6 feet beds) or massive-looking, weathering-resistant.		
5	Shale, dark grey, pebbly; pebbles 1/8 to 1/2 inch in diameter built of black chert; interbedded with some brown, ripple marked, fine grained sandstone; outcrops intermittent and poor; the greater part of the slope covered with rock debris and soil.	470	1,405
4	Sandstone, brown, fine grained, quartzose, contains some rust-weathering, feldspar? grains, thin to medium bedded, platy in part; weathers rubbly; weathering-resistant; numerous pelecypods occuring in this unit include Buchia sp. indet., Legumen.	35	935
3	Covered interval, probably underlain by black shale and brown sandstone as in overlying units; assumed to correspond to about 250 feet of the section.	250	900
2	Sandstone, dull grey, very fine grained, flaggy to thick-bedded; contact with underlying rocks sharp and uneven; it obviously is erosional but there does not seem to be any traces of an angular unconformity or of a basal conglomerate; poor belemnite fragments and casts occur at the base; some fossils collected 55 feet above base include Arcticoceras henryi (Meek), Inoceramus cf. retrorsus Keyserling, Entolium sp. indet., Buchia sp. indet. Identified by Dr. C.R. Stelck of University of Alberta.	480	650
	Permian		
1	Interbedding of sandstone, siltstone and shale with numerous Spirophyton-like whorls; all rock varieties are mostly maroon- to rust-coloured.	170	170

Goat and Eagle Section 65 - G.E.S. -1-56[1]

Section measured by
A.A. McDermot
A. Kryszka

July, 1956

Section begun at top of exposure on prominent N-S trending cuesta like ridge on east side of unmapped tributary to the Main Rat River System. Section measured downward with 5-foot rod from point near summit of mountain.

Approx. Lat. N 67°57'
Long. W 136°23'
Struct. N 33°W. Dip 18°E

Top of section slabby sandstone debris result of poor weathering approx. 100 feet stratigraphically.

JURASSIC

Bug Creek Formation

0'-5'	Sandstone pale brown (deeply weathered). Fine gr. high argillaceous, poor porosity. No fossils (NF) thinly laminated due to concentration of argillaceous material. Thin to medium bedded regular, 2" to 3" and up to 18". At 4' noted a few lines of fine plant debris very poorly preserved.
5'-40'	Covered interval, presumed sandstone as shown with less interbeds of sandstone, rusty brown, rusty orange weathering fine gr. finely laminated, argillaceous, no porosity (NP) traces of plants, very thin regular bedded, 1/4" to 2" thick. Also few interbeds of sandstone, argillaceous, grey, light grey weath. v.f. gr. s/gr. thinly laminated, NP contains either spines? or plant debris, poorly preserved Fossil No. 1 - at 20'.
40'-43'	Sandy siltstone, highly argillaceous, irregular dark grey, rusty yellows red weathering, fine gr. subrounded sands and lesser silts and v.f. argill. material. Whole shows poor sorting, and microslump like features or fine irregular distorted lenses. N.P. N.F. poor irregular thin bedded 1/4" to 2" thick.
43'-50'	Covered interval same as 40'-43' above.
50'-68'	Small cliff forming outcrop of same lithology as above. H.S. (Hand specimens) No. 1-65'.
68'-125'	Covered interval except for 1 foot exposure of same lithology as above.

[1] Reproduced as received from British American Oil Company, except for interpretive remarks.

From 115' large angular debris in talus composed of sandstone in part the argill. pale grey, pale creamy grey white weath. fine gr. sands well sorted subrounded, thin well developed laminae shows traces of cross-bedding tight to patchy poor porosity. N.F. possible some dark material heavy minerals. Does not appear to be in place may have come from above?
H.S. No. 2-125' At 125' continued along strike to the south.

125'-235' At 130' collected badly fractured Belemnite phragmocone and guard. At 225' collected badly fractured Belemnites. Covered interval of thin-bedded sandstones.

228'-240' Apparently badly weathered outcrop. Sandstone incipient-quartzite, pale grey, light whitish grey weathering; very f to f. gr. sand grains, sub-rounded, fair sorting, sl. frosted, argillaceous; massive structurless, N.P. to rare partly poor porosity, scattered poorly preserved. Pelecypods frags and weathered shells apparently parallel to bedding. Thick bedded to massive 3' to 5' and over.
H.S. No. 3 - 237' with pelecy frag. Also few Belemnites were noted orientation parallel bedding. Cross-bedding common.

240'-270' At 271' collected Belemnite frags, from Scree very robust 4" to 8" long and possibly up to 3" in diameter, 1" to 2 1/4" for sure. Some distortion due to entombment. Native rock. Sandstone as above 228'-240'.

270'-294' Sandstone incipient quartzite, banded, light grey and dark grey, dark grey weath. v. fine gr. grains subrounded, frosted, shows good fine laminated appearence due to concentration of fine argillaceous material along certain bedding planes. N.P. N.F. well bedded, regular thin 2" to 4" thick.
H.S. No. 4-275".

294'-310' Sandstone, incipient quartzite light brownish grey to reddy brown, pale white pink weathering vf. gr. gro. subrounded, frosted, sl. argillaceous, patchy poor porosity essential N.P. contains Belemnites, few plant remains, med. bedded, 8" to 20" so fine gr. gives good subconchoidal fracture.
H.S. No. 5-295'. At 300' to base of outcrop noted numerous Belemnite frags--and Inoceramus casts also large scale cross-bedding.

310'-322' Sandstone, calcareous, dk. grey, brown weathering vf. to f. gr. grs. subrounded, in part quartzitic, argillaceous, N.P. contains scattered Belemnite frags. chocerns casts good cross-bedding, massive bedded, thick 3' to 5' has characteristics blocking fracture.
H.S. No. 6-310'. Collected two specimens of Inoceramus for scree at 318'.

322'-365' Sandstone sl. calcareous, light cherty.
H.S. No. 7-322'. Grey, light yellow grey weathering, v. fine

to fine gr. in part calcite cement. shows, fine laminae due concentration of argill. matter. grs. subrounded. N.P. except where weathered, contains Inoceramus frag. and deeply weathered shells usually iron coated. Also few limonite nodules 1/4" to 1" in diameter. Thick bedded, 2' to 5' thick. Weathers with coarse blocky fracture outcrop tends to heave under frost action. The sandstone becomes somewhat banded or laminated in the basal 14'.
H.S. No. 8-365'.

365'-380' Covered to poorly exposed, siltstone with numerous thin highly argillaceous laminae.

380'-404' Sandstone light to med. grey, grey weath. vf. to f. gr., changes from sl. argillaceous to argillaceous, sl. calcareous, grains, subrounded to rounded, frosted, in part incipient quartzite. N.P. to V.P. pors. N.F. irregular med. to thick bedded, 10" to 30" weathers with prominent subconchoided faces. This must be base of upper massive sandstone.

404'-415' Covered interval.

415'-430' Sandstone, med. grey, pale yellowish grey weath. vf. to f. gr. in part quartzitic, sl. argillaceous, with prominent laminae due to concentration of argillaceous material. N.P. N.F. few plant remains. Thin well bedded, 1/4" to 2" weathers with platy habit due to argill. laminae. At 422' 1 foot bed of quartzitic sandstone, light grey, pale yellow grey weathering; N.P. N.F. - well bedded, 1 foot.
H.S. No. 9-422'-423'

430'-475' Silty sandstone highly argillaceous, med. to dark grey, dirty yellow grey weathering; vf. gr. grs. rounded, frosted, fair size sorting, whole highly irregular lenses and packets of sand with distorted argillaceous laminae, N.P. N.F. irregular nodular bedded, thin, 1/4" to 3" thick, contains numerous small pyrite, and limonite after pyrite nodules, 1/8" to 1/2" in diameter, also few traces of plant debris.
Friday, July 6, 1956. Picked up at 475' at sharp change in lithology.

475'-495' Sandstone, light grey, pale yellow white weath. f.f. to f. gr. good sorting, gro. well rounded to sub-rounded, frosted to clear, traces of argillaceous material, fair fine porosity, few scattered Belemnites, thick bedded, regular. 20" to 36" weather to a subconchoidal debris. Thin highly argillaceous sandstone bed at 483 to 483.5 thin bedded, regular 1/4" to 1".

465'-515' Covered interval in part at least sandstone as above but highly argillaceous, platy to laminated. Thin bedded, 1" to 6".

515'-537' Sandstone incipient quartzite, pale grey, pale yellow-white weath. vf. to f. grained, grs. well rounded, sl. frosted, traces of argillaceous material throughout, patchy poor fine

intergranular porosity. Few scattered Belemnites. Well bedded thin to medium, 4" to 6" and 1' to 2'. From 530'-531' massive hi. argillaceous sandstone bed. From 531 to 535' increase in argillaceous content well laminated thin bedded, 1" to 4".

537'-560' Interbedded sandstone and highly argillaceous sandstone. Sandstone, light grey, light brown weath. f. gr. good size grading, subrounded, clear to sl. frosted, traces of argill. matter, well bedded thin, 3" to 6". N.P. N.F. Sandstone, highly argillaceous, similar to above but with numerous very fine distorted argill. laminae, tends to thin nodular highly irregular bedded, 1/4" to 6". Both lithologies compose equal part of outcrop.

560'-562' Sandstone quartzitic, med. grey, pale yellow to rusty red weathering, vf. gr. with numerous thin highly argillaceous laminae these show cross-bedding and 6" band in middle of unit shows torrential cross-bedding; N.P. N.F. well bedded, thin 8" to 10".

562'-682' Covered interval, consists of sandstones and highly argillaceous sandstones in the upper 40' of the covered interval. The basal 80' of the covered interval consists of slightly sandy shale, interbedded with highly argillaceous sandstone, both are med. grey, and dark grey weathering; the sands are fine gr. sl. frosted subrounded. They contain numerous small pyrite and the limonite after pyrite nodules, also plant debris. According to Dr. A.D. Baillie (personal communication of May 7th, 1963) following fossils have been found on talus in the interval 600 to 682 feet (identifications of Dr. C.R. Stelck, University of Alberta): Ammonite sp. indet., Aequipecten sp. indet., Vermiceras sp. indet., Oxytoma sp., Belemnite sp. indet. and dated as of the Lower Sinemurian age. The Vermiceras sp. indet. was subsequently described and figured by Frebold (1960, p. 1) as Arietites sensu lato genus and species indet.

682'-741' Prominent cliff forming sequence the massive bed. Sandstone highly argillaceous to argillaceous, light to med. grey, pale yellow brown to greyish brown weathering; vf. gr. grs. subrounded, sl. frosted, contain numerous small irregular to distorted laminar and lenses of fine argillaceous material. N.P. contains scattered plant debris throughout. Also Belemnites and Inoceramus, especially evident in basal 20 feet. Preservation not too bad but very difficult to extract. Contains numerous pyrite and limonite after pyrite nodules throughout. Nodules 1/4" to 1" in diameter. Noted large ironstone nodules at 689', 693' and 726' all were 3' to 4' long and 12" to 18" thick. Unit is roughly to nodular bedded, medium to thick, 1' to 2' and 3' to 5' thick.

741'-860' Covered interval covered with coarse sandstone talus and talus from the massive bed.

860'-878' Top of Goat Slope. Sandstone, light greenish grey, pale greenish grey weath. f. gr. grs. well rounded, good sorting sl. frosted, N.P. in part incipient quartzite, few poorly preserved plant remains, at 875' prominent clay ironstone nodule, 5' long 8" thick. Well bedded thick 2' to 3'.
H.S. No. 10-860'.

878'-940' Sandstone, med. grey, light brown to greenish brown weathering, f.g. grs. subrounded, sl. frosted, well bedded regular then 8" to 14" trace poor porosity, N.F.
H.S. No. 11-910'. Cluster bedded with sandstone argillaceous, quartzitic, med. greenish grey, dark grey weathering, f.g. the bedding plane contains between the two sands have a light argillaceous on shale coating, rusty coloured, preserved often finely disseminated pyrite, contains scattered plant debris. N.P.
H.S. No. 12-930'. Interval poorly exposed. Sandstone 60% quartzite 40% total exposure.

940'-988' Sandstone, incipient quartzite, pale greenish grey, pale greenish grey weath. f.g. N.P. N.F. well bedded, medium bedded, 14" to 28".
H.S. No. 14-950'. Interbedded with sandstone argillaceous, med. grey greenish, rusty yellow to yellow weathering f.g. in part laminated, N.P. contains plant debris, tends to be roughly bedded thin 4" to 6". Noted ripple marks at 972' and 976'.
H.S. No. 13-942'.

988'-1084' H.S. No. 15-990'. Sandstone, incipient quartzite pale greenish grey to white grey, med. grey weathering f. gr. N.P. N.F. structureless well bedded, medium 8" to 20" exhibits a blocky jointing, and weather to a subconchoidal platy debris. Interbedded with the above is the argill. sandstone with plant debris, similar to unit above. From 1045' to base the block carbonaceous shale partings become more prominent.

1084' At this point traversed along strike to the south to pick above best "Brown Bed" sequence and rock in covered interval. Jack and Roy came in and we got a lift home.
Saturday, July 7, 1956. Climbed up to base of Goat slope (the next one south along strike) from point where we left off last night. Here we get a maximum of exposure although contact will be obscured.

1084'-1124' Covered interval of 40' somewhere near the top of this covered is the contact between the overlying "Barren Sands" and the "Brown Beds".

Pennsylvanian - Lower Permian

1124' Top of prominent small cliff forming Brown Bed sequence.

1124'-1153' Limestone, highly argillaceous, sl. silty to sandy, med. grey, pale grey to dull earthy grey weathering; sand grains appear to

be subangular and clear. N.P. N.F. very irregular and poorly bedded, thin 1/4" to 1" thick, weathers to a fine platy irregular debris. First assurance of plant debris at 1130'. Loss of some argillaceous content at 1145 to 1146'. H.S. No. 16-1148' of the limestone and chert at 1148'.