68-14

GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

PAPER 68-14

CRETACEOUS STRATIGRAPHY BETWEEN TETSA AND LA BICHE RIVERS, NORTHEASTERN BRITISH COLUMBIA

(Report and 3 Figures)

D. F. Stott

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ABSTRACT

Lower Cretaceous rocks between Tetsa and La Biche Rivers in northeastern British Columbia lie unconformably on Triassic to Mississippian sediments. They comprise a thick succession of intertonguing deltaic and marine sandstones and shales, and grade transitionally upward into the alluvial and deltaic conglomeratic sandstones of the Dunvegan Formation. A hiatus representing all of Turonian and probably all of Coniacian time separates those beds from the overlying upper Cretaceous marine shales of the Kotaneelee Formation and a younger succession of alluvial and deltaic sediments included in the Wapiti Formation.

CRETACEOUS STRATIGRAPHY BETWEEN TETSA AND LA BICHE RIVERS, NORTHEASTERN BRITISH COLUMBIA

INTRODUCTION

Cretaceous formations were studied in outcrop sections in conjunction with Operation Liard (Taylor, 1965, 1966), a regional mapping project in the Mountains, Foothills, and adjacent Plains between north latitudes 57° and 60°. The succession south of Tetsa River to Peace River was described previously (Stott, 1966) and beyond there to Smoky River (Stott, 1968). Several major facies changes occur northward and this preliminary account outlines the lithologic variations and establishes regional relationships. Several outcrop sections are described in the Appendix.

Cretaceous rocks in the vicinity of the Alaska Highway were first described by Williams (1944). To the north on Liard River, Kindle (1944) outlined the succession, defining several new formations and showing their distribution. These early descriptions were later compiled in a more comprehensive report by McLearn and Kindle (1950). Cretaceous rocks directly north of the region in Northwest Territories were described by Hage (1944) and by the writer (Stott, 1960).

FIELD WORK AND ACKNOWLEDGMENTS

Field investigations of the Cretaceous succession in the vicinity of Tetsa River were initiated in 1964 and continued during the summer of 1965. Some exposures near Alaska Highway are easily accessible but most sections were reached by helicopter.

The logistics of Operation Liard were the responsibility of G.C. Taylor and the writer is deeply indebted to him for complete cooperation and interest in mutual problems. Transportation in the field was provided by helicopters supplied by Bullock Wings and Rotors, Limited, Calgary. The writer extends his appreciation to that company and the crews consisting of J. Davies, H. Tetz, M. Brown, and P. Ettinger. Assistance in the field was given in 1964 by R. Armstrong, M. Wooding, D. Hetherington, and D. McDougall; and in 1965, by D. Herron. The writer is also grateful to I. Severson, S. McWhinnie, and D. Turner.

Cretaceous macrofaunas were identified and dated by J.A. Jeletzky; and Cretaceous macrofloras, by W.A. Bell.

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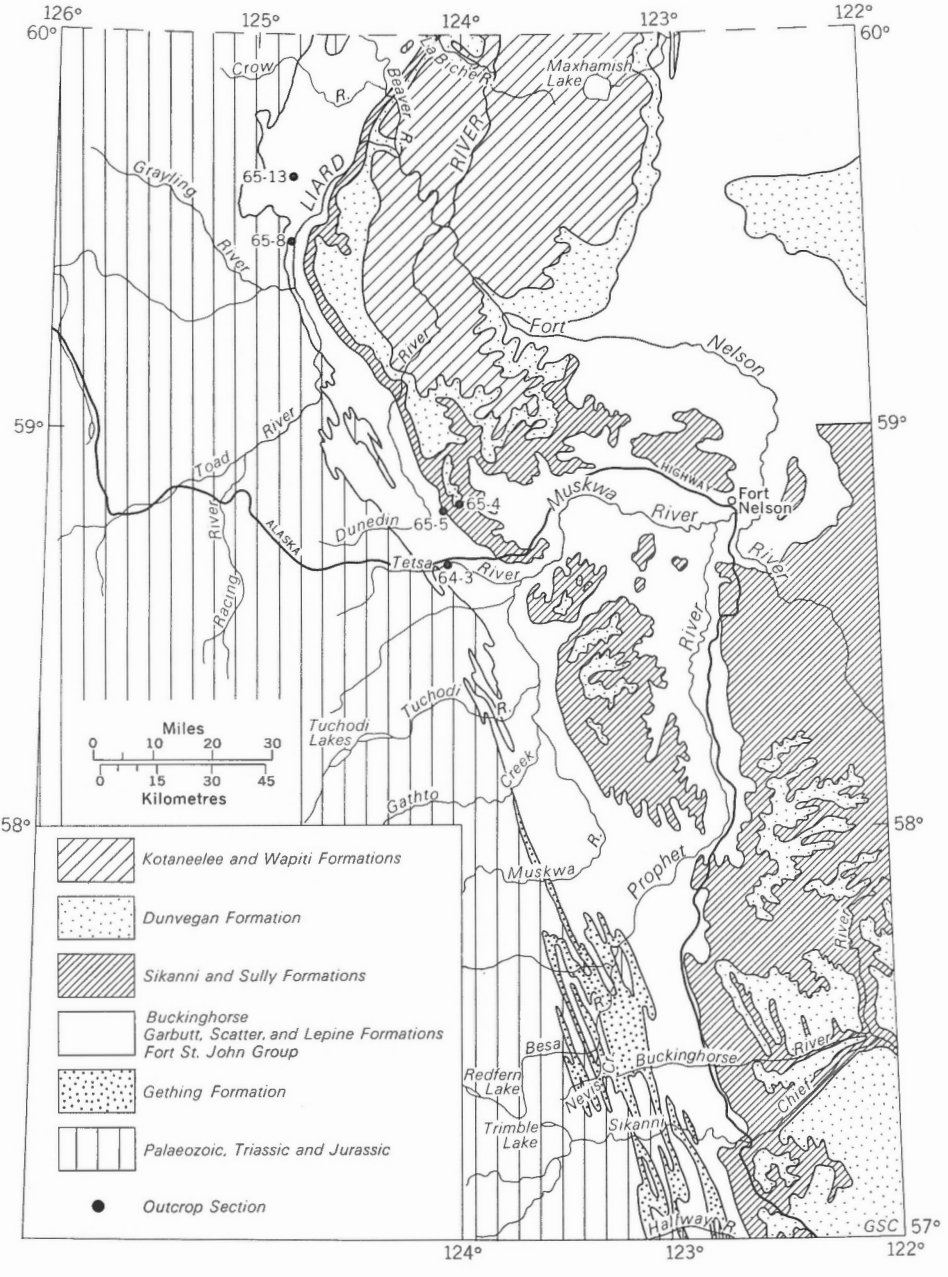

Figure 1. Distribution of Cretaceous rocks and locations of outcrop sections.

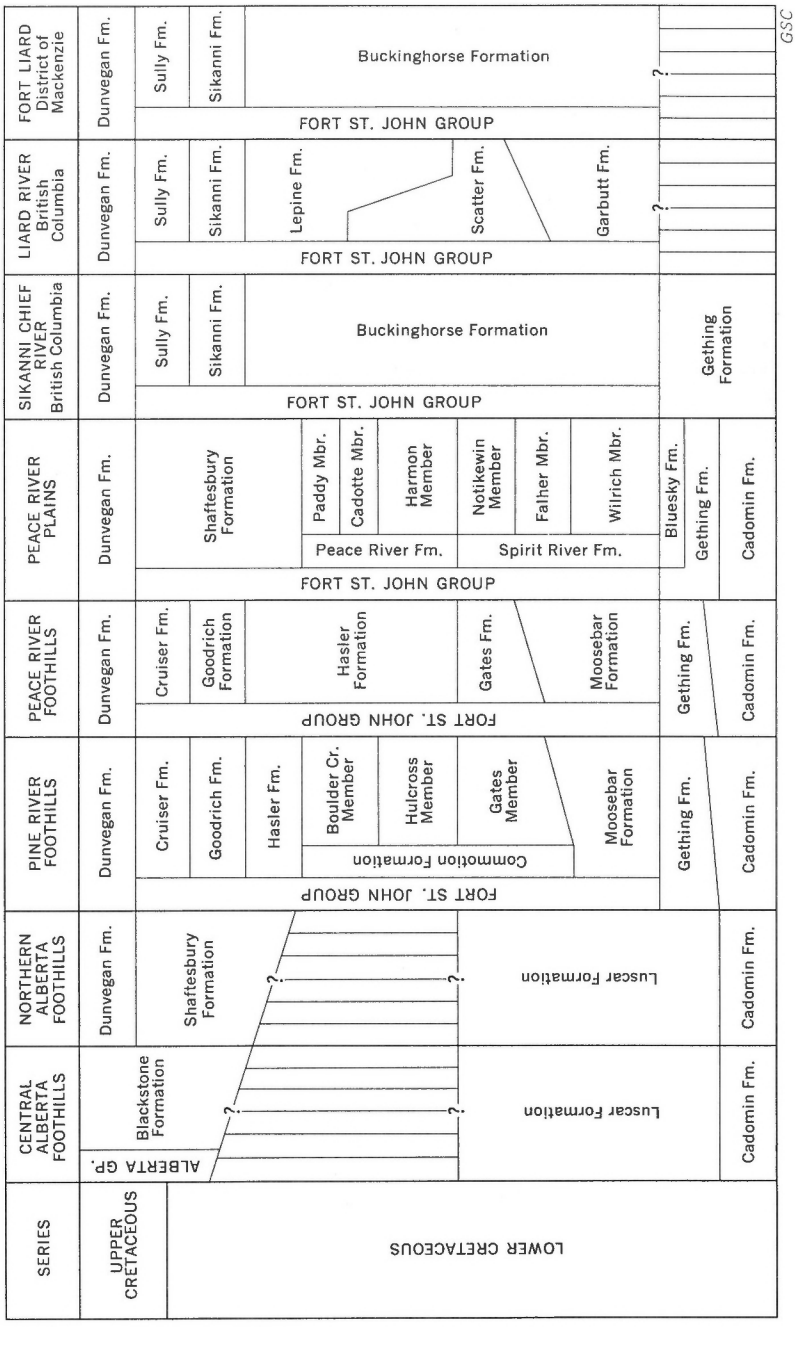

Figure 2. Correlation of Lower Cretaceous rocks of the northern Rocky Mountain Foothills and adjacent regions.

STRATIGRAPHY

Lower Cretaceous rocks between Tetsa and La Biche Rivers (Fig. 1) comprise a thick succession of dominantly marine shale with two large wedges of intertonguing, fine-grained sandstone. The Upper Cretaceous sequence includes a succession of coarse, deltaic and alluvial sediments overlain unconformably by another sequence of marine shale and alluvial deposits.

The base of the succession is a regional unconformity that truncates successively older beds in a northward and eastward direction. Basal Cretaceous beds lie on Triassic Liard sandstone at Mile 375, Alaska Highway; on Lower to Middle Triassic Toad siltstones and shales beyond there into the District of Mackenzie; and finally on Permian sediments north of La Biche River in Yukon and District of Mackenzie. Similarly, in an eastward direction, the unconformity bevels Triassic, Permian, and Mississippian strata. In the vicinity of Bovie Lake at the northern edge of Maxhamish map-area (940), Cretaceous shales lie on Mississippian Mattson sandstone and farther east, on the older Mississippian Flett Formation.

FORT ST. JOHN GROUP

The Fort St. John Group (Dawson, 1881) is a thick succession of marine shale containing two major sandstone sequences which are not present everywhere. In the south as previously described (Stott, 1966), the Sikanni sandstone, occurring in the upper third of the group overlies Buckinghorse shales and underlies the Sully Formation. The Sikanni can be readily mapped as far north as Scatter River although it loses its distinctive character eastward in the northern part of Fort Nelson (94J) map-area (Taylor and Stott, 1968b) and Maxhamish Lake (940) map-area (Taylor and Stott, 1968a). In the vicinity of Scatter River, another major sandstone succession, the Scatter Formation, occurs in the lower third of the group (Fig. 3); the basal shales are included there in the Garbutt Formation, and the shales between the Scatter and Sikanni are placed in the Lepine Formation. The Scatter sandstones are not mappable between Toad and Tetsa Rivers but the upper part of the sandstone succession reappears farther south and is present between Chischa and Tuchodi Rivers.

A previous discussion (Stott, 1966) dealt with the occurrence of the Fort St. John Group in Trutch (94G) and the southern part of Fort Nelson (94J) map-areas, so the following remarks will be concerned mainly with the succession as it occurs between Tetsa River and the northern limits of Toad River (94N) and Maxhamish Lake (94O).

TABLE OF FORMATIONS

Series	Group	Formation	Thickness (feet)	Lithology
Upper Cretaceous		Wapiti	?	Coarse-grained, conglomeratic sandstone
		Kotaneelee	600+	Dark grey, marine shale; some fine-grained sandstone
	unconformity			
		Dunvegan	500 - 600	Massive conglomerate; fine- to coarse-grained sandstone; Carbonaceous shale and mudstone; coal seams
		Sully	300 - 1,000	Dark grey, marine shale with sideritic concretions; flaky, black shale
Lower Cretaceous	Fort St. John 4,500 - 6,500 ft.	Sikanni	350 - 1,000	Fine-grained, laminated, marine sandstone; silty mudstone
		Buckinghorse Formation 3,300 + Lepine	3,000 - 3,600	Dark grey, marine shale with sideritic concretions; fine-grained silty sandstone
		Scatter	1,143	Fine-grained, highly glauconitic sandstone and siltstone; silty marine shale
		Garbutt	950	Silty shales and mudstone, and siltstone; sideritic concretions
Regional erosional unconformity, bevels rock of succeedingly older age northward and eastward.				

The Fort St. John Group is approximately 4,500 feet thick in the vicinity of Sikanni Chief River and attains a maximum of 6,500 feet at Scatter River. The group thins fairly rapidly eastward, particularly in Maxhamish Lake map-area where structure related to the Bovie Lake fault has apparently influenced Cretaceous deposition.

Buckinghorse Formation

The Buckinghorse Formation extends northwesterly in a broad low-lying belt along the eastern edge of the Foothills between Halfway and Muskwa Rivers. It is present in the centre of several synclines within the Foothills, being most extensive in the vicinity of Marion Lake, Nevis Creek, and Besa River (Fig. 1). The most continuous exposures are present on Sikanni Chief and Buckinghorse Rivers although numerous outcrops occur on Prophet and Muskwa Rivers and their tributaries. The formation is commonly faulted or flat-lying so a measured outcrop thickness is not readily obtained. Hage (1944), who first defined the formation, estimated the thickness to be between 3,300 and 3,600 feet and this is confirmed by thicknesses determined from wells drilled in the area.

The Scatter Formation is not recognized between Tetsa and Toad Rivers and shales below the Sikanni sandstone in that region are included in the Buckinghorse Formation. Only small, isolated outcrops were noted on Dunedin River and its western trubutaries. However, more than 2,000 feet of the basal Buckinghorse strata outcrop on Tetsa River (see Stott, 1966, section 64-3). The basal 200 feet of beds and the contact with underlying Triassic beds are well exposed in a road cut at Mile 375 on the Alaska Highway. The upper contact with the Sikanni Formation outcrops at Mile 351.

Rusty-weathering, dark grey to black shale with large sideritic concretions occurs in the lower part of the Buckinghorse Formation in the type region. The lower middle part contains rubbly to flaky shales that contain few or no concretions. An overlying succession of interbedded platy siltstone and silty shale may be equivalent to some part of the Scatter Formation to the north or to the Commotion Formation to the south. Concretionary shales in the upper part of the Buckinghorse are transitional into sandstones of the Sikanni Formation. Farther north at Tetsa River, the lower 900 feet consist of silty, concretionary mudstone with a few units of argillaceous, platy siltstone and sandstone. The overlying 500 feet comprise flaggy to thin-bedded siltstone and sandstone with varying amounts of intercalated shale. Those beds are approximately equivalent to the lower sandstone member of the Scatter Formation. The upper 500 to 600 feet, not all exposed, consist of silty mudstone and siltstone and may be equivalent in part to the middle and upper members of the Scatter Formation. Upper shales of the formation are exposed in gullies along the escarpment west of Steamboat Mountain but were not studied in any detail. They are assumed to be similar to the thick succession of shales occurring above sandstones at the junction of Chlotapecta Creek and Muskwa River (see Stott, 1966, section 64-25).

Lemuroceras (s. lato) cf. L. belli McLearn and Beudanticeras (Grantziceras) cf. B. multiconstrictum Imlay were collected by Stott from the lower part of the Buckinghorse Formation on Buckinghorse Creek and Sikanni Chief River respectively (GSC locs. 52199, 52205). Jeletzky commented as follows:

> "Although it is not possible to say definitely to which of the more refined Lemuroceras s. lato (inclusive of Subarcthoplites) zones any of those lots belongs, the writer considers it more likely that they are somewhere in the lower part of the generalized Beudanticeras affine and Lemuroceras zone and of the early rather than mid-Albian age."

As the Buckinghorse Formation lies below beds that are within the late Albian Neogastroplites zone, it can be dated as (?) late early Albian to middle Albian. It contains beds equivalent to the Moosebar, Gates, Commotion and Hasler Formations of upper Peace River; the Spirit River, Peace River and lower Shaftesbury Formations of the Plains; and part of the Garbutt, Scatter, and Lepine Formations of the Liard region (Fig. 2). Lower beds on Tetsa River are considered equivalent in part to the Gething Formation and, therefore, in that region the basal beds of the Buckinghorse are probably older than in the type region.

Garbutt Formation

The Garbutt Formation was named and described by Kindle (1944) from exposures on Garbutt Creek in Toad River map-area (94N). The creek more or less parallels the strike of the shales and a continuous measurement is difficult to obtain. Slides, large slump blocks, and a tangle of thick vegetation now cover most of the shale at creek level, making access extremely slow and difficult. The basal 200 to 300 feet of the formation are exposed in a cliff near the Triassic contact about four miles (map distance) upstream from Liard River. In addition, the upper 200 to 250 feet of shales are exposed beneath the Scatter sandstone on cliffs along the east side of the creek.

Measurements of the Garbutt Formation were obtained on the creek between Lepine Creek and Scatter River and at two localities within the westernmost exposures along Scatter River (section 65-13)[1]. Those three measurements agree closely,

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[1] Descriptions of outcrop sections are given in the appendix.

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indicating that the Garbutt shales are in the order of 950 feet thick in this area. It is evident that the 2,000 feet determined by Kindle is excessive.

The Garbutt shales extend along the western side of Liard River as far south as Toad River. Beyond there, equivalent beds are included in the Buckinghorse Formation. Basal Cretaceous shales occur in several small synclines near Hell Gate on Liard River. In the region between Chischa and Tuchodi Rivers shales, below sandstones equivalent to the upper Scatter, may be assigned to the Garbutt. It should be realized, however, that the shale succession there includes beds equivalent to the lower Scatter sandstones. To the north of the type locality, Garbutt shales extend as a narrow, recessive belt across Crow River to Beaver River. Exposures of basal Cretaceous shales to the northeast in District of Mackenzie were previously described (Stott, 1960)[2].

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[2] In that earlier report, basal Cretaceous shales were included in the Buckinghorse Formation. Additional studies in 1965 indicate that sandstone in the lower part (see Douglas and Norris, 1959, map unit 12) is the Scatter Formation and therefore, the underlying shales can be assigned to the Garbutt Formation. The Scatter and Garbutt Formations are also mappable in the Fantasque syncline to the west. However, a moderately recessive unit of dark shales and siltstones included in map unit 10 and, in some places, in the basal part of map unit 14 of Douglas and Norris, (1959) is now considered to be Triassic Toad and Grayling Formations.

As indicated by Kindle (1944), the type Garbutt shales are underlain by 4 to 5 feet of fine-grained, argillaceous sandstone. Those beds include some disseminated chert pebbles, wood fragments, and glauconite. Although Kindle suggested a Jurassic age for those beds, their gradational contact with the overlying shales, channel-structures, marine character, and similarity to basal sandstones at Mile 375 Alaska Highway indicate that they are the initial deposits of the Cretaceous transgression. On Scatter River, basal Garbutt shales lie directly on Triassic sediments without any intervening sandy deposits.

The Garbutt Formation on Scatter River consists of two main subdivisions. The lower one comprises silty mudstone, argillaceous siltstone, sideritic concretions, and a few thin seams of bentonite. Crossbedding and slump structures occur in parts of the succession. Flaggy to thin-bedded, fine-grained sandstone occurs at the top of the lower unit, producing a prominent ledge in cliff exposures. The upper subdivision consists dominantly of rubbly mudstone with rows of reddish brown weathering, sideritic concretions. It becomes siltier toward the top, grading upward into a massive unit of argillaceous siltstone.

No macrofossils were obtained from the Garbutt shales. The formation lies below beds that are within the middle Albian zone of Gastroplites and is equated with basal Buckinghorse shales on Tetsa River. The basal Garbutt may possibly be older than Albian because those beds may include equivalents of the Gething Formation.

Scatter Formation

The Scatter Formation, defined on Scatter River by Kindle (1944), consists of two major sandstone members separated by a thick shale member. Kindle indicated that the succession comprises 3 sandstones separated by two shale units, totalling 750 feet, but it is difficult to reconcile that description with the outcrop[1]. Present

[1] Although a number of discrepancies are found in Kindle's work, the reader should realize that those earlier studies were made by foot and canoe traverses without benefit of adequate maps or air photographs, covered an extremely large and unknown area in a relatively short time, and involved a thick and unknown succession of Paleozoic and Mesozoic rocks. It is to Kindle's credit that the map distribution of major units remains little changed and that many of the modifications are necessitated only to maintain consistency with successions more firmly established in other regions.

studies showed the thickness of the lower sandstone member to be more than 400 feet; that of the middle shale member, to be in the order of 450 feet; and that of the upper sandstone member, to be 250 feet; the total thickness of the type section was determined to be 1,143 feet.

Both upper and lower boundaries of the formation are gradational. The lower contact with the Garbutt is drawn at the change from argillaceous siltstone or mudstone to thick-bedded sandstone. The upper contact with the Lepine Formation is represented only by a change from sandy siltstone to silty mudstone.

The Scatter sandstones are well exposed in the canyon of Scatter River where immense blocks have slumped into the valley. Some caution must be exercised to avoid mistaking those blocks at river level for true bedrock. The sandstones become much more massive and contain much less interbedded shale as they are traced westward along the canyon walls. Both sandstones extend northward; are well represented on Crow River, and are traceable along the west flank of La Biche syncline in Yukon Territory[2].

[2] Map-unit 12 of Douglas and Norris (1959) includes most or all of the Scatter Formation on the west flank of La Biche syncline. On the eastern side and in some other exposures in the Fort Liard map-area, map-unit 12 appears to include only the lower sandstone member. Both sandstone members appear to be present in the centre of Fantasque syncline and good exposures of the lower member occur east of Fantasque Lake. The lower sandstone is also exposed on Kotaneelee River about 8 miles south of Etanda Lakes.

The upper sandstone grades laterally eastward into argillaceous siltstone and shale, becoming recessive and indistinct on the east flank of the anticline on Crow River and disappearing almost completely on the flanks of Kotaneelee anticline.

The upper sandstone does not extend as far south as Lepine Creek, and is represented on the east side of Liard River only by silty concretionary mudstone included in the Lepine Formation. The lower sandstone extends southward from the type locality for about two miles beyond the junction of Toad and Liard Rivers but becomes indistinct and is not mappable farther south. Equivalent beds between there and Chischa River are included in the Buckinghorse Formation.

Sandstones of the lower member in the type region are fine-grained, commonly laminated, grey to greenish grey, flaggy to thick-bedded. Channel-fill structures are common. Large-scale slump features are present in the basal beds of the type section on the south side of Scatter River. Glauconite is extremely abundant throughout and several beds, 1 to 4 inches thick, of glauconite are present. Shale beds are common in the upper part of that member. Large Spirophyton-like structures occur on many bedding planes.

The middle member consists of silty, concretionary mudstone. Fragments of Inoceramus are common in the upper part of the member where they occur mainly within the sideritic concretions.

The upper sandstone comprises alternating units of silty, glauconitic sandstone and silty mudstone. Only one prominent sandstone occurs within the member on Scatter River.

A sandstone unit, much like the upper member, occupies a similar stratigraphic position between Chischa and Tuchodi River and appears closely correlative. Presumably it is that sandstone which resulted in the five-fold division of the Fort St. John Group and recognition of the Scatter Formation on Chischa River [1] by Stelck, et al. (1956, Fig. 2). On Chischa River, the succession includes

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[1] Location of section described in personal communication from Dr. Stelck, December 8, 1958.

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two prominent units of fine-grained, silty, thin-bedded sandstone overlain by several alternating units of mudstone, argillaceous siltstone, and sandstone. Henderson (1954, p. 2284) indicates a thickness of 232 feet for this succession, but the writer included 262 feet in the member.

The Cretaceous succession on Petitot River near Bovie Lake was described previously and exposed beds of the Fort St. John Group were assigned to the Buckinghorse Formation (Stott, 1960, section 3; Taylor and Stott, 1968a). Investigations in 1965 showed that beds of the described section lie about 650 feet above 38 feet of thin-bedded, fine-grained sandstone that are thought to lie at the

base of the Cretaceous succession. It now seems likely that a large part of the exposed Cretaceous beds along Petitot River on the west side of the Bovie Lake anticline are equivalent to the Scatter Formation. Most of the sandy beds at that locality are glauconitic, resembling in many respects the type Scatter sandstones. Certain correlation and structural problems resulting from this reassignment are being investigated currently.

Gastroplites? (Paragastroplites?) n. sp. ex aff. liardense (Whiteaves) and Inoceramus cf. I. cadottensis McLearn were collected from the middle shale member of the Scatter Formation on Crow River (GSC loc. 69198). Jeletzky commented that this lot presumably represents some part (lower?) of the generalized Gastroplites zone but indicated that there is some possibility of it being somewhat older and representing a new fauna occurring between the generalized Gastroplites zone and the generalized Arcthoplites and Beudanticeras affine zone. Indeterminate Gastroplitid ammonites were obtained from the upper sandstone member at the type locality of the Lepine Formation. As the middle and upper Scatter Formation contains a fauna that is closely related to that of the generalized zone of Gastroplites and underlies beds included in that zone, the formation is no younger than late middle Albian. The lower sandstone is not well dated but presumably represents some part of middle Albian.

Lepine Formation

The Lepine Formation was defined by Kindle (1944, p. 12) as a 2,000-foot thick series of grey and black marine shales overlying the Scatter Formation and underlying Upper Cretaceous conglomerate assigned to the Fort Nelson Formation. McLearn and Kindle (1950, p. 90) implied that the type section was opposite the mouth of Lepine Creek but Kindle's described section is opposite the mouth of Scatter River, 15 miles to the north. Unfortunately, the successions at those two localities differ greatly in thickness, resulting in considerable confusion in later attempts at correlation. It is clearly evident that the sandstone overlying the shale succession opposite Lepine Creek is the Sikanni Formation, whereas Kindle's described succession (opposite Scatter River) is overlain by much younger conglomeratic beds herein included in the Dunvegan Formation (see Fig. 3). Furthermore, present studies show that the upper Scatter sandstone has graded laterally into mudstone opposite Lepine Creek, so the base of the shale succession there is underlain by the lower Scatter sandstone rather than by the upper member as it is at Scatter River. As used herein, the Lepine Formation includes the shale succession between the Scatter and Sikanni Formations. Kindle believed that the Lepine was equivalent to the Goodrich and Cruiser Formations of Peace River region and to the Sikanni Formation of Hage (1944). Although such an assumption was correct for his described section, it is untenable for the succession opposite Lepine Creek, which is equivalent to beds lying below the Goodrich and Sikanni Formations.

The Lepine Formation is exposed in many steep gullies along the escarpment on the east side of Liard River, although the upper part of the formation is not exposed at the type locality. The most complete description and measurement is based on a composite of sections opposite the creek between Lepine Creek and Scatter River. The thickness of shales lying between the upper Scatter member and Sikanni sandstone is in the order of 3,000 feet. The formation extends northward across low-lying land between Crow and Beaver Rivers and into Yukon Territory along the axis of La Biche syncline. South of the junction of Toad and Liard Rivers where the Scatter is not recognized, equivalent beds are included in the Buckinghorse Formation. A similar shale succession, lying between upper Scatter equivalents and the Sikanni, is well exposed along the escarpment east of Muskwa River. The total thickness opposite Chlotapecta Creek is about 2,000 feet (see Stott, 1966, section 64-25), indicating considerable thinning of that interval in a southeasterly direction.

Where the Lepine Formation includes equivalents of the middle and upper Scatter members, the formational thickness increases by 600 to 700 feet. Those beds consist dominantly of silty, concretionary mudstone with a few units of argillaceous siltstone. Elsewhere, a basal unit comprising 300 to 400 feet of silty, concretionary mudstone, is abundantly fossiliferous and contains numerous ammonites enclosed in concretions. A succeeding unit of black, flaky to fissile shale, about 400 feet thick, is overlain by more concretionary silty mudstone. Sandy siltstone to sandstone occurs near the middle of this rather monotonous succession. A layer of cone-in cone lying within those sandy beds near Scatter River may have considerable extent and be a useful marker.

Large collections of ammonites from several localities on Liard, Scatter, and Crow Rivers were obtained during the present study. Gastroplites kingi McLearn, G. allani McLearn, G. aff. G. canadensis McLearn, G. (P.) spiekeri McLearn, G. cf. G. stantoni McLearn, Inoceramus cf. I. anglicus Woods, and I. cf. I. cadottensis McLearn were collected from the lower 300 feet of the Lepine Formation at its type locality on Liard River (GSC locs. 69196, 69193, 69195, 69192, 69194, 69172, 69191). A similar fauna was obtained from basal Lepine shale at the type locality of the Scatter Formation (GSC locs. 69168, 69169, 69170, 69171). This fauna characterizes the generalized Gastroplites zone dated by Jeletzky (1964, corr. chart) as late middle Albian. Gastroplites? (Paragastroplites?) liardense (Whiteaves) occurs 300 to 750 feet above the base of the Lepine Formation along the eastern side of Liard River (GSC locs. 69179, 69182, 69180, 69185). It was also collected from shales on Crow River. Jeletzky (op. cit) believes that this fauna characterizes a zone of its own, being younger than the generalized zone of Gastroplites but older than any part of the Neogastroplites and Posidonia? nahwisi zone. The G.? (P.?) liardense zone is tentatively considered by Jeletzky as earliest late Albian.

Sikanni Formation

The Sikanni Formation as defined by Hage (1944) included a lower sandstone member and an upper shale member. The name was restricted (Stott, 1960) to the sandstone succession in the District of Mackenzie and that practice proved most acceptable in northeastern British Columbia.

The Sikanni Formation extends from its type locality on Sikanni Chief River northward along a series of prominent escarpments lying east of Minaker, Muskwa, Dunedin, and Liard Rivers. It is the surface bedrock over large areas of Fort Nelson map-area (94J), but gradually becomes much more argillaceous and recessive eastward, and finally becomes inseparable from other beds of the Fort St. John Group. Descriptions of its occurrences in the more southerly region were given previously (Stott, 1963, 1966).

Twelve sections were examined between the type locality and Scatter River. The thickest section, consisting of more than 1,000 feet of strata, occurs on the escarpment east of Dunedin River (section 65-5) but the average thickness along Dunedin and Muskwa Rivers is in the order of 800 feet. The formation decreases in thickness to 380 feet at Sikanni Chief River. Only 433 feet of sandy beds are included in the formation at Scatter River although overlying thin, silty units are equivalent to upper sandstones occurring farther south.

In the vicinity of the junction of Scatter River and Liard River, most of the Sikanni sandstone has graded laterally into siltstone and mudstone (Fig. 3). However, a few units of platy sandstone permit the delineation of the formation. Those sandstone beds were described by Kindle in his "Lepine" section as lying 1,160 feet above the base. Henderson (1954, p. 2283) realized that the Sikanni sandstones were disappearing northward but erroneously correlated them with 190 feet of sandstone and shale lying below massive conglomerate. That sandstone and shale lie within the Dunvegan Formation as mapped herein and those beds are characteristic of the basal part of the Dunvegan throughout the region. The Sikanni sandstones opposite Scatter River lie almost 1,000 feet below those beds.

The Sikanni Formation is not readily traced northward from Scatter River although some part of it is believed to be represented by a sandstone outcrop below the Dunvegan Formation at the big bend of Liard River. It is assumed to extend northeasterly along the east flank of the Kotaneelee anticline [1].

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[1] An outcrop on Kotaneelee River southeast of Pointed Mountain was included in the Sikanni Formation by Douglas and Norris (1959). Based mainly on that exposure, the Sikanni was extended southward to La Biche River where it was shown to be cut off by a fault. It now seems probable that the outcrop is, in reality, part of the Scatter Formation and that it can be shown to be continuous with map unit 12 (lower Scatter) along the east flank of Kotaneelee anticline. The Sikanni apparently occurs in a recessive silty facies east of Pointed Mountain and is almost inseparable from upper Fort St. John shales.

The number of major sandstone units in the formation appears to fluctuate from one section to another. The main part of the formation between Prophet and Dunedin Rivers appears to comprise 7 major cycles of sandstone and shale. The upper 150 to 200 feet of the formation, commonly obscured by talus or vegetation, seems to be formed by a more continuous sandstone succession which is more argillaceous and less well bedded than the underlying sandstones.

Sandstones of the Sikanni Formation are mainly fine-grained, very finely laminated, siliceous, and weather light brownish grey. Bedding varies from flaggy to thick-bedded, and units range from less than one foot to as much as 100 feet. Shales are dark grey to black, rubbly to blocky, and contain some concretions. A 40-foot thick unit of massive, medium- to coarse-grained sandstone occurs at the top of the formation east of Dunedin River. At least 15 feet of conglomerate occurs near the top, containing pebbles averaging about one-half inch to 1 inch in diameter but some are as much as one and one-half inches.

Neogastroplites selwyni McLearn from the basal subzone of the late Albian Neogastroplites zone, has been reported (Jeletzky, 1964, p. 11) from lower beds of the Sikanni Formation on Halfway River, south of the present map area. N. ex gr. cornutus-muelleri occurs in upper sandstone at Sikanni Chief River, suggesting that the Sikanni Formation of the type region lies within the lowest two subzones of Neogastroplites. As the Sikanni Formation along the Muskwa-Dunedin escarpments includes a greater stratigraphic interval, it may contain beds both older and younger than those of the type section. The Neogastroplites and Posidonia? nahwisi fauna was obtained by Hage (1944) from the Sikanni Formation on Sikanni Chief River and by Williams (1944) from exposures along the Alaska Highway near Steamboat Mountain. Posidonia? nahwisi var. goodrichensis (McLearn) and P. ? nahwisi var. moberliensis (McLearn) were collected by Stott at Mile 353 on the Alaska Highway (GSC loc. 65921). In addition to those varieties, Posidonia? nahwisi (McLearn) f. type. were collected from talus of the Sikanni north of Steamboat Mountain (GSC loc. 65926). Posidonia? nahwisi (McLearn) s. lato?, Pteria (Oxytoma) cf. camselli McLearn and P. (O.) via-media McLearn were collected from a road cut near Beaver Creek north of Trutch (GSC loc. 52210).

Sully Formation

The Sully Formation was defined (Stott, 1960, p. 13) as "those shale beds lying below the sandstone and conglomerates of the Fort Nelson (herein designated as Dunvegan) Formation and above the sandstone and siltstone of the Sikanni Formation". The type locality is on Sully Creek in the District of Mackenzie northeast of the Scatter river locality. Beds lying in a similar stratigraphic position can be traced southward through the map-areas of this report to Sikanni Chief River where they overlie the type Sikanni sandstone. The formation, occurring as a recessive unit between two prominent ridge-forming sandstones, is commonly covered by talus or vegetation.

The lower boundary of the Sully appears to lie on successively older sandstones from west to east in Trutch and Fort Nelson map-areas. The boundary descends rapidly from opposite Toad River and Liard River northward toward Scatter River (see Fig. 3). The upper boundary appears to lie at about the same position, lying below a remarkably persistent sandstone of the Dunvegan Formation throughout most of the western region.

The Sully is well exposed on the south side of Sikanni Chief River downstream from Mistahae Creek where over 700 feet are present. Numerous outcrops occur along the canyons of Buckinghorse and Sikanni Chief Rivers east of the Alaska Highway, extending downstream to the junction with Fort Nelson River. In that region, basal beds comprise silty, rubbly, dark grey shales with some sideritic concretions. About 200 feet above the base, a sandy bed containing abundant fish scales and fragments is associated with thin seams of bentonite. Flaky, rusty-weathering shales in the middle part of the formation are overlain by siltier mudstones with sideritic concretions. Some interbedded sandstone and siltstone occur in the transition beds below the massive Dunvegan sandstones.

Although several approximate measurements were obtained along the escarpments east of Muskwa and Dunedin Rivers, much of the Sully does not outcrop there. The formation is 300 to 400 feet thick in that region. It is well exposed in gullies along the escarpment between Ruthie Creek and Scatter River, but is only accessible in a few places.

The Sully shales, forming the upper part of that section described by Kindle (1944) as Lepine, are about 1,000 feet thick. Kindle estimated that the thickness of beds between the type Scatter and conglomerates at the top of the ridge was about 2,000 feet. A sum of the composite Lepine, Sikanni, and Sully as defined by the writer indicates the total to be in the order of 4,400 feet. That thickness is only slightly in excess of the same interval in the IOE Dunedin d-75-E well (d-75-E/94-N-8) located 16 miles southeast of the outcrop section.

In the Scatter River region, the Sully is divided into three members, which are also recognized in the type section (Stott, 1960). The lower one, about 300 feet thick, comprises very silty shales to mudstones with numerous reddish brown weathering concretions. A middle succession, consists of more than 400 feet of flaky to fissile black shales with much yellowish efflorescence, and contains two prominent silty units that form distinct ledges along the cliffs. The upper member, containing more concretionary mudstone, becomes extremely silty in its upper part and grades into overlying sandstones of the Dunvegan Formation.

The Sully Formation at its type section in District of Mackenzie lies above beds containing Neogastroplites cornutus (Whiteaves) (see Stott, 1960, pp. 12-13). Similarly, on Sikanni Chief River, the Sully lies above beds tentatively dated by Jeletzky as lying within the N. cornutus subzone. The Sully Formation along the Muskwa-Dunedin escarpments occupies a smaller stratigraphic interval and probably the basal beds there are considerably younger than at the type section.

On Sikanni Chief River, the Sully Formation includes a prominent "Fish scale" marker horizon which appears to be equivalent to a similar marker used extensively in subsurface correlations (see Burk, 1962, for a recent regional study). That horizon is generally accepted (see Stelck, 1962) as approximating the boundary between Early and Late Cretaceous and the Sully therefore is considered to represent latest Albian to early Cenomanian deposition. It appears that the Sully Formation opposite Scatter River occupies much the same interval although the distinct "Fish Scale" beds were not recognized. Lithologic correlations indicate that the lower member and probably part of the middle member are equivalent to upper sandstones of the Sikanni Formation in the western region between Toad and Prophet Rivers. The Scatter section is very similar to the type section in the District of Mackenzie and although the latter is several hundred feet thicker, the stratigraphic interval appears to be approximately the same. The Sully Formation is approximately equivalent to the Cruiser Formation south of Peace River (see McLearn and Kindle, 1950; Stott, 1963; 1968).

UPPER CRETACEOUS

Dunvegan Formation

A prominent sequence of sandstone and conglomerate occurs near the base of the Upper Cretaceous succession between Peace River and the District of Mackenzie. It seems preferable at this time to include those rocks in the Dunvegan Formation, defined along Peace River (Dawson, 1881), rather than in the Fort Nelson Formation, defined on Liard River (Kindle, 1944). The name Dunvegan was extended northward from the type locality into the Sikanni Chief region by Hage (1944) and the formation was traced from the Charlie Lake map-area (Irish, 1958) into map-areas of Halfway River (Irish, 1961, 1963) and Trutch (Pelletier and Stott, 1963; this report). The succession northward into Trutch is continuous with the type locality but contains more coarse-grained sandstone and conglomerate. It is remarkably similar throughout the remainder of its extent in the present map-areas. This succession on Liard River was included by Kindle (1944) in his Fort Nelson Formation and the type locality was stated to extend along the east side of Liard River from near the mouth of Toad River almost to the mouth of Beaver River (McLearn and Kindle (1950, p. 100). As shown on Kindle's original map, the type Fort Nelson included over 1,000 feet of sandstones and shale now included in the Sikanni and Sully Formations, although Kindle's described section included only the conglomeratic beds (see Fig. 3). Kindle defined the Fort Nelson and Lepine Formations south of Lepine Creek but measured them opposite Scatter River where the stratigraphic interval assigned to each was quite different. To eliminate any further confusion and duplication of names, it is proposed to abandon the name Fort Nelson and extend Dunvegan northward to include the conglomeratic succession throughout northeastern British Columbia and southern part of District of Mackenzie.

Eleven sections and numerous outcrops were examined during the present project. Except in Toad River and Maxhamish map-areas, the upper surface lies immediately below glacial deposits and in most places, the upper beds have probably been removed by erosion. The sections that appear most complete are found east of Dunedin River (section 65-4) and McClellan Creek. The formation is 570 feet thick north of Kledo Creek and decreases to 491 feet in the most easterly section at the headwaters of Adsett and Klua Creeks.

Throughout the region, the formation comprises a basal sandstone overlain by three cycles of carbonaceous mudstone, massive conglomerate, and coarse-grained sandstone. Within those cycles, there is some variation from one locality to another in thickness and number of conglomeratic units. On Dunedin River, about 5 miles upstream from its mouth, a unit of carbonaceous mudstone and platy sandstone occurs at the top of the formation. It is not known if this unit occurs farther south, although some additional sandy beds, which may be equivalent, are present at the top of the formation along the escarpment between Toad and Scatter River.

The basal unit consists of fine-grained, siliceous, thick-bedded to massive sandstone that weathers light brown. Conglomerate was found in this unit only in the section north of Kledo Creek. In exposures opposite Scatter River, this unit lacks distinctive bedding and is overlain by one foot of coal.

The conglomeratic units contain rounded to well-rounded pebbles, dominantly of quartz, quartzite, and chert of various shades of green, blue, grey, white, black, ranging from 1/8 inch to 6 inches in diameter. The average pebble size is much reduced at the headwaters of Adsett Creek where much of the upper massive units consists of coarse-grained sandstone.

The Dunvegan Formation near Peace River is considered to be of late Cenomanian age (McLearn and Kindle, 1950; Bell, 1963; Stelck, 1962).

The Dunvegan flora was not previously reported from the more northerly part of the region. Two collections obtained from the Dunvegan during the course of the present study were identified by W.A. Bell. The first, GSC loc. 7466, was obtained southeast of the junction of Tetsa and Muskwa Rivers, at the headwater of Akue Creek:

Menispermites reniformis Dawson
Populites wickendeni Bell
Laurophyllum sp. Bell
Platanus newberryana Heer
Pseudoprotophyllum boreale (Dawson) Hollick
Pseudoaspidiophyllum latifolium Hollick

Bell commented that "the above species with the exception of Populites wickendeni have been recorded previously from the Dunvegan, the species of Pseudoprotophyllum being restricted so far as known to Cenomanian floras."
The second, GSC loc. 7467, collected on lower Dunedin River, contained:

Pseudocycas unjiga (Dawson) Bell
Ficus daphnogenoides (Heer) Berry
Ficus? lesquereuxi? Knowlton
Magnolia coalvillensis? Knowlton
Menispermites reniformis Dawson
Laurophyllum sp. Bell
Platanus williamsi? Bell
Platanus raynoldsii Newberry
Ampelophyllites sp.
Pseudoprotophyllum boreale (Dawson) Hollick

Bell stated that "the above assemblage is indicative of a Cenomanian age."

Kotaneelee Formation

The Kotaneelee Formation (Hage; 1945; see also Stott, 1960) extends southward from its type locality in the District of Mackenzie into Toad River (94N) and Maxhamish Lake (94O) map-areas. Although the area underlain by those rocks is relatively large, very few outcrops were found between Liard and Fort Nelson Rivers and northeasterly to Petitot River.

The contact between the Dunvegan and Kotaneelee was not seen. It apparently represents a major hiatus, including all of Turonian and possibly part or all of Coniacian time. It is not immediately evident whether beds of that age were not deposited or if such deposits were eroded prior to Kotaneelee deposition. To the south in the vicinity of Peace and Pine Rivers, Kaskapau deposits of that age have a thickness of over 2,000 feet (Stott, 1967). The strong development of near-shore sandstones in that succession suggests that the Turonian marine embayment may not have extended northwesterly into the region of the present project.

Exposures of the Kotaneelee Formation were examined on Capot Blanc Creek, at Joli Butte on Liard River, and on tributaries near the junction of Liard and Beaver Rivers. The formation outcrops on a butte north of the junction of Liard and Fort Nelson River where either basal silty beds or the contact with the Dunvegan are exposed. However, high water prevented any helicopter landing to examine those beds more closely.

Shales of the Kotaneelee, similar to other Cretaceous shales, are dark grey to black, weathering rusty, and contain sideritic concretions. Selenite crystals and fragments of large Inocerami occur within the shales on Capot Blanc Creek. Some highly glauconitic argillaceous sandstone, similar to sediments found in the basal

beds of the type section, was noted in talus at that locality. At Joli Butte, 45 feet of thin-bedded, fine-grained sandstone lie 125 feet below massive sandstone and conglomerate of the Wapiti Formation. The recessive 125-foot interval appears to consist of mudstone. It seems likely that those beds and the underlying sandstone are marine, and represent the uppermost beds of the Kotaneelee. A similar succession was observed on an eastern tributary of Beaver River southeast of the mouth of Crow River.

Scaphites (Clioscaphites) cf. S. (C.) montanensis Cobban was collected from talus of the Kotaneelee Formation in a small tributary of Beaver River (GSC loc. 69183). Jeletzky considers that it represents the Scaphites (Clioscaphites) montanensis zone which he dates as Santonian. Fauna collected from lower middle beds of the type Kotaneelee Formation were reported by Jeletzky (see Stott, 1960, p. 18) to represent the slightly older, combined zones of Scaphites depressus and Scaphites (Clioscaphites) vermiformis of Santonian age.

The Kotaneelee Formation is apparently equivalent to most or all of the Wapiabi Formation of the Rocky Mountain Foothills. The upper sandstone found in Toad River map-area is probably equivalent to similar beds included in the upper Kotaneelee at the type locality (see Stott, 1960, p. 18). That sandstone could possibly be equivalent to the Chungo sandstone of the Wapiabi Formation (Stott, 1963).

Wapiti Formation

The Wapiti Formation was named in Peace River region (Dawson, 1881). Use of the name was extended into District of Mackenzie by Stott (1960) for a sequence of medium-grained, sandstone and conglomerate, originally mapped by Hage (1945), and overlying the Kotaneelee shale. These beds extend southward toward Maxhamish Lake and occur as erosional remnants on several small hills between there and Fort Nelson River. A large area of Wapiti sediments occurs in the centre of Liard syncline. between Liard and La Biche River. Those beds were included by Kindle (1944) in an unnamed Upper Cretaceous succession of sandstone, conglomerate, and marine shale.

At Joli Butte, the basal beds comprise 10 feet of massive, fine- to medium-grained sandstone overlain by 23 feet of coarse-grained sandstone and conglomerate with pebbles as large as 3 inches in diameter. Elsewhere the Wapiti sediments are accessible only with time-consuming difficulty or are not exposed.

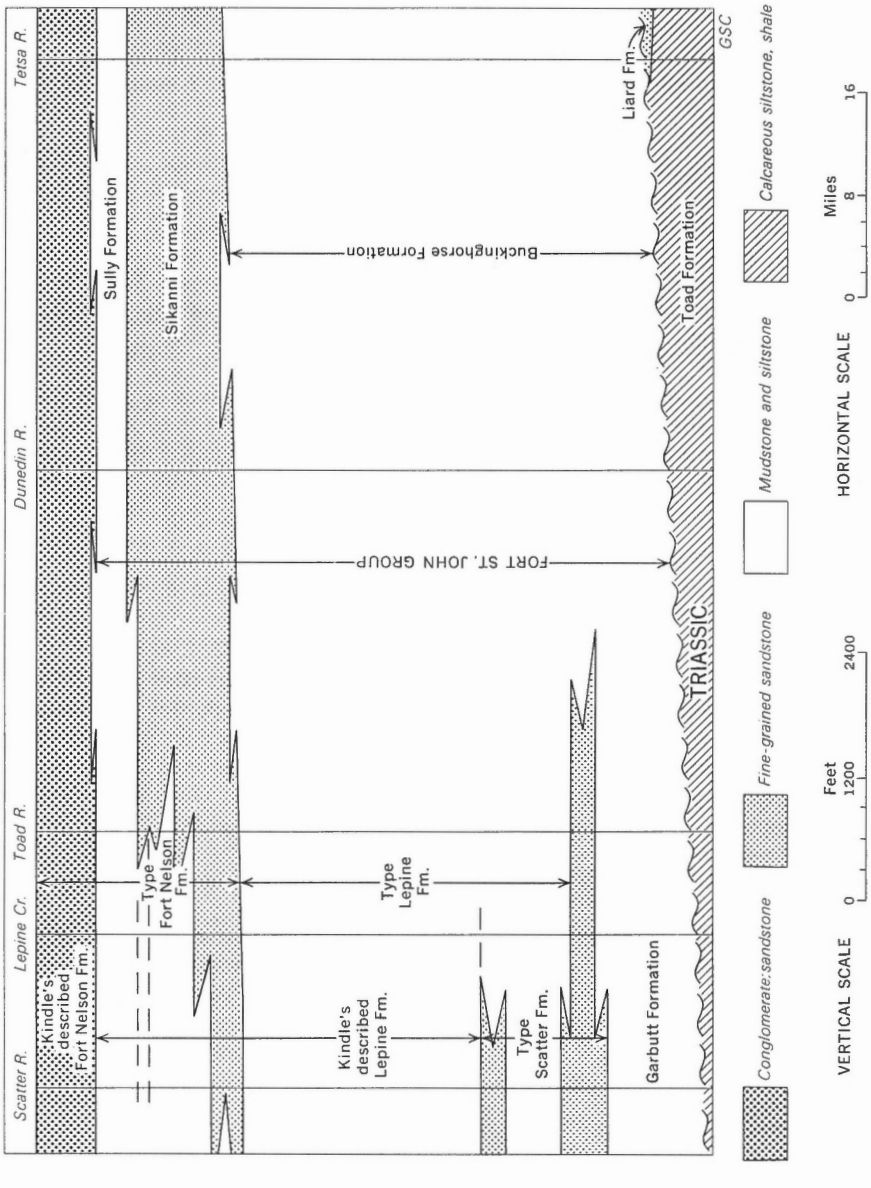

Figure 3. Schematic diagram illustrating facies and approximate thicknesses of Fort St. John Group, northeastern British Columbia.

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APPENDIX

Measured Sections

Section 65-13. Garbutt Formation; large southwesterly tributary of Scatter River, Toad River map-area, British Columbia, 59° 38' N., 124° 52' W

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	The section was measured from creek level up the shale slope to the base of the Scatter sandstones. Most of the latter are inaccessible at this locality.		
	SCATTER FORMATION		
	Sandstone, fine-grained, laminated; thin- to thick-bedded. Inaccessible		
	GARBUTT FORMATION		
14	Siltstone, argillaceous; blocky to bedded; massive appearance; some sandstone beds at top. Inaccessible, measurement approximate	50	924
13	Siltstone, argillaceous; blocky to platy; interbedded mudstone; rusty-weathering	35	874
12	Mudstone, silty; blocky; grades upward into argillaceous, platy siltstone and interbedded mudstone; reddish brown-weathering concretions	147	839
11	Mudstone, rubbly, becoming siltier and blocky near top; rusty-weathering; some reddish brown-weathering concretions. Mostly inaccessible	160	692
10	Mudstone, black; rubbly; rusty-weathering; few reddish brown-weathering concretions	55	532
9	Mudstone, black; rubbly to blocky; rusty-weathering; platy to flaggy sandstone (15%); few concretions and topped by concretionary layer	52	477

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
8	Mudstone, black; rubbly; rusty-weathering; becoming siltier at top with some platy siltstone; few rows of reddish brown-weathering concretions	40	425
7	Mudstone, black; rubbly; rusty-weathering; few concretions. Partly covered	15	385
6	Mudstone, as below; some rows of concretions. Mostly covered	33	370
5	Mudstone, to argillaceous siltstone, platy; rusty-weathering; banded appearance	12	337
4	Sandstone, silty, fine-grained, laminated, grey; platy to thin-bedded; interbedded mudstone and platy siltstone (40-50%) in 2" - 12" beds, rusty-weathering	27	325
3	Mudstone, talus covered	38	298
2	Covered. Approximately	250	260
1	Mudstone, black; platy; rusty-weathering; thin, platy siltstone and glauconitic sandstone; large reddish brown-weathering concretions. Partly covered	10	10
	Contact with underlying Triassic Toad Formation is abrupt without any trace of basal sandstone or conglomerate. Shale lies directly on calcareous siltstone and sandstone, medium to dark grey, platy to thin-bedded, with some interbedded calcareous shale.		

Section 65-8. Scatter Formation: on large creek between Lepine Creek and Scatter River, Toad River map-area, British Columbia, 59° 32' N., 124° 47' W.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	Upper part of section measured on north cliffs above creek. Top of ridge, end of exposure		
	LEPINE FORMATION		
2	Mudstone to siltstone, argillaceous; blocky to platy; some reddish brown-weathering concretions	15	50
1	Shale to mudstone, rubbly to blocky; rusty-weathering; very large reddish brown-weathering concretions	35	35
	Contact with underlying formation is gradational		
	SCATTER FORMATION		
45	Siltstone, sandy; blocky to platy; large reddish brown-weathering concretions	5	1,241
44	Mudstone, silty; blocky; reddish brown-weathering concretions; grades into overlying unit	23	1,236
43	Siltstone, argillaceous, to mudstone; blocky; rusty-weathering	7	1,213
42	Mudstone; blocky to rubbly; rusty-weathering; reddish brown-weathering concretions	14	1,206
41	Siltstone, argillaceous; row of reddish brown-weathering concretions at base	6	1,192
40	Mudstone, black; rubbly to blocky; rusty-weathering	12	1,186

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
39	Siltstone, argillaceous, to mudstone, silty; platy; rusty-weathering; reddish brown-weathering concretions	8	1,174
38	Mudstone, black; rubbly to blocky; rusty-weathering; reddish brown-weathering concretions; resistant silty unit in middle; grades into overlying beds	25	1,166
37	Siltstone, sandy, argillaceous, laminated; blocky to thin-bedded; some concretions and interbedded mudstone	29	1,141
36	Covered, recessive. Mudstone exposed in this interval elsewhere. Estimated	600	1,112
35	Sandstone, fine-grained, laminated, grey; flaggy to thin-bedded; brown-weathering; interbedded mudstone (30%)	13	512
34	Siltstone, sandy to argillaceous; blocky to bedded; interbedded sandstone	5	499
33	Covered, recessive, presumably mudstone. Approximately	45	494
32	Mudstone, black, silty; blocky; interbedded platy siltstone; rusty-weathering	12	449
31	Covered. Approximately	25	437
30	Siltstone, argillaceous; poorly bedded; blocky to massive	3	412
29	Covered	5	409
28	Sandstone, fine-grained, laminated, glauconitic, siliceous	3	404
27	Mudstone, silty; highly glauconitic; blocky to platy	8	401
26	Sandstone, fine-grained, laminated, glauconitic, siliceous; flaggy; some interbedded mudstone	3	393

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
25	Mudstone, black, silty; blocky; rusty-weathering	6	390
24	Sandstone, fine-grained, highly glauconitic, green, siliceous, laminated; platy to thin-bedded	2	384
23	Covered. Highly glauconitic mudstone at top	4	382
22	Sandstone, fine-grained, greenish grey, glauconitic, siliceous; platy to thin-bedded; grey-weathering; some interbedded mudstone	7	378
21	Covered at base. Mudstone, silty; blocky; some interbedded sandstone near top	52	371
20	Sandstone, fine-grained, grey, laminated; flaggy to thin-bedded; greenish brown-weathering	11	319
19	Sandstone, fine-grained, grey, laminated; glauconitic; thin- to thick-bedded, some cross-bedding; brown-weathering; few thin layers of mudstone; some reddish brown-weathering concretions	15	308
18	Mudstone, platy; mostly covered	4	293
17	Sandstone, fine-grained, highly glauconitic, laminated, cross-laminated, greenish grey, siliceous; flaggy to thick-bedded; greenish grey-weathering; some mottling; some thin layers of glauconitic mudstone; few reddish brown-weathering concretions	9	289
16	Mudstone, sandy, greenish grey, highly glauconitic; green- to rusty-weathering	5	280
15	Covered. Approximately	25	275
14	Sandstone, fine-grained, laminated, grey, siliceous; flaggy to thin-bedded, wavy bedded; brown-weathering	19	250

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
13	Sandstone, fine-grained, laminated, glauconitic, grey; flaggy to thin-bedded; interbedded silty, flaky shale	14	231
12	Siltstone, sandy, to sandstone, very fine-grained, argillaceous; laminated; blocky to poorly bedded	4	217
11	Sandstone, fine-grained, laminated, glauconitic, greenish grey, flaggy to thin-bedded; some reddish brown-weathering concretions	5	213
10	Mudstone, black, very silty; blocky; grading into argillaceous siltstone; rusty-weathering; some concretions	11	208
9	Sandstone, fine-grained, laminated, greenish grey; some mottling at top; thick-bedded	17	197
8	Sandstone, fine-grained, laminated, greenish grey; flaggy to thick-bedded; brown-weathering; some crossbedding	21	180
7	Partly covered. Mainly sandstone as below	14	159
6	Sandstone, fine-grained, homogeneous, greenish grey, glauconitic, siliceous; thick-bedded; brown-weathering; bedding is less prominent at top; slight crossbedding; mottled; worm burrows; reddish brown-weathering concretions; large Spirophyton-like structures	27	145
5	Sandstone, fine-grained, laminated, cross-laminated, glauconitic, greenish grey, siliceous; in part, argillaceous; flaggy to thick-bedded but bedding is not prominent; reddish brown-weathering concretionary masses	20	118
4	Sandstone, fine-grained, laminated, cross-laminated, glauconitic, greenish grey; flaggy to thin-bedded; brown to brownish grey-weathering; some thin interbedded silty mudstone; some concretionary masses	15	98

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Sandstone, fine-grained, laminated, grey; beds 2" - 8", slightly irregular; few thin layers of mudstone	24	83
2	Sandstone, fine-grained, laminated, some cross-laminated, grey, glauconitic; beds 2" - 6"; grey- to brownish grey-weathering; interbedded argillaceous siltstone; some concretions	35	59
1	Sandstone, fine-grained, laminated, slightly argillaceous, grey; flaggy to platy; dark grey-weathering; interbedded argillaceous siltstone and mudstone (25%); sandstone increases toward top; few reddish brown-weathering concretions	24	24
	Contact with underlying Garbutt Formation is transitional with only a downward decrease in number and thickness of sandstone beds until succession becomes entirely mudstone.		

GARBUTT FORMATION

Mudstone and interbedded siltstone

Section 65-5. Sikanni Formation; escarpment east of Dunedin River, Tuchodi Lakes map-area, British Columbia, 58°52' N., 124° 12' W.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	SIKANNI FORMATION		
	Top of ridge, end of exposure		
68	Sandstone, medium-grained, grey, siliceous; massive, some crossbedding; grades laterally and upward into coarse-grained sandstone and conglomerate, massive but very lenticular; at least 15 feet of conglomerate occurs near the top, well-sorted; pebbles 1/8" - 1½". Approximately	40	1,019
67	Sandstone, fine-grained, laminated, cross-laminated, grey; flaggy, crossbedded; grey-weathering	29	979
66	Covered	46	950
65	Sandstone, fine-grained, laminated, grey, siliceous; flaggy to thick-bedded, some crossbedding; grey- to brown-weathering	31	904
64	Covered	17	873
63	Sandstone, fine-grained, laminated, grey, siliceous; flaggy to thick-bedded, some crossbedding; grey- to brown-weathering	37	856
62	Covered	73	819
61	Sandstone, fine-grained, laminated, cross-laminated, grey, siliceous; thick-bedded to massive; brown-weathering	46	746
60	Sandstone, fine-grained, laminated, grey, siliceous; platy to flaggy; some thin layers of shale and siltstone	24	700
59	Covered	33	676

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
58	Sandstone, fine-grained, laminated, grey, siliceous; thick-bedded to massive; brownish grey-weathering	9	643
57	Covered	9	634
56	Sandstone, fine-grained, laminated, grey, siliceous; thick-bedded to massive; grey- to brown-weathering; some concretionary masses	64	625
55	Mudstone and sandstone (50%); becoming sandier at top and grading into overlying unit. Partly covered	25	561
54	Mudstone, very silty; blocky to platy; numerous thin, platy beds of fine-grained, laminated, sandstone and siltstone, 1" - 2" (25%), increasing toward top and grading into overlying unit; reddish brown-weathering concretions	33	536
53	Mudstone, black, silty; blocky; becoming very silty at top with small reddish brown-weathering concretions; 6" fine-grained, cross-laminated, grey sandstone at top. Partly covered	7	503
52	Sandstone, fine-grained, silty; poorly bedded; rusty-brown-weathering; some concretions	2	496
51	Mudstone, very silty, black; blocky	2	494
50	Sandstone, fine-grained, laminated, grey, siliceous; thick-bedded; rusty- to brown-weathering	3	492
49	Mudstone, very silty, black; blocky	3	489
48	Sandstone and interbedded mudstone	2	486
47	Sandstone, fine-grained, laminated, cross-laminated, grey siliceous; flaggy to thin-bedded; brown-weathering	2	484
46	Mudstone, silty, black; blocky; rusty-weathering; few thin beds of argillaceous sandstone; becoming		

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	very silty at top and grading into overlying unit; some concretions	16	482
45	Sandstone, fine-grained, laminated, grey, siliceous; thin- to thick-bedded; rusty-weathering; some interbedded mudstone at base	5	466
44	Mudstone, black; blocky; rusty-weathering; grades into overlying unit; numerous small concretions at base	18	461
43	Mudstone, coaly, black	3	443
42	Sandstone, fine-grained, laminated, siliceous; thin- to thick-bedded; brown-weathering	3	440
41	Mudstone, blocky; some concretions	2	437
40	Sandstone, fine-grained, laminated, siliceous; thin- to thick-bedded; brown-weathering; few small concretions	5	435
39	Mudstone, silty, black, blocky; grading upward into interbedded sandstone and mudstone	5	430
38	Sandstone, fine-grained, laminated, grey, siliceous; thick-bedded; rusty-weathering	2.5	425
37	Mostly covered. Mudstone, silty; platy at top	10.5	422.5
36	Sandstone, fine-grained, grey; poorly bedded; rusty-weathering; traces of wood fragments and logs	2	412
35	Mostly covered. Mudstone, black, flaky	9	410
34	Siltstone, sandy; blocky to bedded; rusty- to grey-weathering	2	401
33	Sandstone, fine-grained, laminated, grey, cross-laminated, siliceous; thin- to thick-bedded; brown- to grey-weathering; ripple-marks	10	399

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
32	Shale, coaly, black: platy	0.5	389
31	Mudstone, blocky: poorly exposed	6.5	388.5
30	Sandstone, fine-grained, grey, laminated: cross-laminated, siliceous: flaggy to thick-bedded: brown- to rusty-weathering: some large ripples, producing wavy bedding: worm trails	10	382
29	Mudstone, black; rubbly	2	372
28	Sandstone, argillaceous and silty; poorly bedded, rust to grey-weathering	3	370
27	Mudstone. Mostly covered	4	367
26	Sandstone, argillaceous, cross-laminated: poorly to irregularly bedded, thin-bedded to massive; rust- to grey-weathering	7	363
25	Covered	7	356
24	Sandstone, fine-grained, laminated, grey, siliceous; flaggy, to thick-bedded at top: brown-weathering: strongly cross-laminated; some mudstone and siltstone at base	10	349
23	Sandstone, fine-grained, laminated, cross-laminated, grey, siliceous; flaggy at base with some platy siltstone, thick-bedded at top; brown-weathering	19	339
22	Sandstone, fine-grained, laminated, some cross-lamination, grey siliceous; thick-bedded; greyish brown- to brown-weathering; few reddish brown-weathering concretionary masses	13	320
21	Covered	9	307
20	Sandstone, fine-grained, laminated, grey, siliceous; thick-bedded; light brown-weathering	6	298

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
19	Sandstone, fine-grained, laminated, cross-laminated, grey, siliceous; thin-bedded; rusty-weathering; interbedded mudstone and siltstone (40%), platy; few concretions	16	292
18	Covered, recessive	14	276
17	Sandstone, fine-grained, laminated to mottled, grey, siliceous; flaggy to thin-bedded; grey- to brown-weathering; some shaly to silty intervals	16	262
16	Mudstone, black; rubbly to blocky; rusty-weathering; becoming very silty at top and grading into overlying unit; reddish brown-weathering concretions	24	246
15	Mostly covered. Rubbly mudstone at base	19	222
14	Sandstone, fine-grained, laminated, grey, siliceous; flaggy, becoming thicker-bedded at top; some crossbedding; few concretions	24	203
13	Sandstone, fine-grained, finely and uniformly laminated, some cross-lamination, grey, siliceous; thick-bedded, grey- to light brown-weathering; minor channel-fill structures; concretionary layer at top	29	179
12	Sandstone, fine-grained, laminated, grey, siliceous; some cross-laminations; flaggy to thick-bedded; grey- to light brown-weathering; few thin shaly intervals	12	150
11	Covered	8	138
10	Mudstone, black, silty; blocky to platy; rusty-weathering; interbedded fine-grained, argillaceous sandstone, platy to flaggy	10	130
9	Partly covered. Mudstone, black; rusty-weathering; few small reddish brown-weathering concretions	21	120

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
8	Sandstone, fine-grained, finely and uniformly laminated, grey, siliceous; thin- to thick-bedded; rusty grey-weathering; few thin platy intervals; some large concretionary masses	10	99
7	Shale, silty, dark grey; platy; grading upward into overlying unit	2.5	89
6	Sandstone, fine-grained, laminated, grey, siliceous; thin-bedded to massive; brownish grey-weathering; few thin shaly layers with small concretions	10.5	86.5
5	Shale, silty, black; platy; some siltstone and sandstone, platy to flaggy	3	76
4	Sandstone, fine-grained, finely and uniformly laminated, grey, siliceous; thick-bedded, grey-weathering; few shaly beds	20	73
3	Sandstone, fine-grained, finely and uniformly laminated to homogeneous, grey, siliceous; thick-bedded to massive; grey-weathering; some cross-lamination; few flaggy intervals; some small channel-fill structures; few concretions	23	53
2	Sandstone, fine-grained, finely and uniformly laminated, grey, siliceous; thin- to thick-bedded; grey-weathering; some cross-lamination; some orange-weathering concretions	17	30
1	Sandstone, fine-grained, laminated, well-sorted, grey, siliceous; flaggy to thin-bedded; some platy, silty mudstone and siltstone, increasing toward top; all grey- to brown-weathering	13	13
	BUCKINGHORSE FORMATION		
	End of exposures. Slopes below covered by shale and sandstone talus.		

Section 65-4. Dunvegan Formation; escarpment east of Dunedin River, Tuchodi Lakes map-area, British Columbia, 58° 52' N., 124° 11' W.

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
	DUNVEGAN FORMATION		
	Top of ridge, end of exposures		
25	Conglomerate, grey; massive; matrix of coarse-grained sandstone; pebbles 1/8" - 2", some boulders up to 4"; pebbles of quartz, chert, quartzite; blue, white, grey, black; partly inaccessible. Approximately	80	548
24	Conglomerate, grey; massive; much coarse-grained sandstone matrix; pebbles $\frac{1}{4}$" to $\frac{1}{2}$", as above	35	468
23	Covered. Farther along slope, the lower part of this interval appears to be mudstone, siltstone, and few seams of coal or coaly shale. The upper half may include conglomerate	80	433
22	Conglomerate, grey; massive; much coarse-grained sandstone matrix; pebbles, $\frac{1}{4}$" - 1", average $\frac{1}{4}$" - $\frac{1}{2}$". Top of this unit may be somewhat higher as large blocks cover slopes	25	353
21	Sandstone, coarse-grained, grey, conglomeratic; massive; pebbles $\frac{1}{4}$" - $\frac{1}{2}$"	20	328
20	Conglomerate, grey; massive; much coarse-grained sandstone matrix; pebbles, $\frac{1}{4}$" - 4", average $\frac{1}{2}$" - 1", rounded, quartz, quartzite, chert, argillite, red, green, blue, grey, white, black	30	308
19	Conglomerate, grey; massive; much coarse-grained sandstone; pebbles as above	20	278
18	Sandstone, coarse-grained, conglomeratic; brownish grey; massive, brownish grey-weathering; crossbedded and cross-laminated; streaks and lenses of pebbles	10	258

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
17	Conglomerate, grey; massive; much coarse-grained sandstone matrix; pebbles as above, maximum of 2"	11	248
16	Covered	12	237
15	Sandstone, silty, argillaceous, greenish grey, soft	2	225
14	Mudstone, very silty, olive-green; blocky	7	223
13	Mudstone, dark grey to black; rubbly to blocky	6	216
12	Covered	6	210
11	Conglomerate, dark grey to brown; extremely massive; dark grey-weathering; pebbles $\frac{1}{4}$" - 2", averaging $\frac{1}{2}$" - 1", rounded, quartz, quartzite, chert, argillite; red, green, blue, grey, white, black; some beds consist entirely of well-sorted pebbles, others have matrix of coarse-grained sandstone	52	204
10	Covered, recessive. Some flaky shale in talus	30	152
9	Siltstone, sandy, argillaceous, laminated, dark olive-grey; poorly bedded	4	122
8	Covered	5	118
7	Mudstone, very silty; some beds of argillaceous siltstone, olive-brown	9	113
6	Covered, recessive. Talus of rubbly mudstone	10	104
5	Mudstone, silty, dark grey to black; blocky; dark grey-weathering; few thin, soft, concretionary layers; some argillaceous siltstone at top	15	94
4	Siltstone, argillaceous; blocky to flaggy; some interbedded silty mudstone; dark grey-weathering	7	79

Unit	Lithology	Thickness (feet)	Height Above Base (feet)
3	Sandstone, fine-grained, laminated, grey, siliceous; some cross-lamination; massive to thick-bedded; brown-weathering; few intervals of platy sandstone; some concretionary masses	34	72
2	Covered, recessive. Presumably mudstone	21	38
1	Sandstone, fine-grained, brownish grey, laminated, calcareous, cherty; massive, becoming thin-bedded at top; some crossbedding; light yellow-brown-weathering; few small concretions	17	17
	FORT ST. JOHN GROUP		
	SULLY FORMATION		
1	Mudstone, silty, brownish grey; blocky; very sandy at top; some reddish brown-weathering concretions	4	4
	End of exposure. Slopes below are covered with rubbly, rusty-weathering shale and platy siltstone.		