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CAMBRIAN SECTIONS IN THE EASTERNMOST SOUTHERN ROCKY MOUNTAINS AND THE ADJACENT SUBSURFACE, ALBERTA

(Report and 7 figures)

J. D. Aitken

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[1] Described stratigraphic sections are identified by permanent field numbers used in cataloguing specimens, fossil collections, etc.

ABSTRACT

The Cambrian of the easternmost Rocky Mountains and adjacent Plains comprises five depositional cycles, each commencing with fine clastic rocks and ending with carbonate rocks. With one exception, the carbonate facies belt for each successive cycle shifted progressively northeastward, following the Cambrian marine transgression. The recurrence of a limited number of lithologic associations, or lithofacies, permits graphic representation of the stratigraphy in terms of these lithofacies.

Lithologic analogues of the Lower Cambrian Gog Group of the Rocky Mountains, encountered in the subsurface, are younger than the Gog, and are assigned to the Basal sandstone unit. The Mount Whyte Formation is recognized only where the Cathedral Formation can be delineated; beyond the facies edge of the Cathedral carbonate rocks, the Lower fine clastic unit, lithologically similar to the Mount Whyte and Stephen Formations, is equivalent to the sequence Mount Whyte-Cathedral-Stephen. Carbonate rocks of the Eldon Formation extend northeast beyond the limit of the Cathedral, but eventually pass into the Lower fine clastic unit. The Pika Formation, youngest of the Middle Cambrian formations, is remarkable for its uniform and widespread development; carbonate rocks of the Pika extend beyond the limits of the Eldon.

The Arctomys and Waterfowl Formations are clearly recognizable in Foothills wells, but no lithologic equivalents are known in the Plains subsurface, and time-equivalents are thought to be missing. Lithologic and at least partial time-equivalents of the Sullivan Formation in the Plains subsurface are assigned to the Upper fine clastic unit. The Sullivan and the Upper fine clastic unit are overlain by mainly carbonate rocks of the upper division of the Lynx Group. Except in the east, where thin Lower Ordovician deposits may be present, the upper Lynx is overlain by basal Devonian rocks.

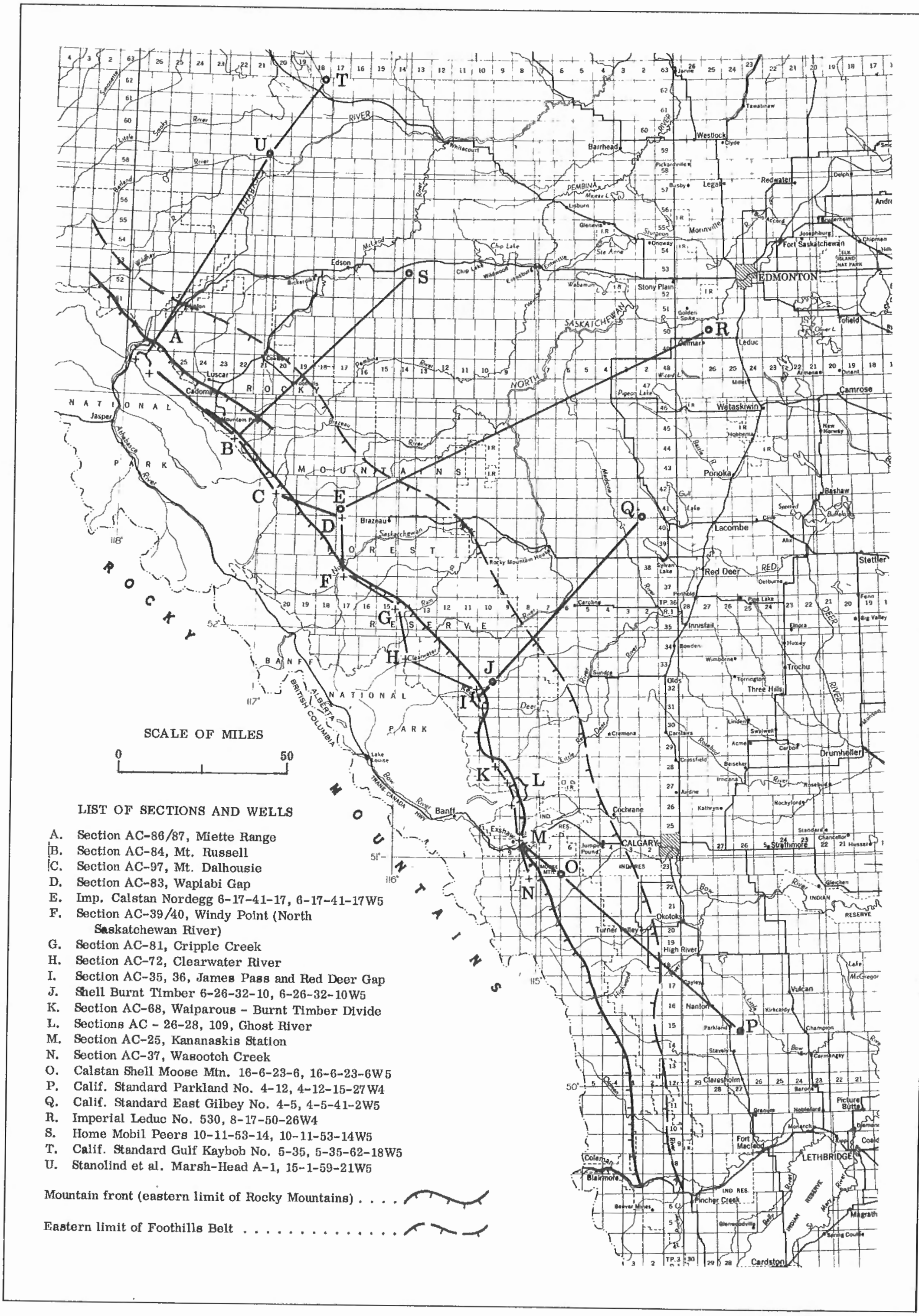

Figure 1. Index map

CAMBRIAN SECTIONS IN THE EASTERNMOST SOUTHERN ROCKY MOUNTAINS AND THE ADJACENT SUBSURFACE, ALBERTA

INTRODUCTION

The Cambrian System in Alberta has received little study, despite its importance in the geology of the province, and the pioneering work of Walcott and others in the Rocky Mountains has not been followed by regional studies. The Cambrian in the subsurface of the Foothills and Plains (Fig. 1) has been penetrated by a mere handful of deep wells, and was practically unknown fifteen years ago. The Cambrian nomenclature of the Rocky Mountains has been extended in part to the subsurface of the Plains, but this has been done almost entirely by palaeontological correlation with published Cambrian sections of the mountains. Misconceptions have arisen because of the fragmentary and largely preliminary nature of existing literature concerned with the Cambrian of the Rocky Mountains. In making the correlations presented here, the writer has enjoyed the advantage of having been engaged for several years in a regional study of the Cambrian in the southern Rocky Mountains.

This report does not attempt to present a regional subsurface study of the Cambrian. It aims to serve, rather, as a foundation upon which such a study may be built. Its principal objectives are:

(a) to illustrate correlations and relationships between Cambrian formations encountered in the subsurface and those recognized in surface exposures;

(b) to extend the established Cambrian nomenclature of the Mountains to the subsurface, where possible and advisable;

(c) to illustrate the facies relationships between the Cambrian sections of the eastern Front Ranges and the Foothills wells, which are dominated by carbonate rocks, and Cambrian sections beneath the Plains, which are dominated by clastic rocks.

To achieve these ends, the broad pattern of the Cambrian stratigraphy of southern Alberta will be sketched, with emphasis on the cyclic character of the deposits; the characteristics of the Cambrian rocks of the region will be described in detail; and finally, each of the formations dealt with in this report will be described, and the regional relationships among formations will be illustrated by a series of correlation sections using a simplified system for the graphic representation of lithofacies.

The lithostratigraphic units recognized in this report are gross units; finer subdivisions of wide extent can probably be established, but this will require study of wells more closely spaced than those upon which the present report is based.

Previous Work

The first mention in any detail of Cambrian rocks in the eastern Front Ranges was by Walcott (1921, 1923, 1928). Beach (1943) provided careful descriptions of the Cambrian rocks exposed on the eastern slopes of the Fairholme Range, and penetrated by wells in the Moose Mountain map-area. McGehee (1949, 1954) drew attention to the widespread presence of a thick Cambrian section beneath the Plains. Clark (1949, 1954) described and mapped Cambrian rocks in the Front Ranges near Bow River. Following Walcott, he assigned these to the Ghost River Formation, and an underlying formation, mainly limestone, tentatively correlated with the Cathedral Formation. Webb (1951, 1954) summarized the lithology of the Cambrian of the Plains, and published the first map to show Cambrian isopachs and the eastern eroded edge of the Cambrian in the Plains. North (1953) and North and Henderson (1954) summarized the Cambrian stratigraphy of southern Alberta, including what little data were then available for the subsurface. DeWit (1956a, b) published descriptions of Upper Cambrian sections in the Front Ranges, in connection with his study of the Ghost River Formation. The drilling of the California Standard Parkland No. 4-12 well in 1954-55, and the fortunate choice of cored intervals, provided data that permitted a great advance in subsurface Cambrian stratigraphy. With this new material, Raasch and Campau (1957) were able to establish faunal and lithologic correlations with the Middle Cambrian of the mountains. Gussow (1957), lacking the faunal evidence, published a very different correlation of the Parkland well at nearly the same time. DeMille (1958) published a subsurface cross-section and on the basis of faunal evidence provided by Crickmay indicated a Middle Cambrian-Upper Cambrian boundary. Van Hees (1959, 1964) taking as his principal datum points the published correlations of the Parkland No. 4-12 and Windfall No. 12-36 wells, presented correlation sections, and isopach and structure contour maps for the Middle Cambrian, that illustrate the erosional edge of the Upper Cambrian. Van Hees (1959) also summarized the faunal control available at that time, to which little has been added since. Mountjoy (1962) correlated the Cambrian section of the Miette and Bosche Ranges with the Cambrian sequence of the Main Ranges. He also demonstrated the Cambrian age of thick, unfossiliferous carbonate rocks underlying the Devonian Fairholme Group in the Front Ranges near Athabasca River. Fitzgerald (1962a, b) was the first to point out that the typical Main Ranges Middle Cambrian sequence, Cathedral-Stephen-Eldon-Pika, was present in the Ghost River area at the Mountain Front. He provided full descriptions of these formations and of the overlying Ghost River Formation, and indicated correlations with the Parkland well. Suska (1963) studied in considerable detail the subsurface Cambrian rocks of townships 60 to 90, between the 4th and 5th meridians, effected an eightfold subdivision of the Cambrian sequence, and provided isopach, lithofacies, and structure contour maps. Aitken (1963, 1965) demonstrated that the type "Ghost River Formation" was a Cambrian formation embracing the upper half of the Pika Formation, the Arctomys Formation (restricted), and the Lynx Formation (now Lynx Group). Aitken and Greggs (in press) present a revision of the Upper Cambrian stratigraphy of the southern Rocky Mountains of Alberta, the basis for the Upper Cambrian nomenclature employed in this report.

Field Work

Field work pertinent to this report was carried out during parts of the summers of 1961, 1962, and 1963, as part of a broader project dealing with the Cambrian rocks of the southern Rocky Mountains of Alberta. The field work of the broader project has provided a network of detailed stratigraphic sections tied to the type sections of the formations dealt with here, thus permitting correlations to be made with confidence throughout a quadrilateral Exshaw-Mount Assiniboine-Jasper-Entrance. This work has been summarized insofar as the Upper Cambrian is concerned, by Aitken and Greggs (in press).

Careful measurements and descriptions of selected, accessible, well-exposed and structurally simple stratigraphic sections were made. Lithologic samples were collected systematically from more than half of these sections and subsequently examined in the laboratory. At all localities, the Cambrian formations were mapped on air photographs to confirm their practicality as mappable units.

Subsurface studies were carried out from time to time in 1962, 1963, and 1964. Nineteen wells in all were studied, by examination of ditch samples and geophysical logs, and of such cores as are stored in Calgary. A list of the wells studied is included in the Appendix.

Acknowledgments

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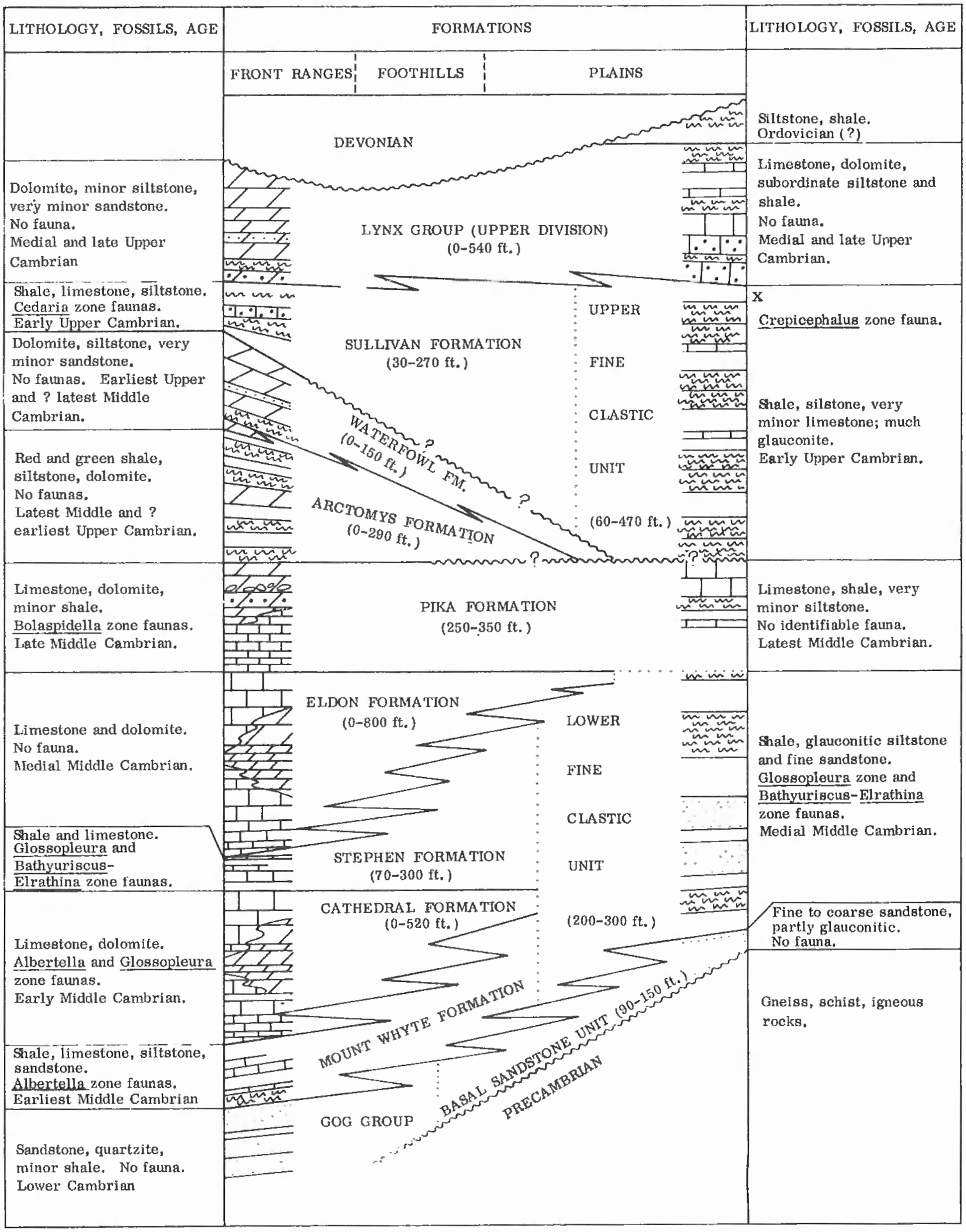

TABLE OF FORMATIONS

Cyclic Development of Cambrian Facies Belts

The general history of the Cambrian period in southern Alberta is that of a great marine transgression in which the shoreline migrated from a position in the Main Ranges in Early Cambrian times to a position in central Saskatchewan at the end of the Middle Cambrian, and possibly even farther to the northeast in Late Cambrian times. The rocks laid down in Alberta during most of this time, like coeval rocks in much of the western United States, display a regional pattern of an inner or shoreward detrital belt, a middle carbonate belt, and an outer detrital belt (Palmer, 1960; Robison, 1960). Superimposed on this record of general transgression is a pronouncedly cyclic pattern. The cycles reflect a sudden southwestward (basinward) shift of the outer edge of the inner detrital belt, followed by renewal of its gradual retreat northeastward. They are manifested in the Rocky Mountains and western Plains by the sudden interruption of carbonate deposition (middle carbonate belt) by fine clastic rocks, followed by a period of clastic deposition gradually giving way once more to carbonate deposition. A more detailed description of these cycles, as manifested in the Upper Cambrian, is given by Aitken and Greggs (in press). The relationships are remarkably similar to those illustrated for the Lower and Middle Cambrian of the Grand Canyon region by McKee (1945).

In the Main Ranges, where the cyclic character of Cambrian deposits is most strongly expressed, there are three Middle Cambrian cycles (Mount Whyte-Cathedral, Stephen-Eldon, and Pika), and three Upper Cambrian cycles (Arctomys-Waterfowl, Sullivan-Lyell, and Bison Creek-Mistaya). In much of the Front Ranges, the Bison Creek Formation, and hence the Bison Creek-Mistaya cycle, is unrecognizable. Farther to the northeast, in the subsurface of the Plains, one complete cycle, the Arctomys-Waterfowl, appears to be missing, and the Middle Cambrian cycles are progressively obscured from the base upward as carbonate formations change facies to clastic rocks of the inner detrital belt.

Lithology

The entire Cambrian succession of the study-area is composed of a limited number of rock-types, and because nearly all are closely associated with a small number of other rock-types, they are repeated many times in a single section. Many of these rock-type associations or lithofacies are limited to the Cambrian and Lower Ordovician of the region, and most are as prominent in the Middle as in the Upper Cambrian. Brevity is therefore served by describing each of the recurrent lithofacies in detail only once; in the subsequent discussion of formations, any lithofacies mentioned may be assumed to fall within the range of characteristics described here.

Carbonate Rocks

Specimens representative of all of the carbonate lithologies have been examined in detail, with the aid of acetate peels and thin sections. This has proved that with few exceptions, the Cambrian carbonates of the region can be accurately assigned, on the basis of binocular-microscope examination of etched hand-specimens or well cuttings, to one of the lithofacies erected here. The classification scheme employed is based on that of Folk (1962), with modifications and additions to suit the peculiarities of the Cambrian carbonate rocks.

Micrite and mottled micrite[1]. Rocks described as micrite probably include some pelmicrite and intramicrite, and also some recrystallized micrite (microspar), all of which might pass undetected by the methods employed. These rocks occur in association with micrites in the outcrop sections, and have in some instances been detected where acetate peels or thin sections have been made from supposed micrites. Nearly all of the micrites examined in detail contain one to ten per cent dolomite rhombs, typically about fifty microns in diameter, more or less evenly scattered throughout the rock. These dolomite crystals impose a falsely crystalline appearance to many micrite specimens.

The dolomite is associated with micrite as irregular partings between thin and very thin flaggy beds and as random mottlings composing five to fifty per cent of thick-bedded and non-bedded micrites, and is entirely distinct from the scattered dolomite rhombs referred to above. The dolomite of the mottlings is brown to brownish white in colour, and is characteristically of about 100-micron grain. That of the partings is of 50- to 100-micron grain and is generally slightly argillaceous. Dolomite-mottled micrite can be recognized, or at least interpreted, from well cuttings. Upon complete dolomitization, the pattern of the mottlings and irregular partings is preserved as dolomite of darker colour and finer grain in the light-coloured, generally fine- and medium-crystalline[2] dolomite derived from micrite.

Micrite makes up a large proportion of the principal carbonate formations. It is not known to occur interbedded with shale but does occur, interbedded with calcisiltite, in thick intervals interrupting shaly sequences.

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[1] Folk's (1962) term, micrite, is here extended to rocks composed of particles with modes (largest size-classes) as coarse as 12 microns. Such rocks are generally brown in colour and of "aphanitic" appearance in cuttings and specimens, and are nearly always distinguishable from calcisiltites (modes greater than 12 microns), which are very pale brown, light grey, or white in colour, and of "microcrystalline" appearance.

[2] See footnote, p. 10.

Calcisiltite. Calcisiltite is easily recognized by its light colour and microcrystalline appearance. It commonly contains a scattering of fossil remains, generally trilobite fragments, and in some instances, where the fossil content exceeds ten per cent, is best called biocalcisiltite. Many calcisiltite beds are silty to very silty, and intergrade with very calcareous siltstones. The calcisiltites are almost invariably thin- or very thin-bedded. Irregular partings of very fine crystalline dolomite, with protuberances into the calcisiltite beds, are very common. Dolomite-mottled calcisiltite beds, analogous to mottled micrites, are less common.

Unlike micrites, calcisiltites characteristically occur in shaly sequences, are commonly interbedded with shales and here and there contain interbeds of calcisiltite-pebble conglomerate.

Dolomites derived from calcisiltite are not positively recognizable as such; some evidence suggests that the derived dolomite is light-coloured and of a grain similar to that of the original calcisiltite.

Pelsparite and intrasparite. The pelsparites and intrasparites are closely related rock-types that intergrade with one another. The practice, recommended by Folk, of drawing an arbitrary boundary between pellets and intraclasts at a diameter of 0.2 millimetre has not been followed, because in many specimens this boundary would divide into two artificial populations of different names what is obviously a single population of particles. Instead, the term pellet has been used where the particles display a community of size and form; where size, form, and most diagnostically, lithology of the particles are highly variable, the term intraclast has been used.

With the exception of some pelsparites composed of extremely small pellets, and some pelsparites and intrasparites in which merging of the allochems has occurred, these rocks are easily identified under the binocular microscope, and in most instances can be identified at the outcrop.

Pelsparites and intrasparites characteristically occur as isolated, thin to thick, massive, non-mottled beds interrupting sequences of micrites; locally they may be the dominant beds in units tens of feet thick. They are also found locally in association with fine biocalcarenites and calcisiltites.

Dolomites derived from intrasparites and pelsparites are readily recognized as such, because the dolomite replacing the allochems inherits their brown pigment, whereas the dolomite replacing the interstitial spar is light-coloured.

A distinct group of pelsparites and intrasparites, found only in the Cathedral and Eldon Formations, and not recognized to date in the subsurface, are designated as leuco-pelsparite and leuco-intrasparite. These rocks are distinct in that the pellets and intraclasts are not the usual brown colour, but are a light cream colour instead. Furthermore, the allochems are closely packed and largely merged, and many specimens appear to be light-coloured aphanitic limestone with abundant blebs of fine spar, inviting the field designation "birdseye limestone". Rocks of this lithofacies do not display dolomite mottling, but commonly contain scattered blebs of medium- and coarse-crystalline, very light coloured dolomite. Unlike the ordinary pelsparites and intrasparites, these light-coloured rocks characteristically form unbroken, non-bedded, massive units many tens of feet thick.

Folk (1962) strongly emphasized the importance of intraclasts as a key to lithogenesis, and identifies all rocks with 25 per cent or more of intraclasts as intraclast-rocks. This procedure serves very well for the strata considered here, insofar as micrite-dominated sequences are concerned. On the other hand, pebbles (intraclasts) occur so widely in the Cambrian calcarenites and oolites that to allow their presence to dominate the rock-name would obscure important differences between genetically distinct rocks. Accordingly, in the coarsely particulate limestones, those containing from ten to fifty per cent of pebbles are described as pebbly calcarenite, etc., whereas those with over fifty per cent pebbles are called conglomerates.

Calcarenite and oolite. The Cambrian calcarenites and oolites of the region are closely associated spatially and display a complete intergradation; most oolitic limestones contain some bioclasts, and most biocalcarenites contain some oolites or oolitically coated grains (superficial oolites). Both occur typically as thin to thick massive beds, punctuating sequences of shales and siltstones, and less commonly as isolated beds in certain formations dominated by dense carbonate rocks. Oolite beds are common at the bases of carbonate formations, immediately above the gradational, interbedded contact with underlying shaly formations.

The dominant calcarenites are biocalcarenites, composed mainly of sorted, broken, and rounded pelmatozoan and trilobite fragments. Thick, fibrous oolitic coatings are widely developed on trilobite fragments, whose fibrous structure appears to have favoured initiation of the oolith growth-process. These oolitic coatings, acquired prior to lodgement of the grain, are distinct from drusy-fibrous outgrowths of sparite crystals that grew in a comb-like fashion into an initial void. Oolitic coatings are much less commonly observed on pelmatozoan fragments.

Oolites and biocalcarenites generally have either sparite cement or calcisiltite matrix filling original voids. The two types of void-filling material are closely associated, and in places occur in the same bed; in general they have not been distinguished in descriptions presented here, although with practice, the clear, glassy sparite can be distinguished from the white or grey, relatively opaque calcisiltite. Biocalcarenites in shaly sequences are commonly glauconitic, those in carbonate sequences rarely so. The glauconite occurs mainly as polished pellets, but locally replaces fossil material. In a given formation, glauconite is much more common and abundant in the northeastern part of the area than in the southwestern part.

Biocalcarenite and oolite beds generally contain pebbles, and commonly contain a layer of limestone-pebble conglomerate at their base or top. The range of pebble lithologies is limited; from most to least abundant these are: calcisiltite, calcareous or dolomitic siltstone, biocalcarenite, oolite. There is a scattering of quartz sand and silt grains in many oolite and calcarenite beds.

A type of "calcarenite" distinct from biocalcarenite is composed of coarse sand- and granule-sized clasts of dense and commonly argillaceous limestones and dolomites. These rocks are generally sandy or silty, and occur as discrete medium and thin beds within sequences of dense, partly argillaceous carbonates. The term lithocalcarenite is avoided, because upon dolomitization it is generally not possible to know whether the clasts were limestone or dolomite. The term microconglomerate is preferred, thereby emphasizing the relationship of these rocks to the carbonate-pebble conglomerates.

The colour-contrast between oolites and bioclasts and their matrices is commonly preserved upon dolomitization to very fine- to medium-crystalline dolomite, the origin of the dolomite being thus readily ascertained. In certain instances, there is little evidence in thin sections viewed by ordinary light that the rock is dolomite rather than the original biocalcarenite. Dolomitized microconglomerates are recognized more by the textural difference between replaced clasts and replaced matrix, than by colour differences.

Limestone conglomerate. Limestone conglomerates are striking, though volumetrically unimportant constituents of the Cambrian section. Flat-pebble conglomerates are the most common and are conspicuous because of the large size of the pebbles in some beds (long axes exceeding 10 centimetres are fairly common), and the local "edgewise" arrangement, in which one of the longer axes stands at a large angle to the bedding. Nevertheless, conglomerates with moderately spherical pebbles, and others with equant, angular, blocky pebbles are also widespread. Thin to medium, and rarely thick beds of limestone-pebble conglomerate occur as interruptions of shale sequences, as breaks in sequences of thin beds of calcisiltite, at the top or base of beds of biocalcarenite and oolite, and as isolated beds in sequences of dense, impure carbonates.

The lithology of the pebbles can generally be related to closely associated beds. Calcisiltite, commonly silty to very silty, is by far the most prominent pebble-forming material, and many conglomerates contain only calcisiltite pebbles. Fine biocalcarenite and very calcareous siltstone also are found as pebbles in conglomerate. Many beds contain pebbles with a peripheral pink or red stain, suggestive of subaerial oxidation. The limestone conglomerates are in part spar-cemented. More commonly the matrix is calcisiltite or very fine biocalcarenite.

In outcrop and core, dolomitized conglomerates are readily recognized by the contrast in colour and texture between replaced pebbles and replaced cement or matrix. On the other hand, conglomerates are rarely detected in well cuttings.

Intrasparite is distinct from pebble conglomerate in character, associations and presumably, origin. Intrasparites are rocks closely associated with micrites and pelsparites, whose intraclasts are well-rounded, equant, and largely composed of brown micrite. Pebble conglomerates, on the other hand, are rocks associated with calcisiltites, shales, oolites, and calcarenites, whose intraclasts (pebbles) are subangular to well-rounded, largely non-equant, and of varied lithology.

Dolomite. Dolomitized equivalents of every type of limestone studied are known, furthermore, all dolomites studied to date could reasonably have been derived from original limestones, and the majority can be demonstrated to have originated in this way. For these reasons, the nature of the original limestone is considered more significant from the point of view both of correlation and palaeoenvironmental interpretation than the detailed character of the derived dolomite. Wherever for example a dolomite can be interpreted with confidence as being a dolomitized biocalcarenite, it will be referred to as ex-biocalcarenite.

Ex-calcarenites, ex-oolites, ex-pelsparites, ex-intrasparites, and ex-conglomerates are normally easily recognized by the inherited colour-difference between original clasts and original matrix or cement. In some instances, however, it may not be clear whether a biocalcarenite, an oosparite or a pelsparite was the original rock; in these instances, the rock is described as "dolomite with relict particulate fabric".

Of the dolomitized "dense" limestones, only the dolomite with colour-mottling or colour-partings inherited from micrite or calcisiltite with dolomite mottlings or partings, can be positively recognized. Where the primary nature of the rock cannot be interpreted with confidence, the dolomites are described in objective terms of colour, crystallinity[1], insoluble residues, and bedding features where these are known.

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[1] An arbitrary scale of crystallinity, which is applicable without resort to thin-section examination, and serves to distinguish the important classes of Cambrian dolomite, has been used throughout:

very coarse-crystalline – greater than 4 mm average crystal diameter
coarse-crystalline – 1 mm to 4 mm
medium-crystalline – 1/16 mm to 1/4 mm
very fine-crystalline – 1/32 mm to 1/16 mm
microcrystalline – less than 1/32 mm
aphanitic – appearing non-crystalline in specimens and cuttings.

Carbonates of algal origin. The sediment-binding (and possibly carbonate-precipitating) activities of blue-green algae (Logan, et al., 1964; Ginsburg, et al., 1954) are manifested in several different ways. Algal pisoliths (oncolites) are distinguished from oolites by their strong, irregular, concentric structure, lack of radial structure, and generally much larger size. Although typically present as scattered, accessory particles, they do make up the bulk of rare beds, referred to as algal pisolites. The structure of algal pisoliths is generally recognizable in derived dolomites, but is unlikely to be detected in well-cuttings. Although algal pisoliths belong to the class of objects known as stromatolites, they are not referred to here as stromatolites, the latter term being restricted to bodies that grew in place, and accreted on the upper surface only.

Algal stromatolites (excluding the pisolites discussed above) are present at many levels of the Cambrian column. Except where dolomitized, they are composed of light grey, very dense, clotted-appearing limestone, generally at the finer end of the calcisiltite range. Many bodies lacking concentric laminations, but composed of clotted limestones and displaying the external features and relationships of algal stromatolites such as those illustrated by Bradley (1929), are here included in the class of algal stromatolites[1]. The stromatolites are described in non-systematic descriptive terms, hemispherical, hemicylindrical, pancake-shaped, etc. Thick massive limestone beds, lacking the external form diagnostic of algal stromatolites but composed of the distinctive clotted calcisiltite, are referred to as "clotted, stromatolitic limestone". Where superposed, convex-upward laminations are present, these are described as stromatolitic laminations. Upon dolomitization, the dense limestone of the non-laminated "stromatolites" becomes light-coloured, fine- and very fine-crystalline dolomite, and the stromatolites can be recognized only by their external form. Algal stromatolites may be recognizable in cores, if the intersection is favourable, but are unlikely to be recognized in cuttings.

Further indications of the work of blue-green algae are found in certain dense limestones and dolomites described as "algal-laminated". The laminations in these rocks are distinct from laminations produced by sediment settling in quiet water, and also from those produced by deposition from currents of variable intensity. They display all or most of the criteria listed by Ginsburg et al. (1954) as diagnostic of "relatively flat, laminated, algal stromatolitic sediments", namely "detrital texture, structures which require a sediment-binding surface film, minor domes, bubbles, undulations and microunconformities, and confluence of laminae with larger heads". Very commonly associated with laminations of this character are small, unworn parallel-sided clasts derived from the destruction of a single lamina.

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[1] An element of impropriety is acknowledged. Study of these non-laminated "stromatolites" continues.

Clastic Rocks

With minor exceptions, descriptions of clastic rocks are based on examination of specimens, cores, and well-cuttings under the binocular microscope. A few siltstones, sandstones, and conglomerates from outcrop sections have been studied in thin section.

Shale and mudstone. Cambrian shales of the region display little variation. The predominant shale at all stratigraphic levels ranges in colour from greenish grey to bright green or deep olive green. Except where calcareous, it is highly fissile, commonly displaying a splintery fracture. Intervals of brick-red to deep purple-red shale, otherwise identical to the green shales, are rare in outcrop sections, but in the subsurface are found in most green-shale units, and are locally the dominant shales of thick units. The colour of shale does not appear to be a useful criterion for correlations within the subsurface Cambrian succession, because correlations based on other criteria suggest that in many instances, red shales are stratigraphically equivalent to green shales. Chocolate-brown fissile shale is found in small amounts in many green-shale units. Many intervals of green shale contain abundant squamose chlorite especially in deeper parts of the subsurface Cambrian succession. Chitinous brachiopods are fairly common in the Cambrian shales; trilobite tests and impressions are rare. Fossils are about as common in red as in green shales, and mud-cracks are about as common in green as in red shales. These observations suggest that the colours of the shales may be secondary, rather than primary.

Non-fissile mudstone forms minor units within the Cambrian succession. The mudstones are almost entirely red beds. One orange-coloured, conchoidal-fracturing variety is identical with beds widely present at or near the base of the Devonian Elk Point Group. Sandy and silty mudstones are characteristic of the basal part of the subsurface Cambrian succession.

Siltstone. The Cambrian succession of the region contains a high proportion of siltstone,[1] especially in the subsurface of the Plains. There are two main varieties, the first, most characteristic of the subsurface Cambrian section, is light to dark green, grey, white, or pink, micaceous and slightly to very glauconitic. It is a dense, non-porous rock silica-cemented and commonly calcareous or dolomitic. A close association is noted between siltstones of this type and abundant "lebensspüren", mainly feeding-burrows. Burrows in shale are often filled with siltstone; in well-cuttings, such burrows are found as cylinders of siltstone, free of shale

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[1] Much of this material lies at the coarse end of the siltstone range, by the writer's determination. It has been described as sandstone by several authors.

matrix. Mud-cracks and cross-lamination are common in these thin-bedded rocks. Siltstones of this class intergrade with very fine-grained sandstone of similar character.

A second type of siltstone, very common in the post-Pika succession in outcrop sections, and in the Foothills subsurface, is white to light brown in colour and invariably calcareous or dolomitic, and can readily be mistaken for very fine-crystalline dolomite. Outcrop specimens are nearly always yellow from weathering, and commonly have an earthy appearance. In these siltstones, euhedral dolomite rhombs appear to enclose the grains of quartz silt without filling the intergranular spaces, and good porosity is commonly preserved. Siltstones of this class are generally cross-laminated. Those in the Arctomys Formation are commonly vuggy. The salt-crystal impressions in shale, found in the Arctomys, are filled with, and preserved by siltstone of the latter type. These siltstones commonly display high gamma-ray activity, the mineralogical significance of which is unknown.

Sandstone and greensand. Excluding the Gog Group of the Rocky Mountains and the basal sandstone of the Plains, Cambrian sandstones are almost entirely fine- and very fine-grained and well sorted. This generalization is important in recognizing the Devonian-Cambrian contact, because most of the sandstones in the basal part of the Devonian succession are in part medium- and coarse-grained, and are relatively poorly sorted.

The predominant Cambrian sandstones are fine- and very fine-grained, white, pink, red, or green in colour. Most are clean, quartzose sandstone, cemented mainly by white and pale green clay, and locally by dolomite, calcite and silica. Glauconitic sandstones are very common, and grade to greensands with more than 50 per cent glauconite. These rocks have no significant porosity. Red, argillaceous and hematitic sandstones are found low in the Cambrian of the subsurface; in some of these, the peculiar association of abundant glauconite in red beds is encountered. Partial alteration of glauconite to hematite is common, and serves to prove that the red coloration is at least in part post-depositional. Some of the sandstones are cross-laminated and crossbedded in sets rarely exceeding 8 inches in thickness, but depositional structures generally have been completely destroyed by intense biotic reworking of the sediments. Feeding burrows are common, especially those extending downward from sandstone into shale.

Sandy dolomites grading into dolomitic sandstones are generally subordinate constituents of the Waterfowl Formation and the upper division of the Lynx Group. They also occur locally in the Eldon Formation near its northeastern depositional limits.

Sandstones assigned to the basal sandstone unit differ from higher sands in being very fine- to coarse-grained and less well sorted. They are mostly near-white in colour and generally non-glauconitic. White or pale green clay cement is common, but in some wells the sandstone is porous and friable, and locally so little consolidated that it appears in ditch samples only as loose sand grains.

Lithologic Associations and their Graphic Representation

Advantage has been taken of the limited number of Cambrian rock types and of their tendency to occur in certain associations, or lithofacies, (see p. 5 et seq.) to employ a simple and compact scheme for the graphic representation of the lithostratigraphy. The well-logs and columnar sections expressed graphically in terms of lithofacies must be understood as generalizations; much detail is sacrificed, and only lithofacies that can be recognized in well-cuttings with the binocular microscope are depicted. Only those accessories and minor structures considered to be of major importance for correlation and the reconstruction of environment, are plotted as "accessories".

"Dense" limestone facies (Ld). Units assigned to this facies consist of micrites, pelmicrites, intramicrites, and calcisiltites. The "bird's-eye" limestones whose field description might be "limestone, cream-coloured, aphanitic, with calcite 'eyes' ", are not included, microscopic examination having proved them to be fundamentally light-coloured pelsparites and intrasparites.

Pelsparite-intrasparite limestone facies (Li). Units assigned to this facies are dominated by pelsparite and intrasparite, and usually contain minor intervals of "dense" limestones other than calcisiltite.

Calcarenite limestone facies (Lc). Units assigned to this lithofacies are dominated by biocalcarenite, commonly pebbly and oolitic. Minor calcisiltite beds may be included. Biocalcarenite and microconglomerate ("lithocalcarenite") are not distinguished in the lithofacies scheme, because they are difficult to differentiate in well-cuttings. Unlike biocalcarenite, microconglomerate is nowhere present in units of plottable thickness, and is generally associated with intervals of dense and argillaceous carbonates.

Oolitic limestone facies (Lo). Units assigned to this lithofacies are dominated by oosparite and oocalcisiltite; pebbles, conglomerates, and layers of biocalcarenite are common associates. Where oosparites and oocalcisiltites are minor constituents, and where oolites are accessory particles, the oolith symbol is plotted in the "accessory" column.

"Dense" dolomite facies (Dd). The boundary between "crystalline" and "dense" dolomite facies has been arbitrarily placed at an average grain size (crystal diameter) of 1/32 mm, the boundary between very fine-crystalline and microcrystalline. The commonly described "microcrystalline to very fine-crystalline" dolomite is arbitrarily placed in the "dense" facies. "Dense" and "crystalline" dolomites are commonly interbedded in some formations, notably the Lynx Group. Such interbedded units are plotted according to the dominant lithology, except for thick units where the interbedding can be suggested graphically. With few exceptions, "dense" dolomites are argillaceous or siliceous or both.

"Crystalline" dolomite facies (Dx). "Crystalline" dolomites are those with an average grain-size (crystal diameter) greater than 1/32 mm. This lithofacies includes the mottled dolomites derived from dolomite-mottled "dense" limestones, and the majority of dolomites with recognizable, relict particulate fabrics (ex-oolites, ex-biocalcarenites, ex-intrasparite, etc). The lithofacies assignment of the original limestone is indicated wherever it can be determined. "Crystalline" dolomites of uncertain origin also are widely encountered, particularly in the subsurface.

Clastic facies. Units of clastic rocks, where thin, are plotted according to the dominant lithology, with subordinate lithologies indicated by the appropriate letter-code (Sh, St, Ss). Where the thickness of units permits, the interbedding of lithologies is suggested graphically. Mudstone is not distinguished from shale in the graphic plot of lithofacies.

Description of Formations

Gog Group

In the Rocky Mountains, sandstones and quartzites subjacent to Middle and latest Lower Cambrian shales and limestones are assigned to the Gog Group (Mountjoy, 1962; Mountjoy and Aitken, 1963).

The group is dominated by thick units of very fine- and fine-grained sandstone and quartzite. Intervals of medium-grained sandstone are subordinate, and coarse-grained beds are rare, although concentrations of quartz granules on bedding planes are common. The sandstones are quartzose, generally white or yellow, rarely pink, red, or purple. Complete cementation by silica is general; porosity is preserved only locally. Red to purple, ferruginous beds are found at the top of the Gog in many sections. Intervals containing much grey, green or red shale, commonly silty and micaceous, occur at several horizons. Bedding style varies widely; crossbedding is prevalent at many horizons. "Lebensspüren" are abundant in certain intervals and totally lacking in others. Ripple-marks and mud-cracks occur locally.

Along the Mountain Front outcrops of the Gog Group are known only at Ghost River and Miette Range (L and A, Fig. 1). The base of the Group is not exposed. Its top is conformable and gradational with the Middle Cambrian Mount Whyte Formation, and is demonstrably progressively younger in a northeasterly direction (see also Raasch and Campau, 1957).

The Gog Group of the Rocky Mountains and the Basal sandstone unit of the Plains are lithologically similar. Both unconformably overlie Precambrian rocks and are in conformable, intertongued contact with the overlying Mount Whyte Formation. For these reasons, they are probably physically continuous with one another, although this cannot be proved on available evidence.

Basal Sandstone Unit

The Basal sandstone unit corresponds to the basal, relatively coarse-grained part of the diachronous basal clastic facies of van Hees (1959, 1964), and in the California Standard-Gulf Kaybob No. 5-35 well (T, Fig. 1) coincides with unit (a) of Suska (1963). It is distinguished from overlying, very fine- and fine-grained sandstones of the Mount Whyte Formation and the Lower fine clastic unit by the presence of medium- and coarse-grained sandstones, generally less well sorted and rounded than the higher sandstones. Excellent porosity has been encountered in some wells. Crossbedding and cross-lamination are locally well-developed, but all depositional structures are elsewhere destroyed by intense biotic reworking of the sediment. Although locally glauconitic, the Basal sandstone is much less consistently so than are higher sandstones. In some wells the Basal sandstone unit contains subordinate intervals of green and red shales; in others it consists entirely of sandstone.

The base of the Basal sandstone unit is an unconformable contact with Precambrian gneiss, schist, and igneous rocks. The top of the unit is placed at the base of a unit of glauconitic shales, siltstones, and minor sandstones, which displays conspicuously high gamma-ray activity. The radioactive unit is strongly diachronous, being subjacent to beds low in the Cathedral Formation in the Parkland well (P, Fig. 1), and equivalent to Stephen beds in the Leduc No. 530 and Kaybob No. 5-35 wells (R, T, Fig. 1). The Basal sandstone unit is considered to be a shoreline facies equivalent to the radioactive unit, and similarly diachronous. Medium- and coarse-grained sandstones do not necessarily persist to the top of the Basal sandstone unit.

In the wells studied, the Basal sandstone unit varies in thickness between 90 and 148 feet.

Mount Whyte Formation

In the Rocky Mountains, basal Middle Cambrian limestones interbedded with shales, siltstones, and minor sandstones, subjacent to massive carbonate rocks of the Cathedral Formation, are assigned to the Mount Whyte Formation (Walcott, 1908, 1928; Rasetti, 1951).

In Rocky Mountain outcrops, the Mount Whyte Formation is generally dominated by a variety of limestones. "Dense" limestone, calcarenites, and oolites are generally present, and one or more beds crowded with large pisoliths are very characteristic of the formation. Most sections contain stromatolites. The "dense" limestones are in part silty and argillaceous. Grey and green shales and calcareous siltstones and very fine sandstones are generally subordinate to the carbonate rocks. Glauconite occurs both in siltstones and in particulate limestones. Intensive biotic burrowing and reworking of the siltstones and sandstones is characteristic of the formation.

The Mount Whyte of the Plains subsurface differs from that of the outcrop belt; limestone is present in traces, if at all and the formation consists of green and minor purple-red shales, glauconitic siltstones, non-glauconitic to highly glauconitic, very fine- and fine-grained quartzose sandstones, and thin beds of greensand. Hematitic alteration of glauconite and of green shales is fairly common. The siltstones and sandstones are commonly intensely reworked by burrowing animals; there seems to be a correlation between highly glauconitic and highly burrowed zones.

For purposes of surface mapping, the term Mount Whyte Formation is retained wherever the Cathedral Formation can be clearly delineated. Northward, the limits of the Cathedral become uncertain because of facies change to a largely shaly section. Where this is the case, as in the Miette Range (A, Figs. 1 and 2), the entire interval, Mount Whyte-Cathedral-Stephen, becomes a single formation of shales, siltstones, and subordinate limestones, here referred to as the Lowerfine clastic unit. Similarly, in the subsurface, the term Mount Whyte is restricted to the region in which the Cathedral Formation can be delineated; beyond this region, it passes into the Lower fine clastic unit. It is recognized that in parts of the subsurface of the Plains the Mount Whyte Formation, so distinguished, may be entirely younger than any part of the type section of the formation.

The Mount Whyte Formation, although entirely pre-*Albertella* zone at its type section, becomes younger to the northeast, as sandstones assignable to the Gog Group appear at higher stratigraphic levels, and as the basal Cathedral carbonates give way to interbedded fine clastic rocks and limestones. At Ghost River and the California Standard Parkland No. 4-12 well (P, Fig. 1), *Albertella* is found in the Mount Whyte Formation. In the subsurface to the north and northeast, the top of the Mount Whyte approaches the *Glossopleura* zone, as the Cathedral Formation thins and disappears by progressive loss of basal limestones.

In the Rocky Mountains, the Mount Whyte Formation is up to 600 feet thick, but is locally missing where Cathedral carbonate rocks rest on Gog sandstones, as at Vermilion Pass. It thickens northwestward from the type section, at the expense of the overlying Cathedral Formation. No complete section of the Mount Whyte has been seen at or near the Mountain Front. The Formation is 168 feet thick in the Parkland well, and thins to the northeast.

The present interpretation differs from that of van Hees (1959, 1964), in that the interval of the Mount Whyte and the lower fine clastic unit correlated by van Hees as the "Albertella zone" (because it yields Albertella in the Parkland well) is here correlated as a strongly diachronous, radioactive facies deposited immediately seaward of the Basal sandstone unit. Support for the present interpretation comes from two lines of evidence. In the first place, parts of the Stephen Formation develop the same high gamma-ray activity in a shoreward direction (van Hees, 1959, 1964, Profiles A-B, C-D). In the second place, those contacts (top of Cathedral, top of Eldon, top of Pika), which on surface and subsurface evidence appear to approximate time-planes, diverge only slightly from parallelism with one another, while converging rather strongly against the Precambrian basement and the Basal sandstone. The top and base of van Hees' "Albertella zone", if they were time-planes, would be unique in the subsurface Middle Cambrian, in that they converge strongly against another time-plane (top of Cathedral), and this is considered highly unlikely.

Cathedral Formation

The Cathedral Formation (Walcott, 1908, 1928; Rasetti, 1951) is recognized throughout much of the southern Rocky Mountains as the lower of two thick, cliff-forming Middle Cambrian carbonate formations.

The Cathedral Formation is dominated by dolomite-mottled micrite and derived dolomite. This lithofacies is thin-bedded and flaggy both at the base of the formation where it overlies shaly members, but becomes non-bedded and massive at higher levels. Intraclasts and algal pisoliths are common immediately above contacts with shales. Most intervals of micrite contain a few beds of pelsparite and intrasparite; in most Cathedral sections these sparry rocks are dominant in one or more intervals, some tens of feet thick. Important intervals of leuco-pelsparite and leuco-intrasparite occur in several sections. So far as is known, intervals of specific carbonate lithofacies, as delineated from the main mass of uninterrupted carbonates, are not persistent laterally.

The distribution of dolomite, other than mottlings and partings, is not stratigraphically controlled within the Cathedral Formation. Remarks on the distribution of dolomite in the Eldon Formation (p. 22) apply equally to the Cathedral Formation.

In the Rocky Mountains, the Cathedral Formation ranges in thickness between 500 and 1,200 feet. The only complete section measured at the Mountain Front is at Ghost River; there, the formation is 522 feet thick. Beneath the Plains, the Cathedral thins northeastward by progressive facies change of its basal beds to shale, and is last seen in the T.G.T. Nacmine No. 6-8 well, where it is 200 feet thick, the Mobil-C.P.R. Hutton No. 11-18 well, where it is 70 feet thick, and the California Standard East Gilbey No. 4-5 well, where it is 142 feet thick (van Hees, 1959, 1964, Profiles A-B, C-D, E-F). Beyond the depositional limit of the Cathedral carbonate rocks, there is no means of separating Mount Whyte and Stephen strata, and the entire sub-Eldon section (excepting the Basal sandstone) is assigned to the lower fine clastic unit.

The "shale-out" of the Cathedral Formation can be studied in outcrop sections, as recognized by Fitzgerald (1962a, Fig. 2). At Mount Eisenhower (Castle Mountain), the carbonate rocks of the Cathedral Formation are interrupted only by a thin shale member with Albertella (Ross Lake Shale), 327 feet above the base. At Ghost River (L, Fig. 1), there is again only one thin shale member, 137 feet above the base, but this shale contains Glossopleura. Albertella is found at Ghost River in the Mount Whyte Formation. This means that at least 327 feet of basal Cathedral limestones of Mount Eisenhower have passed eastward into a shale-and-limestone sequence assigned to the Mount Whyte Formation at Ghost River. The Ross Lake Shale may thus be regarded as a tongue of the Mount Whyte Formation, just as the shale with Glossopleura of Ghost River may be regarded as a tongue of the Mount Whyte and the lower fine clastic unit. Similar relationships are observed in tracing the Cathedral Formation of the area south of Brazeau River into the Lower fine clastic unit (Unit 3 of Mountjoy, 1962, 1963) at Athabasca River.

The gradational and diachronous nature of the base of the Cathedral Formation has already been emphasized. In contrast, the contact with the overlying Stephen Formation is believed to approximate a time-plane throughout much of the study-area. This belief is based on three observations: (a) an abrupt contact and a similar succession of lithologic units at the base of the Stephen Formation, in nearly all sections, (b) the presence in many localities of a single thin bed crowded with great numbers of cranidia, pygidia, and free cheeks of Glossopleura, 30 to 60 feet above the base of the Stephen Formation, and (c) orderly, gradual northeastward thinning of recognizable units in the upper part of the Cathedral, as contrasted with rapid thinning of units low in the Cathedral. (For example, the interval between the base of the Stephen Formation and shales with Albertella is 618 feet at Mount Eisenhower and 522 feet at Ghost River, whereas the entire 327 feet of pre-Albertella limestones at Mount Eisenhower is missing at Ghost River.)

Van Hees (1959, 1964) includes in the Cathedral Formation subsurface clastic rocks intervening between thick carbonates (Cathedral of this paper) and the Precambrian basement, distinguishing these as a "diachronous basal clastic facies". As has been shown, rocks overlying the Basal sandstone unit correspond in lithology and position to the Mount Whyte Formation, and are here so designated, despite the fact that they are largely or entirely younger than the type Mount Whyte.

Stephen Formation

The Stephen Formation (Walcott, 1908, 1928; revised by Rasetti, 1951) is recognized as a recessive-weathering formation of shales and thin-bedded flaggy limestones, which separates the massive Cathedral and Eldon carbonates.

Limestones of the Stephen Formation are almost entirely of the "dense" variety, predominantly flaggy calcisiltite, with mottlings and partings of dense, argillaceous dolomite. Beds of oolite, and locally of algal pisolite, occur in the upper half of the formation. Limestone-pebble conglomerates, commonly with glauconitic coatings on their upper surfaces, are found at most localities; in contrast with the bulk of Cambrian conglomerates, the pebbles are generally well-rounded. One or more horizons of algal stromatolites occur in most Stephen sections. Thin and medium beds of trilobite-pelmatozoan biocalcarenite, commonly glauconitic, locally pink in colour, are minor components of some sections. Stephen shales seen in outcrop are greyish green, olive-green, and most characteristically, emerald-green. At Ghost River, a thin bed of purple-red shale occurs, and in Miette Range, minor purple shale occurs among green shale and siltstone correlative with the Stephen; these are the most westerly occurrences of the red coloration that occurs widely in the Stephen Formation of the subsurface. Calcareous and glauconitic siltstone, light grey to white, or green, occurs near the base of the Stephen in the Front Ranges, but was not seen farther west. Grains of quartz sand occur in some of the particulate limestones.

Where penetrated in Foothills wells, the Stephen Formation is lithologically identical with the Mountain Front outcrop sections.

In the subsurface of the Plains, limestone, where present, is of the same varieties as those seen in outcrops, but makes up only a minor part of the formation. The formation is dominated by fissile shales, largely deep green, partly purple-red or purplish brown, locally glauconitic. Siltstones as described above are present in small amounts.

The Stephen Formation is generally from 200 to 500 feet thick in the Main Ranges. Seventy-one feet thick at Ghost River (L, Fig. 1), it thickens northwestward along the Mountain Front to 214 feet at Windy Point (F, Fig. 1). This northwestward thickening is also seen between the Burnt Timber (J, Fig. 1) (166 feet) and Parkland (P, Fig. 1) (78 feet) wells, and the East Gilbey No. 4-5 well (Q, Fig. 1) (290 feet).

For reasons listed above, the base of the Stephen Formation is believed to approximate a time-plane throughout most of the area studied. The top of the formation, on the other hand, is a gradational facies-contact, undoubtedly diachronous. At several levels in the Middle Cambrian, the gradual lateral transition from shales through flaggy calcisiltites and micrites with partings of shale and argillaceous dolomite to thin-bedded micrites, can be documented. The Stephen-Eldon transition is a vertical sequence of this nature. Following a practice which Rasetti (1951, pp. 74, 75) suggested but did not follow, the Stephen-Eldon contact has been drawn at the top of the highest shale, because no higher contact can be drawn on the basis of objective, depositionally significant criteria. The lateral extent of the Stephen Formation in the Rocky Mountains and in the subsurface of the Plains is limited to the region in which the Cathedral Formation can be clearly delimited. Thus, along the line of Athabasca River, the Cathedral Formation is replaced by shales to such an extent that its limits are not definable, notwithstanding the fact that certain limestone intervals are obviously continuous with the Cathedral. In this region, the Mount Whyte, Cathedral and Stephen merge into a single unit, here referred to as the Lower fine clastic unit (Unit 3 of Mountjoy, 1962, 1963).

Palaeontological confirmation of the Stephen Formation in the subsurface is provided by the presence of the Bathyuriscus-Elrathina zone fauna at the Parkland well (Raasch and Campau, 1957). Occurrences of Glossopleura, a genus common in the Stephen Formation, at Windfall No. 12-36 (idem.), and at 8,022 feet in the Rio Bravo Ronald No. 1-6 well (Hutchinson, 1960; cf. van Hees, 1959, Profile E-F), are in beds which although here referred to the Lower fine clastic unit, are readily correlated with the Stephen Formation.

Lower Fine Clastic Unit

The informal designation, Lower fine clastic unit, is applied to the sequence of shales, siltstones, and fine sandstones intervening between the Basal sandstone and the Eldon (locally, Pika) Formation, where the Cathedral Formation is not delineated. It has the lithologic attributes of the Mount Whyte and Stephen Formations.

The Lower fine clastic unit has been studied in outcrop only in Miette Range, where it is 843 feet thick. The unit thins northeastward from the Mountain Front; its maximum thickness in the wells studied is 263 feet, at the Kaybob No. 5-35 well (T, Fig. 1), where it corresponds to unit b and part of unit c of Suska (1963).

Eldon Formation

The Eldon Formation, as originally defined by Walcott (1908, 1928), was restricted by Deiss (1939), who erected the Pika Formation for the upper, dark-weathering, thin-bedded part of the original Eldon. The Eldon Formation, a very resistant formation dominated by massive carbonate rocks, overlies the Stephen Formation or, where the Stephen is not recognized, the Lower fine clastic unit. A carbonate unit continuous with the Eldon is known as the Titkana Formation in the Jasper-Mount Robson region (Mountjoy, 1962). The Eldon Formation is widely present in the subsurface, as recognized by van Hees (1959, 1964), and forms a part of unit c of Suska (1963).

The Eldon Formation consists entirely of limestones and derived dolomites, except near its northeastern limit, where it contains sandstones. Like the Cathedral Formation, the Eldon is dominated by dolomite-mottled micrite and derived, mottled fine-crystalline dolomite. At the base of the formation, the Eldon micrites are flaggy, with dolomite partings; higher in the formation, they are mainly non-bedded. At most localities, one or more intervals are present in which the dolomite "mottlings" are largely branching, cylindrical structures of organic origin, probably burrows. Medium beds of pelsparite and intrasparite generally interrupt the micrite-dominated intervals, and locally dominate in intervals tens of feet thick. In a few sections, beds of oolite are present near the base of the formation. Along the Mountain Front, leuco-pelsparite and leuco-intrasparite form thick intervals in a number of sections; these are much less prominent farther west. Rare bodies tentatively interpreted as algal stromatolites occur at some localities. In the Main Ranges the Eldon Formation contains a number of carbonate lithofacies not recognized at the Mountain Front or in the subsurface; these facies are not considered in this report.

In wells near the line along which the formation thins and disappears, sandstones are interbedded with the Eldon dolomites and sandy dolomites. This relationship is important, in that it implies that the shoreward facies change is not necessarily from carbonates to shales and from shales to sandstones, but at some levels and in some areas is a direct change from carbonates to sandstones, probably through intervening sandy carbonates.

Certain lithofacies of the Eldon Formation have been observed only as dolomites, and are probably early diagenetic or less likely, primary dolomites. None of these occurs at the Mountain Front. The bulk of dolomites in the Eldon Formation at the Mountain Front and elsewhere are obviously derived from limestone, and are in bodies of limited lateral extent, whose boundaries transect bedding; many of these bodies, in fact, have greater vertical than horizontal dimensions, and some bear an obvious relationship to fractures. These relationships suggest that the bulk of Eldon dolomites along the Mountain Front, and particularly the mottled dolomites, the most widespread dolomite lithofacies, result from dolomitization which, in a broad sense was hydrothermal rather than diagenetic.

The Eldon Formation thins northward and eastward, from a maximum of about 1,600 feet in Kicking Horse Pass to about 800 feet near Jasper, and about 800 feet at the Mountain Front near Ghost River. Northwestward along the Mountain Front from Ghost River, the formation thins to about 300 feet at

Roche Miette. This thinning is mainly due to thickening of the Stephen Formation and the Lower fine clastic unit at the expense of the Eldon. In the subsurface, the Eldon thins from about 800 feet in Foothills wells to disappearance along a line to the northeast of the North Richmond No. 31-1 well, the Swanson No. 10 well, and the East Gilbey No. 4-5 well (van Hees 1959, 1964). Although no significant carbonate unit referable to the Eldon Formation is present in the Leduc No. 530 well (R, Fig. 1), a thin interval containing some calcisiltite and brown crystalline dolomite is correlated with the top of the Eldon in the East Gilbey No. 4-5 well (Q, Fig. 1), and provides a contact between the Lower fine clastic unit and the overlying Pika Formation.

The writer cannot agree with van Hees' (1959, 1964) criterion for correlation of the base of the Eldon Formation on the basis of a marker bed, as between the Swanson No. 10 and Leduc No. 530 wells. In the first place, this practice results in the Eldon Formation being recognized as a unit of fine clastic rocks lying between two carbonate markers; the Eldon becomes a format (Forgotson, 1957), rather than a formation, and acquires the attributes of a time-rock unit, rather than a lithologic unit. In the second place, the lower marker is shown as an interval of dolomite, which might be offered as justification of its assignment to the Eldon. The marker is not, however, dolomite, but dolomitic siltstone, as is the "dolomite" assigned by van Hees to the Eldon in the interval 10,515-10,708 feet in the Windfall No. 12-36 well.

Pika Formation

The Pika Formation (Deiss, 1939) is a unit of dark-weathering flaggy limestones and dolomites, with minor intervals of shale near the base. It is one of the most uniformly developed and widely recognizable formations in the Cambrian of the Southern Rocky Mountains, and the most persistent Middle Cambrian unit in the Alberta subsurface.

The Pika Formation along the Mountain Front is dominated by flaggy, dense limestones, calcisiltites and micrites, with mottlings and prominent irregular partings of dense argillaceous dolomite. Minor intervals of grey, greenish grey, and brown fissile shale, with thin interbeds of trilobite biocalcisiltite, occur near the base of the formation. The base of each shale unit initiates a cycle that grades upward through decreasingly argillaceous and slightly thicker-bedded limestones, to the dominant, flaggy, mottled calcisiltites and micrites. Flat-pebble conglomerates are prominent among the flaggy limestones. In all of the Mountain Front sections studied, the upper one-third, more or less, is mainly brown, fine-crystalline dolomite which has inherited the bedding style and mottling pattern of the underlying flaggy limestones, and is in irregular replacement contact with them. An upper member of the Pika, always lying within the dolomitized part, is characterized by abundant, coarse, flat-pebble conglomerate and beds of dolomitized oolite; it is present in all of the Mountain-Front sections. Minor beds crowded with algal pisoliths occur in several localities, but do not appear to mark a consistent horizon.

Beds containing great numbers of well-preserved trilobite cranidia, pygidia, and free cheeks are found in most Pika outcrop sections. Unfortunately, in many instances very few species (in several instances, only one species) are represented in these crowded beds, and the forms present are of little value for precise dating. W.H. Fritz (personal communications, 1964, 1965) suggests, however, that among the more informative collections, the Bolaspidella zone is definitely present, and all collections to date suggest that the Pika Formation is assignable to the Bolaspidella zone.

The Pika Formation is the most widely recognizable and the least variable of the Middle Cambrian formations. Five hundred and twenty-two feet thick at its type section, the Pika locally exceeds 900 feet in the Main Ranges. The Pika of the Mountain Front is remarkably uniform in thickness from Bow River to Brazeau River, the extremes being 300 and 340 feet (Fig. 2). Northwestward from Brazeau River, the formation thins gradually to 235 feet at Roche Miette. Beneath the Plains, the same remarkable uniformity extends throughout the area of this study, thicknesses ranging only between a minimum of 260 feet in the Parkland well and a maximum of 342 feet at Leduc No. 530. Northeast of the present study-area, however, the Pika undergoes a facies change to shales and siltstones, a change similar to that experienced by the Cathedral and Eldon Formations (van Hees, 1959, 1964). The upper, dolomite part of the Pika Formation corresponds to Suska's (1963) unit e at the Kaybob No. 5-35 well.

Van Hees' subdivision of the Eldon Formation into a "main carbonate facies", a "shale facies", and a "Pika Member" reflects a misunderstanding of the type Pika and Eldon Formations. The shales underlying the main mass of Pika carbonate rocks are included in the Pika Formation at the type section, and the Pika fauna is known only from thin limestone beds interbedded with shales near the base of the formation. The straightforward correlation from nearby surface exposures to the Moose Mountain and Burnt Timber wells leaves no doubt that the base of the Pika Formation in the subsurface is the base (not the top) of the "shale facies" of van Hees.

Van Hees and others have placed the Middle Cambrian-Upper Cambrian boundary at the top of the Pika Formation. Aitken and Greggs (in press) give reasons for placing the boundary a little higher, within the Arctomys-Waterfowl. Nevertheless, the top of the Pika is a boundary which in the mountains marks a change between two similar but distinct regimes of sedimentation, regimes that might be usefully thought of as the "Middle Cambrian" and "Upper Cambrian" regimes. Furthermore, if the tentative conclusions drawn here as to the absence of Arctomys and Waterfowl equivalents beneath the Plains are correct, then the top of the Pika of the Plains is indeed a hiatus at the Middle Cambrian-Upper Cambrian boundary.

Regional Facies Change in the Middle Cambrian

The present study is restricted to that region in which a part at least of the Middle Cambrian stratigraphic nomenclature of the southern Rocky Mountains is applicable. Within this region, the main formational boundaries are the boundaries of the three principal carbonate units, the Cathedral, Eldon, and Pika Formations. Each of these formations disappears to the northeast, by facies change from carbonate to clastic rocks. Each successively younger carbonate unit oversteps the one beneath, the great Middle Cambrian transgression having carried the shoreline and facies belts of each successive cycle farther and farther to the northeast. These relationships are remarkably similar to the facies relationships of the Lower and Middle Cambrian of the Grand Canyon region, so admirably well illustrated by McKee (1945). The last Middle Cambrian carbonate unit to disappear is the upper, carbonate part of the Pika Formation, but the Pika as a whole can only be traced where the Eldon Formation or a marker correlatable with its top, can be recognized. In western Saskatchewan, where the Pika carbonate rocks have changed to clastic rocks, the entire Cambrian succession is represented by rocks of the inner detrital facies, and the present scheme of nomenclature is totally inapplicable. In other words, the lower fine clastic unit (Middle Cambrian) has come into contact with the upper fine clastic unit (Upper Cambrian); the two together comprise the entire Cambrian succession, and are indistinguishable (see van Hees, 1959, Figs. 3, 4). Subdivision of this entirely clastic facies of the Cambrian is a problem worthy of further study.

Arctomys Formation

The Arctomys Formation of the Rocky Mountains, as restricted by Aitken and Greggs (in press), is a recessive-weathering unit of brightly coloured shales, siltstones and subordinate carbonate rocks. It is prominently developed along the Mountain Front, is easily recognized in the wells of the Foothills, but is unknown from the subsurface of the Plains.

The Arctomys Formation is best known for its purple-red shales, although these are generally subordinate to green and grey shales. Black shales occur as partings between siltstone beds near the top of the formation at many localities. Mud-cracks filled with siltstone are ubiquitous in shales of the Arctomys. Yellow-weathering calcareous and dolomitic siltstones, thin-bedded, flaggy, commonly vuggy, and generally cross-laminated, are prominent in the formation, and are the dominant rocks at many localities. Ripple-marks and mud-cracks are common in the siltstones and the well known salt-crystal casts of the formation are found on the bases of siltstone beds. Siltstones grade in part to very fine-grained sandstones at the top of some sections of the Arctomys Formation. Limestone and dolomite form an important part of the Arctomys Formation in the Main Ranges, but in the Front Ranges, only small amounts of dolomite are present. The dolomite is partly thin-bedded and silty, and intergrades with dolomitic siltstones. One or two thick massive beds of microcrystalline dolomite, commonly supporting algal stromatolites, occur in the middle of many Arctomys sections in the Front Ranges.

The maximum known thickness of the Arctomys Formation is 771 feet, at the type section. Along the Mountain Front, the formation thickens northwestward, from 60 feet in the Ghost River region to 283 feet at Roche Miette. In the Foothills wells, the formation is easily recognized as a 28-to 75-foot-thick unit of siltstone, shale and dolomite, that overlies the Pika Formation and is characterized by high gamma-ray activity.

The basal contact of the Arctomys Formation is marked by an abrupt change from dolomite to siltstone and shale. Although concordant, the contact is so sharp as to suggest a disconformity; no conclusive evidence of disconformity has been found, but the abrupt and local thinning to only ten feet in the Shell Panther River wells Nos. 1 and 2 suggests that the Arctomys Formation may overlie an irregular surface. In contrast, the upper contact of the formation is gradational and indefinite.

No lithologic equivalent of the Arctomys Formation has been recognized in the subsurface of the Plains. Although not provable on the available evidence, it is, for the following reasons highly probable that time-equivalents of the Arctomys are indeed missing. The Arctomys Formation reveals more definite evidence of extremely shallow water deposition and intermittent emergence than any other Middle or Upper Cambrian formation; it is clearly in large part a shoreline deposit. Because the top of the Pika Formation is traceable throughout the study area, and probably approximates a time-plane, equivalents of the Arctomys beneath the Plains, if they exist, are glauconitic green fossiliferous shales and siltstones in the basal part of the upper fine clastic unit. Equivalence of regionally seaward red beds and shore-line deposits in the southwest with regionally shoreward green, glauconitic, fossiliferous deposits in the northeast appears highly unlikely if not impossible. For this reason, all correlation sections have been drawn to show northeastward overstep of the Sullivan Formation across a depositional-erosional edge of the Arctomys Formation.

The suggestion that a part of the Eldon-Pika may be equivalent to the Arctomys Formation (North and Henderson, 1954, and others) arises from a miscorrelation by Walcott, as pointed out by Aitken and Greggs (in press). All evidence indicates that the Arctomys Formation is entirely younger than the underlying Pika Formation.

Waterfowl Formation

The Waterfowl Formation (Aitken and Greggs, in press), is a resistant carbonate and siltstone unit that overlies the Arctomys Formation. Like the Arctomys Formation, the Waterfowl is prominently developed along the Mountain Front, and is easily recognized in Foothills wells, but is unknown in the subsurface of the Plains.

The Waterfowl Formation is dominated at most Mountain-Front localities by "dense" and "crystalline" dolomites, in part dolomitized oolites, calcarenites, conglomerates, etc. These relict fabrics are perfectly preserved in rare chert nodules. Thin-bedded, massive, cross-laminated siltstones, partly dolomitic, partly quartzitic, are prominent in most sections and dominate a few. One or more beds of fine-grained sandstone and one or more horizons of stromatolites occur at most localities.

The formation is thickest at Vermilion Pass where 670 feet of strata are present. Along the Mountain Front, it thickens from 54 feet in the Ghost River region to 117 feet at Cardinal River (Mount Russell), the most northerly complete section in the study-area. In the Foothills wells, the formation is recognized as a 100- to 160-foot unit of dolomite and minor siltstone, separating two intervals of siltstone and shale.

Unlike the gradational lower contact of the Waterfowl Formation the upper contact is very sharp, being marked by the abrupt appearance of shales. This has prompted the search for evidence of disconformity, which has been found only at Maligne Lake. There, the Sullivan Formation lies upon a sculptured surface of undoubted erosional origin. Lithologic equivalents of the Waterfowl Formation are unknown in the subsurface of the Plains. A shoreward facies change from carbonates to shales and siltstones has been demonstrated for the three principal Middle Cambrian carbonate formations, and could explain the northeastward disappearance of the Waterfowl carbonate rocks. However, for the following reasons, this is considered less likely than the interpretation of absence by non-deposition and erosion, as illustrated in the correlation diagrams. Firstly, the Arctomys and Waterfowl Formations jointly constitute a complete depositional cycle. In all other Cambrian cycles, it is observed that the mid-cycle boundary between shaly and carbonate half-cycles is a diachronous contact which is younger in the regionally shoreward direction. Thus, shoreward equivalents of the Waterfowl Formation should resemble the Arctomys Formation. The absence of lithological equivalents of the Arctomys Formation beneath the Plains, and the reasons for believing Arctomys time-equivalents to be missing beneath the Plains, have been discussed above. Secondly, the evidence of disconformity at the base of the Sullivan Formation at one locality in the Mountains increases the likelihood that the bases of the Sullivan Formation and the Upper fine clastic units are disconformable beneath the Plains, regionally shoreward. Thirdly, if the general marine transgression throughout the Cambrian were continuous and uninterrupted, the Waterfowl carbonate rocks should extend northeastward beyond the limits of the Pika carbonates, as the Pika extends beyond the Eldon. Since the Waterfowl fails to extend as far northeastward as the Pika, a regression of some magnitude is indicated. Whether this regression took the Waterfowl shoreline west of Cambrian penetrations in the Plains (the interpretation illustrated), or merely shifted the inner clastic facies belt westward (which appears unlikely for reasons given above) is not provable on available evidence.

Sullivan Formation

The Sullivan Formation (as revised by Aitken and Greggs, in press) is a recessive-weathering unit of shales, limestones and derived dolomites, and siltstones. It is easily recognized along the Mountain Front, except at Red Deer River and southward, where its thinness causes some difficulty in recognition.

Shales of the Sullivan Formation are greenish grey and grey, and weather to a greenish shade that facilitates recognition of the formation in outcrop. Limestones are predominantly biocalcarenites and oolites; micrites, calcisiltites and silty calcisiltites form minor intervals. The particulate limestones are generally glauconitic at the Mountain Front, but only locally glauconitic farther west in the Mountains. Thin-bedded calcareous siltstones with "lebensspüren" form minor intervals within the formation, and are everywhere present at or near the base. Several horizons of algal stromatolites associated with particulate limestones occur in most sections. Flat-pebble conglomerate is generally present, and is locally prominent. Excellent trilobite faunas assignable to the Dresbachian Cedaria zone can be collected from most outcrop sections.

The base of the Sullivan Formation is sharply defined, and has been found to be disconformable in outcrops at Maligne Lake. The top of the formation, on the other hand, is an interbedded, gradational contact with the Upper Lynx; it is drawn at the top of the highest shale bed.

The Sullivan Formation is 1,390 feet thick at the type section in the Main Ranges. It is only 29 feet thick at the Mountain Front at Ghost River, and changes little in thickness northwestward to Red Deer River, beyond which it thickens rather rapidly to between 240 and 270 feet, thicknesses of this order being maintained to Mount Russell, the most northerly of the Mountain Front sections (Fig. 2).

Although the name Sullivan Formation could be extended to strata equivalent in lithology and age in the Plains subsurface, this has not been done. The reason is the uncertainty as to whether equivalents of the Arctomys-Waterfowl are present above the Pika in the Plains. For the time being, the informal designation "Upper fine clastic unit" is recommended for the Sullivan-like strata of the Plains subsurface. The name Sullivan Formation may properly be extended to these beds if and when it is proved that they do not include equivalents of the Arctomys and Waterfowl Formations.

Upper Fine Clastic Unit

The informal term "Upper fine clastic unit", is applied to an interval of siltstones, shales, and minor carbonate rocks overlying the Pika Formation in the Plains subsurface. This unit corresponds to Suska's (1963) unit f, at the Kaybob No. 5-35 well.

The dominant siltstones of the unit are mainly white, but locally grey and brown, calcareous and generally glauconitic. They commonly contain a large proportion of finely comminuted chitinous brachiopod fragments, and bear abundant organic burrows. The shales are predominantly green, with minor intervals of purple-red. They commonly contain inarticulate brachiopods and rarely trilobite fragments. Carbonate rocks are present only in small amounts, and do not occur in all wells. They are almost entirely biocalcarenites and derived dolomites. A few beds of very fine-grained sandstone occur in the Upper fine clastic unit in some wells.

The Upper fine clastic unit varies in thickness between 60 feet and 480 feet. The base of the unit is a sharp contact with the Pika limestone or dolomite. The top of the unit, on the other hand, is placed where the proportion of carbonate beds increases sharply; this is a definite contact in some wells, and a very indefinite one in others.

Raasch's report (van Hees, 1959, 1964) of Crepicephalus, a Dresbachian trilobite, in the Upper fine clastic unit in the East Gilbey No. 4-5 well, confirms the Dresbachian age of the Upper fine clastic unit, and also confirms the expected diachroneity of the Sullivan-Upper Lynx contact, because Crepicephalus is a younger form than any yet collected from Sullivan outcrops.

Lynx Group (Upper Division)

The Upper Lynx of the Front Ranges, a resistant unit of carbonate rocks with minor siltstone and sandstone, overlies the Sullivan Formation (Aitken, 1965; Aitken and Greggs, in press). The unit is easily recognized in the subsurface and it corresponds to Suska's (1963) unit g at the Kaybob No. 5-35 well.

In Mountain Front outcrops, the Upper Lynx carbonates are entirely light-coloured dolomite, of which the "dense" variety predominates over the "crystalline" variety. Most of the dense dolomites are laminated, and the laminations are commonly of the algal type. Dense nodular dolomites are also widespread. Much of the "crystalline" dolomite is demonstrably derived from particulate limestones. In the subsurface, "crystalline" dolomites are dominant, and limestones occur in some wells. Particulate fabric is widespread, and oolitic dolomite and limestone are generally present at the base of the unit. Dolomitic siltstone and sandstone are present in the Upper Lynx at most localities, and locally form thick intervals. Intervals of interbedded siltstone and shale encountered in the Upper Lynx in the more easterly wells are similar in character to those of the Upper fine clastic unit. In an extensive area lying between the Pembina oil field and Athabasca River, drillstem tests of porous intervals of Upper Lynx carbonate rocks have yielded large recoveries of salt water.

The gradational lower contact of the upper Lynx has been discussed above. The formation is unconformably overlain by beds of Devonian age, except in the easternmost part of the study-area where a thin, conformable Lower Ordovician section may overlie Upper Lynx equivalents[1] (Fuller and Porter, 1962; van Hees, 1964).

The maximum thickness of the upper division of the Lynx Group in outcrop along the Mountain Front is 540 feet, at Clearwater River. The maximum thickness noted in the subsurface is 354 feet, in the Home Mobil Peers well. In part of the region south of Bow and Ghost Rivers, the formation has been removed by sub-Devonian erosion.

Devonian Formations

Formational assignments of basal Devonian units in surface sections are by the writer and are based largely on Aitken (1965). Formational assignments of basal Devonian deposits in the subsurface are based on published material and personal communications from Dr. H. R. Belyea.

Correlation Sections

The correlation sections (Figs. 2 to 7), which illustrate the main points of this paper, attempt to span directly the broad area where the Cambrian has not been penetrated, that is between Mountain Front outcrops and Foothills wells and the most westerly Cambrian penetrations in the Plains. That data-points are spaced up to 124 miles apart is regrettable, but at present unavoidable. With the single exception of section B-S, however, all correlation sections tie at their eastern ends to Profiles A-B, C-D, and E-F of van Hees (1959). The writer's minor disagreements (mainly nomenclatural)

[1] The writer is unable either to endorse or contest van Hees' placement of the base of the Ordovician at 7,732 feet in the Leduc No. 530 well (R, Fig. 1); the present assignment of the overlying beds to the Upper Lynx is tentative. On the other hand, van Hees' placement of the base of the Ordovician in the Windfall No. 12-36 well falls within an interval assigned by the writer to the Devonian Elk Point Group, on the basis of a straightforward correlation with the clearly defined base of the Devonian, as seen in core from 10,274 feet in the nearby Kaybob No. 5-35 well (T, Fig. 1), where fragments of fish bone are present in sandstone a few inches above the contact.

with van Hees' correlations are explained in earlier pages; we are in complete agreement in correlation of the principal formational contacts which appear to approximate time lines (top of Cathedral, top of Eldon, top of Pika). For this reason the writer has not duplicated van Hees' Profile A-B, which, coupled with Figures 2, 3, and 7 of this paper provide a closed correlation loop around the perimeter of the studied area.

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APPENDIX

STRATIGRAPHIC SECTIONS

1. Composite Section AC-86/AC-87, Miette Range (township 48, range 27, west of the 5th meridian). (A, Figs. 1, 2, 7)

The following section was studied and measured in two parts. The upper part, spanning an interval from beds low in the Eldon Formation to beds low in the Flume Formation, was measured at reasonably accessible exposures near the top of a long, largely unforested spur projecting northwestward from the northeast shoulder of Roche Miette toward the highway. The base of the Eldon and subjacent beds are not exposed at this locality. The lower part of the section, spanning the interval from the uppermost beds of the Gog Group to a horizon in the Eldon Formation correlative with the base of the former section was measured on the northeast slopes of a minor summit, elevation 7,300 feet plus, which lies midway between Capitol Mountain and Utopia Mountain and directly overlooks Miette Hot Springs to the northeast. The two sections are correlated on the contact between two distinct lithologic units of the Eldon Formation; some gain or loss of section may be involved. The somewhat disturbed section of the Eldon Formation at the latter locality (AC-87) does not precisely duplicate the sequence of rock units at the former locality (AC-86), and appears to be 55 feet thinner. A 5-foot staff was used for measurement. Lithologic descriptions are based on field descriptions amplified by laboratory study of systematically collected rock specimens.

Unit No.		Thickness in Feet Unit	Total from base
	UPPER PART (AC-86)		
	FAIRHOLME GROUP (FLUME FORMATION)		
	The units described below are moderately resistant.		
4	Limestone as below, thick-bedded, massive, with abundant silicified stromatoporoids.	not meas.	
3	Limestone, mainly brown, dense, dolomitic, laminated, partly platy, brown-weathering; one 8-inch massive bed of grey, dense, grey-weathering limestone.	11	51

Unit No.		Thickness in Feet Unit	Total from base
2	At the base, three feet of limestone, biomicrite or biocalcisiltite, grey-brown, dolomitic, laminated platy, with abundant Amphipora. Grades upward to limestone, largely leuco-pelsparite, light grey, thick-bedded, massive, light grey-weathering, some beds containing abundant dolomitized Amphipora.	38	40
1	Dolomite, brown, very fine-equicrystalline, argillaceous, bituminous, brown-grey weathering, with abundant small Amphipora (?) preserved as white medium crystalline dolomite.	2	2
	Total thickness of Fairholme Group.	51	
	Contact poorly exposed, apparently planar and concordant. Dolomite below contact is locally stained red and orange.		
	WATERFOWL FORMATION		
1	Siltstone, dolomitic, and dolomite, microcrystalline, silty, brownish grey to yellowish grey, mainly thick-bedded, massive, grey- and yellow-grey-weathering, with minor resistant silicified lenticles. Intervals 7 to 9 feet and 16 to 20 feet above the base contain several thin beds of sandstone, light yellowish grey, fine-grained, well sorted, dolomitic. A resistant unit.	33	33
	Total thickness of Waterfowl Formation.	33	
	Gradational contact.		

Unit No.		Thickness in Feet Unit	Total from base
	ARCTOMYS FORMATION		
8	Siltstone as below. 30 per cent of the unit is 1- to 2-foot intervals of interlaminated siltstone and shale, dark grey to black, silty, hard, platy. Local ripple-marks.	55	283
7	At the base, mainly dolomite, brown, dense, silty, argillaceous, grading to dolomitic mudstone with abundant siltstone laminae. Grades upward to mainly siltstone, brownish grey to yellowish grey, dolomitic, pyritic, cross-laminated; mainly thick-bedded, massive with minor platy recessive intervals. Weathers yellow-grey and orange. Local ripple-marks and mud-cracks. At the top, 1 foot of shale, dark grey, hard, platy.	70.5	228
6	Siltstone, light yellow-grey, pink, dolomitic, thin-bedded, cross-laminated, orange weathering.	6.5	157.5
5	Siltstone, yellow and yellowish grey, dolomitic, partly with blebs of calcite; thin shale partings; largely platy and recessive. Minor silty dolomite.	19	151
4	Recessive, poorly exposed. 30 per cent shale, purple-red, green, fissile, partly dolomitic. 70 per cent siltstone, partly yellowish white, minor green and pink, dolomitic, calcareous, hard, compact, porous; partly yellow, soft, earthy to microcrystalline, calcareous, porous, with abundant small calcite-lined vugs. Minor silty dolomite. Interval is thin- to very thin-bedded, laminated and cross-laminated, platy,		

Unit No.		Thickness in Feet Unit	Total from base
	orange weathering. Mud-cracks and ripple-marks common, salt-crystal casts rare.	29	132
3	Recessive, poorly exposed. 40 per cent shale, purple-red and green, as below. 60 per cent siltstone, yellow, calcareous, very dolomitic, soft, vuggy, thin- to very thin-bedded, platy and flaggy. Cross-lamination and ripple-marks widespread, salt-crystal casts rare. Interval weathers yellow.	61	103
2	Shale, purple-red, minor green, with minor laminae and lenses of siltstone, yellow, calcareous. Rare mud-cracks and salt-crystal casts.	22	42
1	Shale, green to olive, dolomitic, fissile to platy. Very minor thin beds of dolomite, yellow-grey, very fine-crystalline, very argillaceous. Interval weathers khaki-coloured, recessive.	20	20
	Total thickness of Arctomys Formation.	283	
	Gradational contact.		
	PIKA FORMATION		
15	Dolomite, yellow-grey, very fine-crystalline, very argillaceous, irregularly very thin-bedded, orange weathering. Burrows widespread. Minor mudstone, very dolomitic, grading to shale. Interval is moderately recessive.	14	235.5
14	85 per cent shale, greenish khaki, very dolomitic, soft, fissile; 15 per cent dolomite, very fine-crystalline, mainly ex-flat-pebble conglomerate,		

Unit No.		Thickness in Feet Unit	Total from base
	brown pebbles in light yellow-grey matrix; some inter-crystalline porosity. Recessive.	22	221.5
13	50 per cent dolomite, yellowish khaki, very fine-crystalline, siliceous, partly argillaceous, partly ex-flat-pebble conglomerate as above. 50 per cent shale and platy mudstone, yellow, very dolomitic. Mud-cracks.	11.5	199.5
12	Shale, olive to khaki, dolomitic and calcareous, fissile.	14.5	188
11	Recessive, poorly exposed. 80 per cent shale, olive-green, minor khaki, fissile, partly micaceous. 20 per cent dolomite, yellowish khaki, very fine-equicrystalline, very siliceous, with calcite-lined vugs; occurs in thin-bedded 1-foot intervals.	21	173.5
10	Mudstone, olive-grey, very dolomitic, partly calcareous, weathers yellow and orange.	7	152.5
9	Dolomite, as above, weathers yellow to orange.	2.5	145.5
8	Recessive, poorly exposed. Shale, greenish grey, fissile, grading to mudstone, calcareous and dolomitic, partly with limestone nodules.	12	143
7	Limestone, mainly micrite, very thin-bedded, flaggy, with irregular partings of dolomite, yellow-grey, very fine crystalline, calcareous. Many thin beds of flat-pebble conglomerate. Several 1/4-inch to 1 1/2-inch beds of trilobite biocalcisiltite and biosparite,		

Unit No.		Thickness in Feet Unit	Total from base
	yielding abundant specimens. G.S.C. cat. Nos. 57617 and 57630; (Identifications by W.H. Fritz) cf. Rowia or Ehmaniella; Parehmania? sp. Limestone is locally entirely dolomitized to dolomite, grey, very fine-crystalline, very calcareous, slightly argillaceous, mottled with dolomite, pale brown, very fine-crystalline.	21.5	131
6	Covered, except for a 3-foot rib of thin-bedded limestone as above, 8 feet below the top of the unit. Interval sheds float of grey and green shale; thin limestone beds may be present also.	34	109.5
5	Very thinly interbedded and inter-laminated limestone, dolomitic, micrite, and dolomite, light yellow grey, very fine-crystalline, calcareous, orange weathering. A single massive resistant unit. Trilobites, G.S.C. cat. No. 57626, collected from a thin bed of trilobite biocalcisiltite 3 feet above the base. (Identification by W.H. Fritz) Elrathia? sp.	4	75.5
4	Covered.	60	71.5
3	Limestone, thin-bedded calcisiltite and micrite, with partings and mottlings of dolomite as below; flaggy.	2	11.5
2	Limestone, dolomite-mottled micrite, non-bedded, massive; abundant burrows. A single massive resistant unit.	4	9.5
1	Limestone, mainly thin-bedded calcisiltite, with partings and mottlings of very fine crystalline dolomite. One 8-inch bed of		

Unit No.		Thickness in Feet Unit	Total from base
	intrasparite, very dolomitic, and one 4-inch to 6-inch bed of trilobite biosparite. One 1-inch to 2-inch bed of flat-pebble conglomerate, partly pink, with trilobite biocalcisiltite matrix. One bed is topped by large scale oscillation ripple-marks. Unit is moderately resistant.	5.5	5.5
	Total thickness of Pika Formation.	235.5	
	Abruptly gradational, conformable contact.		
	ELDON FORMATION		
	Units 2 to 10 below are strongly resistant.		
10	Limestone, dolomite-mottled micrite as below; becomes flaggy on prolonged weathering.	6.5	336
9	Limestone as below, interspersed with subordinate pelsparite beds up to 6 inches thick.	20	329.5
8	Limestone, micrite, prominently mottled by dolomite, very light brown, calcareous, very fine-crystalline; non-bedded, massive; aligned mottlings locally suggest thin bedding. Burrows are prominent, especially in upper third.	124	309.5
7	Limestone, pelsparite, very dolomitic, medium- to very thick-bedded, massive, partly irregularly laminated; grey weathering.	19	185.5
6	Unit composed of two laterally alternating, laterally segregated facies; (a) intervals, characteristically two feet wide, of dolomitic pelsparite in thin beds,		

Unit No.		Thickness in Feet Unit	Total from base
	separated by concave-upward laminae of very fine-crystalline dolomite; (b) intervals, 2 to 3 feet wide, of limestone, light grey, dense, massive, with prominent random mottling by very fine-crystalline dolomite. The non-bedded masses are probably stromatolitic in origin.	23	166.5
5	Limestone, almost entirely pelsparite, variably dolomitic; indistinctly thin-bedded, massive, grey weathering.	24	143.5
4	Limestone, mainly micrite with subordinate pelsparite, strongly mottled by dolomite, very light brown, very fine-equicrystalline. Dolomite locally exceeds 50 per cent of the mass. Non-bedded, massive; aligned mottling locally produces thin-bedded appearance.	19	119.5
3	Limestone, mainly intra-pelsparite, dolomitic, non-bedded, very massive, grey-weathering.	21	100.5
2	Limestone, alternately micrite, dolomite-mottled, thin-bedded, and pelsparite, thin- and medium-bedded. Unit is massive, grey-weathering.	15	79.5
	Offset to lower part of section (AC/87) on contact between units 1 and 2.		
	LOWER PART (AC/87)		
	ELDON FORMATION (Continued)		
1	Limestone, mainly thin-bedded micrite, largely very dolomitic, with partings and mottlings of dolomite, yellow to very light brown, very fine-equicrystalline,		

Unit No.		Thickness in Feet Unit	Total from base
	calcareous. Dolomitized and pyritized burrows are common. Two-inch beds of intrasparite occur at wide intervals. Uppermost 25 feet of unit contains 5 to 7 per cent of 6- to 12-inch beds of oosparite and oocalcisiltite. Unit is moderately resistant; resistance increases upward.	64.5	64.5
	Total thickness of Eldon Formation.	336	
	LOWER FINE CLASTIC UNIT		
	This unit supports largely talus-covered slopes, interrupted by two ribs of limestone outcrop in the lower third.		
13	Covered.	74	843
12	Shale, green, splintery; minor thin beds of limestone, calcisiltite and biocalcisiltite, partly silty. Minor beds of cross-laminated calcareous siltstone. Shale increases upward to 100 per cent. At the base, 1 foot of grey dolomitic biocalcarenite, coarse-grained, overlies a thin bed of purple-red shale.	30	769
11	Covered. Thickness questionable because of change of dip within unit. Interval sheds talus of shale, olive-green, splintery, partly silty, and calcareous siltstone and silty limestone with abundant trails and burrows. Rare slabs of silty limestone bear trilobite free cheeks and rare small cranidia, G.S.C. Cat. No. 57619, (Identification by W.H. Fritz) Ehmaniella sp.	329	739

Unit No.		Thickness in Feet Unit	Total from base
10	Siltstone and silty biocalcisiltite, grey, very thin-bedded, brown weathering, platy, with dimpled and burrowed bedding surfaces. At the base, overlies green silty shale. At the top, a 10-inch bed of limestone, grey oolitic micro-conglomerate (lithocalcarenite), glauconitic, dolomitic. Top of bed is irregular, lumpy, coated with glauconite. Chitinous brachiopods common in siltstones. Slightly resistant.	6	410
9	Covered.	98	404
8	Limestone, micrite, strongly dolomite-mottled, non-bedded, massive. Minor intramicrite with pockets of intrasparite. A resistant unit. Possibly represents uppermost unit of Cathedral equivalent.	49	306
7	Recessive, poorly exposed. Shale, deep green, partly waxy, partly chloritic, platy. Rare thin beds of dolomitic siltstone, glauconitic trilobite-pelmatozoan biocalcarenite, and derived dolomite.	71	257
6	Limestone, mainly pisolite with calcisiltite matrix, very dolomitic, becoming dolomite upwards. Very thick-bedded, massive below, becoming flaggy in top 8 feet. Resistant, weathers pale brown.	21.5	186
5	Limestone, mainly calcisiltite, thin-bedded with dolomite partings. Rare thin beds of biocalcarenite. Near the top, minor thin beds of oolite and flat-pebble conglomerate.	20.5	164.5
4	Limestone, pisolite with dolomitized calcisiltite matrix; a single massive bed.	3.5	144

Unit No.		Thickness in Feet Unit	Total from base
3	Limestone, mainly calcisiltite, thin- and very thin-bedded with prominent partings of light brown, very fine-crystalline dolomite. At the base, a 2-foot bed of biocalcarenite with scattered algal pisolites. In the top 5 feet, several thin beds of fine oosparite.	30	140.5
2	Covered. In nearby exposures, interval is occupied by sheared green shale with minor siltstone beds.	101.5	110.5
1	Shale, deep green, chloritic, sheared, with many thin beds of siltstone, dolomitic, brown weathering, and dolomite, pale orange, very fine-crystalline, argillaceous, very silty. Tops of siltstone and dolomite beds are coated with glauconite and covered with burrows. Traces of trilobite remains.	9	9
	Total thickness of lower fine clastic unit.	843	
	Abrupt, concordant contact.		
	GOG GROUP		
1	Quartzite, fine-grained, well sorted, 60 per cent purple to pink, ferruginous, 40 per cent white, locally calcareous; mainly thick-bedded, massive, with minor thin-bedded intervals. Burrows are present at the tops of most beds.	31	31
	Section ends downward at structurally disturbed quartzite beds.		

2. Composite Section AC-39/AC-40, Windy Point (township 38, range 17, west of the 5th meridian). (F, Figs. 1, 2, 5)

Five miles southwest of Tershishner Creek, the David Thompson Road crosses a prominent limestone spur which descends from the mountain on the north to the North Saskatchewan River. This feature is known as Windy Point. One-half mile northeast of Windy Point, the McConnell Thrust brings Cambrian rocks into contact with the Lower Cretaceous Luscar Formation (Douglas, 1956, map). A splay fault subsidiary to the McConnell Thrust passes immediately east of Windy Point and west of the minor summit, elevation 7,000 feet-plus, one mile to the north. This splay fault exposes Middle Cambrian rocks that are not present above the trace of the McConnell Thrust proper. For this reason the following section was measured in two parts. The upper part (AC-40), which spans the interval from the base of the Arctomys Formation to the Devonian Cairn Formation, was measured at very good and highly accessible exposures directly uphill from the abandoned site of the McDermott-Triad Cline River No. 9-17 well, about one-half mile northeast of Windy Point. The lower part (AC-39), which spans the interval from the lowest continuous exposures of the Cathedral Formation to the base of the Arctomys Formation, was measured in the hanging-wall block of the above mentioned splay fault, at excellent exposures north of the saddle west of the 7,000-foot summit, and is much more difficult of access, except by helicopter. Measurement was by 5-foot staff. Lithologic descriptions are based on field descriptions, amplified by laboratory examination of systematically collected specimens.

SECTION AC-40

Unit No.		Thickness in Feet Unit	Total from base
	FAIRHOLME GROUP (CAIRN FORMATION)		
2	Dolomite, brown, crystalline, containing abundant large tabular 1-inch-thick bodies of black chert and abundant silicified stromatoporoids; very massive, cliff-forming.	20-plus	55
1	Covered.	35	35
	LYNX FORMATION (upper division)		
	The units described below form bold, persistent cliffs.		

Unit No.		Thickness in Feet Unit	Total from base
11	Dolomite, grey, light brown, fine- and very fine-crystalline, scattered vugs; non-bedded, grey-weathering, massive.	23	278
10	Dolomite, light grey, light yellowish and pinkish grey, fine- and very fine-crystalline, minor microcrystalline, mostly silty, with laminae and rare thin beds of siltstone; laminated, massive; 23 feet and 37 feet above base, ten-inch beds of sandstone, grey to yellowish-white, very fine-grained, very dolomitic.	84	255
9	Dolomite, light brown and brownish grey, fine-crystalline to microcrystalline, partly sandy; laminated and cross-laminated, massive; lenticles and very thin beds of dark grey chert occur at intervals.	25	171
8	Sandstone, as Unit 6.	1	146
7	Dolomite, light brown, mottled, very finely crystalline, relict pelletoid fabric; also dolomite, yellowish grey, microcrystalline, silty, grading to dolomitic siltstone; blebs of grey chert at base.	12	145
6	Sandstone, very light yellowish grey, fine-grained, poorly sorted, low roundness and sphericity, very dolomitic.	1	133
5	Dolomite, brownish grey, very fine and microcrystalline, mostly silty to very silty; laminated, massive, dark-grey weathering, monotonous.	32	132
4	Dolomite, very silty, and siltstone, dolomitic, brownish grey to purplish brown, microcrystalline; laminated		

Unit No.		Thickness in Feet Unit	Total from base
	and cross-laminated, some ripple-marks, weathers grey and buff.	40	100
3	Dolomite, grey, greyish brown, fine- and very fine-crystalline, silty, interbedded, interlaminated and inter-lensed with siltstone, brown, greyish brown, dolomitic; laminations disturbed, wavy; unit is massive, weathers mottled brown; 17 feet above base, a horizon of hemispherical stromatolites with 6 inches relief.	50.5	60
2	Shale, grey, red, green, mottled, very dolomitic, very compact, conchoidal fracture.	1	9.5
1	Dolomite, yellowish and brownish grey, fine- and very fine-crystalline, also interlaminated and inter-lensed dolomite and siltstone as Unit 3. Unit is capped by a layer of egg-shaped stromatolites 1 foot high; oolitic dolomite locally present at base to a maximum thickness of 8 inches.	8.5	8.5
	Total thickness of upper Lynx.	278	
	Sharp contact with underlying recessive shales.		
	SULLIVAN FORMATION		
13	Ninety per cent shale, grey to olive, minor brown, fissile, with abundant thin lenses of siltstone, greenish grey, pale brown, dolomitic, calcareous. Ten per cent dolomite, at the base microcrystalline, silty, platy; higher, mainly very fine- to medium-crystalline; ex-calcarenite, ex-conglomerate, and ex-oolite; in orange-weathering 1- to 2-foot intervals. Unit is moderately recessive.	33	270.5

Unit No.		Thickness in Feet Unit	Total from base
12	Covered.	67	237.5
11	Recessive, slumped, very poorly exposed. 90 per cent shale, grey to brown, fissile. 10 per cent limestone, flatstone and roundstone conglomerate, and trilobite-pelmatozoan biocalcarenite, glauconitic, pebbly. Minor platy dense limestone. From the base, G.S.C. Cat. No. 52580,	35	170.5
	(Identifications by B.S. Norford) ? <u>Coosella</u> sp. <u>Kormagnostus</u> <u>simplex</u> Resser <u>Claragnostus</u> sp.		
10	Limestone, trilobite-pelmatozoan biosparite, glauconitic, pebbly, largely altered to orange-weathering, medium-crystalline dolomite.	2.5	135.5
9	Recessive, very poorly exposed. Mainly shale, greenish grey, soft, fissile, with widely spaced medium beds of limestone, trilobite-pelmatozoan biocalcarenite and biosparite, glauconitic, very dolomitic.	57	133
8	Limestone, largely oolite as below, subordinate trilobite biocalcarenite and biosparite, glauconitic; dolomitic, orange-weathering, massive. Rare lenticles of laminated siltstone.	9	76
7	Shale, grey to light brown, calcareous, platy, locally nodular.	2	67
6	Limestone, oosparite and oocalcisiltite, very dolomitic, massive, resistant. Discontinuous one-half-inch-thick slabs or lenticles of dense silty orange-weathering dolomite give a crudely thin-bedded appearance. At the base, near-spherical stromatolites of grey dense limestone, 4 feet in		

Unit No.		Thickness in Feet Unit	Total from base
	diameter. Trilobites collected from top of unit, G.S.C. Cat. No. 52579.	14	65
	(Identifications by B.S. Norford) Arapahoia aff. A. snowiensis Howell and Duncan Arapahoia cf. A.aspinosa Lochman Cedarina cf. C. cordillerae Howell and Duncan Kormagnostus simplex Resser		
5	Covered.	5.5	51
4	Limestone, oosparite, with scattered trilobite fragments and orange-weathering bodies as above.	3.5	45.5
3	Shale as below, with two 3-inch beds of limestone, trilobite biocalcarenite, biosparite, and biocalcisiltite, very glauconitic, commonly conglomeratic. G.S.C. Cat. No. 52578.	3.5	42
	(Identifications by B.S. Norford) Arapahoia aff. A. snowiensis Howell and Duncan Kormagnostus simplex Resser		
2	Ninety per cent shale, grey, fissile. Ten per cent siltstone, grey and light yellow-brown, calcareous, dolomitic, glauconitic, very thin-bedded, flaggy. Prominent sole-markings and burrows. Recessive.	31	38.5
1	Very recessive, very poorly exposed. Shale as above, with two thin beds of dolomite, grey, medium-crystalline, orange-weathering, very glauconitic, ex-coarse calcarenite.	7.5	7.5
	Total thickness of Sullivan Formation.	270.5	
	Abrupt, concordant contact.		

Unit No.		Thickness in Feet Unit	Total from base
	WATERFOWL FORMATION		
6	Mainly siltstone, greenish white to brownish grey, dolomitic, and minor silty dolomite, laminated, locally sandy. Unit is resistant, weathers pale yellow-brown, but orange-pink in uppermost 8 feet. Twelve feet above the base, a thin bed of siltstone flat-pebble conglomerate. Twenty-two feet above the base, thin beds of very fine-grained sandstone.	36.5	93
5	Interbedded dolomite, light grey and brownish grey, very fine-crystalline, silty, partly sandy, partly ex-calcarenite, and siltstone, dolomitic; thick-bedded, laminated, massive, resistant, weathers grey and pale yellow-brown.	13	56.5
4	Dolomite, light grey, very fine-crystalline, very sandy, laminated and cross-laminated, brown-weathering, massive, resistant.	5	43.5
3	Seventy per cent dolomite as Unit 1; 30 per cent siltstone, grey, partly dolomitic, partly silicified, in units 1 inch to 2 feet thick. Massive, resistant.	18.5	38.5
2	Dolomite, brown, very fine-crystalline, ex-oosparite, massive, resistant.	11.5	20
1	Dolomite, brown, grey, very fine-crystalline and microcrystalline, argillaceous, silty, thin- and medium-bedded, massive, with wavy laminations.	8.5	8.5
	Total thickness of Waterfowl Formation.	93	
	Gradational contact.		

Unit No.		Thickness in Feet Unit	Total from base
	ARCTOMYS FORMATION		
14	Interbedded siltstone, brown, grey, dolomitic, laminated, flaggy, yellow-weathering, with rare laminae of very fine-grained sandstone, and shale, brown, black, hard, platy, partly silty. Rare beds of siltstone flat-pebble conglomerate. Sole-markings, ripple-marks, rare salt-crystal casts. Proportion of shale diminishes upward.	56.5	211.5
13	Siltstone as above, with a median six-inch bed of shale as above. Moderately resistant, weathers pale grey.	10	155
12	Covered.	17	145
11	Dolomite, grey, microcrystalline, silty, and dolomitic siltstone, thin-bedded, laminated, flaggy, yellow-grey weathering; minor dolomitic shale. Five feet above the base, large pillow-shaped stromatolites 18 inches high, of grey microcrystalline dolomite, with conglomerate at the base.	22.5	128
10	Covered.	2	105.5
9	Breccia of shale chips, cemented by crystalline calcite; soft, non-resistant.	.5	103.5
8	Interbedded dolomite, microcrystalline, argillaceous, slightly silty, laminated, yellow-grey-weathering, and siltstone, calcareous, partly very light grey, vuggy, partly yellow, earthy, very thin-bedded, platy, cross-laminated.	10	103
7	Covered, except for 2 inches of calcareous breccia as above.	6	93

Unit No.		Thickness in Feet Unit	Total from base
6	Siltstone, grey-green with purple laminae, dolomitic, cross-laminated, flaggy, pale yellow-weathering. Mud-cracks.	9	87
5	Covered.	5.5	78
4	Alternating intervals of siltstone as above and shale, olive-green, hard, fissile. Salt-crystal casts.	17.5	72.5
3	Interbedded green shale and siltstone, partly pale green, dolomitic, partly silicified, hard, dense, and partly yellow, calcareous, soft, earthy, porous. Ten feet below the top, a 1-inch bed of flat-pebble conglomerate.	27	55
2	Interbedded shale, green above, purple below, fissile, with siltstone-filled mud-cracks, and siltstone, pinkish green to pale yellow brown, calcareous, laminated and cross-laminated, pyritic, vuggy, platy to flaggy. Unit forms ledgy outcrop.	25.5	28
1	Covered.	2.5	2.5
	Total thickness of Arctomys Formation.	211.5	
	Contact concealed, concordant.		
	Uppermost 2 feet of underlying dolomite is stained pink to orange.		

SECTION AC-39

PIKA FORMATION

18	Dolomite, light grey to brown, fine-crystalline, partly ex-pelsparite; medium-bedded, massive, weathers		

Unit No.		Thickness in Feet Unit	Total from base
	pale orange. Uppermost bed is a 2-inch bed with abundant algal pisoliths (oncoliths) up to 2 inches maximum diameter.	15	318.5
17	At the base, 1 foot of shale, grey to olive, dolomitic, fissile, khaki-weathering, grading up through very argillaceous dense rubbly dolomite to dolomite, grey-brown, partly mottled, fine-crystalline, slightly silty, slightly argillaceous, thin-bedded. Moderately resistant.	8	303.5
16	Dolomite, mottled pale brown and brown, very fine-crystalline, silty, argillaceous, thin-bedded, flaggy, partly rubbly; weathers mottled grey and orange, moderately resistant. Six feet above the base a 1-foot massive bed of dolomite, ex-intrasparite.	13	295.5
15	Dolomite, light brown, very fine-crystalline, ex-oolite, and oolitic calcarenite, coarse below, fine above; massive, resistant.	4.5	282.5
14	Seventy-five per cent dolomite and dolomite conglomerate as below; 25 per cent medium beds of dolomite, fine-crystalline, ex-oolite and ex-pelsparite. Conglomerates in part have oolitic matrix.	29	278
13	Seventy-five per cent dolomite, as below, irregularly thin-bedded, flaggy. Twenty-five per cent thin and medium beds of dolomite, fine- and very fine-crystalline, ex-flat-pebble conglomerate. Sixteen feet above the base, a 4-inch bed of ex-oolite, with abundant algal pisolites.	42	249

Unit No.		Thickness in Feet Unit	Total from base
12	Dolomite, brown, fine- and very fine-crystalline, mosaic, locally laminated, largely mottled in the style of dolomite-mottled limestone. Partly ex-pelsparite in basal 5 feet. Burrows in some beds. Medium-bedded, massive, weathers grey-brown, moderately resistant, poorly exposed in upper half.	25.5	207
11	Dolomite, grey, pale brown, fine- and very fine-crystalline, argillaceous, silty, bedding style and mottling as underlying limestone beds. Weathers smooth pale yellow brown, forms a small cliff.	16.5	181.5
10	Covered, except for 1 1/2 feet of thin bedded limestone as below, 3 feet above the base. Clay-rich talus suggests shale.	10	165
9	Limestone, micrite, thin and very thin bedded, flaggy, with prominent partings and mottlings of dolomite, pale brown, very fine-crystalline, calcareous. Bedding-plane markings as below. One 3-inch bed of flat-pebble conglomerate near top.	28	155
8	Covered, except for 1 foot of thin-bedded limestone as below, 3 feet above the base. Float of grey fissile shale, and thin dense limestone beds with burrows and/or coprolites.	11	127
7	Limestone, calcisiltite and trilobite calcisiltite, thin-bedded, flaggy to platy; weakly resistant. G.S.C. Cat. No. 52577.	6	116
	(Identifications by W.H. Fritz) _Bolaspidella_ sp. _Americare_ sp.		

Unit No.		Thickness in Feet Unit	Total from base
	Rowia sp. 2 *Rowia*? sp. *Parehmania*? sp.		
6	Covered.	8	110
5	Limestone, calcisiltite and minor biocalcisiltite, very thin-bedded, flaggy, with very irregular prominent partings of dense dolomite. Light-tan-weathering parting material outlines a variety of burrows and other markings on bedding planes. Weathers grey striped with light tan, forms a small cliff.	31	102
4	Covered. Talus of dark grey fissile shale.	14	71
3	Recessive, poorly exposed. Limestone, calcisiltite and biocalcisiltite, very thin-bedded, platy, with interbeds of grey shale. Minor conglomerate, abundant burrows. Trilobite collection G.S.C. Cat. No. 52576.	14	57
	(Identifications by W.H. Fritz) *Marjumia* sp. 1 *Marjumia* sp. 2 *Marjumia*? sp. *Modocia* sp. 2 *Modocia*? sp.		
2	Limestone as below, but irregularly bedded, beds 1/2 inch to 6 inches. Small cliff-former, weathers light brown.	22	43
1	Limestone, thin-bedded micrite and calcisiltite, with scattered pellets and intraclasts, in regular 3/4 inch flaggy beds, with thin partings of dolomite, pale brown, very		

Unit No.		Thickness in Feet Unit	Total from base
	fine-crystalline. Forms a series of small ledges, weathers light brown.	21	21
	Total thickness of Pika Formation.	318.5	
	Gradational contact.		
	ELDON FORMATION		
22	Limestone, intrasparite and dolomite-mottled micrite, thick-bedded, massive, brown-weathering, resistant.	10.5	781.5
21	Limestone, leuco-intrapelsparite, dolomitic, non-bedded, massive, resistant. Discontinuous dolomite laminae locally pass into patches of dolomite, very light grey, medium-equicrystalline, mosaic. Unit weathers very pale grey.	73	771
20	Limestone as above, with mottling, filigree, and patches of light coloured dolomite.	13	698
19	Dolomite, light grey, fine- and medium-equicrystalline, mosaic, non-bedded, massive, weathers cream-coloured.	32	685
18	Limestone, leuco-pelsparite, non-bedded, massive, with 30 per cent dolomite, grey, fine-crystalline, in widely spaced 1- to 2-foot intervals and random masses.	65	653
17	Limestone, leuco-pelsparite and leuco-intrasparite. In the basal third, a few thick beds of brown micrite and intra-sparite. Massive, resistant.	130	588
16	Dolomite, very calcareous, light grey-brown, very fine-crystalline, with relict intraclasts.	7	458

Unit No.		Thickness in Feet Unit	Total from base
15	Limestone, leuco-intrapelsparite, non-bedded, massive, resistant. Weathers very pale grey.	15	451
14	Dolomite, as Unit 16.	3	436
13	Limestone, leuco-intrasparite and leuco-pelsparite, with scattered clots of light coloured, coarse dolomite crystals; non-bedded, very massive, resistant. Thickness of unit in doubt because of tectonic disturbance.	95	433
12	A heterogeneous unit of micrite and intrasparite, with minor pisolite-sparite beds. Partly replaced by dolomite, calcareous, light brownish grey, fine-equicrystalline, euhedral, brown weathering. Unit is massive.	44	338
11	Limestone, pelsparite and intrasparite, thin- and medium-bedded, slightly dolomite-mottled.	17.5	294
10	Limestone, micrite, thin-bedded, massive, with partings and mottlings of dense dolomite. Subordinate medium beds of pelsparite and intrasparite. Unit is grey weathering, resistant.	23.5	276.5
9	Limestone, mainly pelsparite, medium-bedded, massive.	8	253
8	Limestone, mainly dolomite-mottled micrite, non-bedded, massive. Minor intervals of pelsparite.	38	245
7	Limestone, micrite, thin-bedded, flaggy, with irregular tan-weathering partings of dense dolomite; slightly recessive.	9	207

Unit No.		Thickness in Feet Unit	Total from base
6	Limestone, micrite, strongly dolomite mottled, non-bedded, massive. Large spongy patches of dolomite, light brown, very fine-crystalline.	23	198
5	Limestone, dolomite-mottled micrite, non-bedded, massive. Aligned mottling suggests bedding. Mottling in part follows cylindrical structures, probably burrows.	33	175
4	Limestone, micrite, with mottlings and partings of very fine-crystalline dolomite; flaggy at base, becoming massive, cliff-forming upward. Weathers light grey with dolomite partings and mottlings in relief.	109	142
3	Covered.	9.5	33
2	Limestone, as below, but dolomite partings are less prominent, and less persistent; bedding thickness 1/2 inch to 2 inches. Rare traces of trilobite fragments. Forms a small cliff.	15.5	23.5
1	Limestone, calcisiltite and micrite, slightly silty, slightly argillaceous, very thin-bedded, flaggy; partings of argillaceous dense dolomite are very prominent, locally reaching 50 per cent of total. Unit is somewhat sheared, weakly resistant.	8	8
	Total thickness of Eldon Formation.	781.5	
	Contact not exposed.		
	STEPHEN FORMATION		
14	Covered.	45	214

Unit No.		Thickness in Feet Unit	Total from base
13	Slate, light greenish-grey, calcareous, fissile, sheared, with nodules of calcisiltite.	4.5	169
12	Covered.	47.5	164.5
11	Shale, light green, partly non-calcareous, very fissile, partly calcareous, weakly platy; widely spaced 1-inch beds of siltstone, green, calcareous, laminated, with abundant "lebensspüren". Eight feet below the top, one 2-inch bed of trilobite biocalcarenite, glauconitic, conglomeratic.	26	117
10	Shale, green, very calcareous, weakly platy, partly glauconitic, with a few 1/2-inch beds of siltstone, green, calcareous, brown weathering.	12	91
9	Covered.	5	79
8	Siltstone, grey, calcareous, partly dolomitic, laminated, with partings of grey shale.	3	74
7	Covered. Float of greenish grey shale.	31	71
6	Shale, green, very fissile, with very minor 1/4-inch beds of siltstone as above.	1.5	40
5	Limestone, trilobite bio-oosparite, partly conglomeratic, in very irregular, lenticular 1-inch to 6-inch beds, interbedded with siltstone as above and shale, grey to brown.	2.5	38.5
4	Shale, olive to light yellow green, fissile, glauconitic, silty. Highly sheared.	12	36
3	Covered.	11	24

Unit No.		Thickness in Feet Unit	Total from base
2	Limestone, calcisiltite, laminated, platy, with partings of dense dolomite.	1	13
1	Covered.	12	12
	Total thickness of Stephen Formation.	214	
	Contact not exposed.		
	CATHEDRAL FORMATION		
6	Limestone, dolomite-mottled micrite, non-bedded, massive, resistant, cliff-forming; thin bedding becomes apparent toward top of unit.	269	483
5	Limestone, micrite, in flaggy thin lenticular beds, with prominent partings and mottlings of dense dolomite. Proportion of dolomite increases upward to, locally, 50 per cent. Unit is slightly recessive.	66.5	214
4	Limestone, dolomite-mottled micrite, massive, resistant. Dolomite in part forms branching cylindrical bodies, probably burrows.	3.5	147.5
3	Limestone, mainly dolomite-mottled micrite, non-bedded, massive, with minor non-mottled beds of intra-sparite. A resistant unit.	44	144
2	Dolomite, grey to very light grey, fine inequicrystalline, calcareous, partly shattered, non-bedded, massive, resistant. Several relict masses of limestone as below.	35	100
1	Limestone, leuco-intrasparite and leuco-pelsparite, non-bedded, massive, with scattered resistant clots of coarse		

Unit No.		Thickness in Feet Unit	Total from base
	light-coloured dolomite crystals. Unit weathers light grey, resistant.	65	65
	Total thickness of Cathedral Formation measured.	483	
	Section continues downward in highly disturbed outcrops of the Cathedral Formation.		

3. Composite Section AC-26/AC-27/AC-28/AC-109, Ghost River Area (townships 26 and 27, range 9, west of the 5th meridian). (L, Figs. 1, 2, 3)

The uppermost part (AC-27), of the composite section, which spans the interval from the base of the Arctomys Formation to the base of the Devonian, was measured on east-facing slopes two miles west of the summit of Black Rock Mountain. The Pika Formation was measured at better exposures (AC-26) 1/2 mile to the south of AC-27. The interval from the base of the Cathedral Formation to the base of the Pika Formation (AC-28) was measured in the northern of two deep gullies on the northeast shoulder of Orient Point, passage through the Eldon Formation being gained via steep narrow gully or "chimney" on the west side of the main gully. A tie with sub-Cathedral beds was obtained in the southeastern of the two northeast gullies of Orient Point. The incomplete section of the Mount White Formation (AC-109) was measured in outcrops on the south side of Ghost River and just above river level, at a point about 3 1/2 miles upstream from the Ghost River Diversion. All measurements were made by use of a 5-foot staff. Lithologic descriptions are based on field description amplified by laboratory examination of systematically collected specimens.

Unit No.		Thickness in Feet Unit	Total from base
	AC-27		
	CAIRN FORMATION		
5	Dolomite, brown with white patches, very fine-crystalline, calcareous, ex-pelmicrite. Abundant partly silicified stromatoporoids. Thick-bedded, massive, weathers dark brown.	Not measured	

Unit No.		Thickness in Feet Unit	Total from base
4	Recessive, poorly exposed. Limestone, partly white and brown interlaminated, micro-crystalline, partly argillaceous, vuggy; partly pelmicrite, very thin-bedded.	14	40.5
3	Recessive, poorly exposed. Dolomite, grey, very fine-equicrystalline, thick-bedded, massive, weathers yellow-grey; minor grey dense limestone as above.	11	26.5
2	Covered.	5	15.5
1	Dolomite, grey, very fine-crystalline to aphanitic, partly vuggy, mainly thick-bedded, massive, weathers yellow grey.	10.5	10.5
	Total thickness of Cairn Formation measured.	40.5	
	Contact poorly exposed, apparently concordant.		
	YAHATINDA FORMATION		
2	Dolomite (dolsiltite) pink to red, minor white, locally mottled, silty, slightly argillaceous; locally contains glauconite and dolomitized bioclasts. Thick-bedded, massive, moderately resistant.	35	38
1	Dolomite (dolsiltite) grey, pink, red, partly mottled, argillaceous, silty, and siltstone, pink to white, dolomitic, argillaceous; interval is recessive, thin-bedded, flaggy.	3	3
	Total thickness of Yahatinda Formation.	38	
	Contact fairly sharp, concordant.		

Unit No.		Thickness in Feet Unit	Total from base
	LYNX GROUP (UPPER DIVISION)		
3	Siltstone, grey, white, pink, dolomitic, and siltstone flat-pebble conglomerate; subordinate dolomite, greenish white, pinkish white, very fine-crystalline, silty, laminated. Unit is medium- and thick-bedded, massive, resistant.	22.5	90
2	Dolomite, light grey to white, minor pink, very fine-crystalline and microcrystalline, mainly silty; subordinate siltstone, dolomitic. Unit is mostly laminated; cross-lamination and contorted laminations are common. Massive, resistant, weathers pale orange.	66	67.5
1	Siltstone, pink, dolomitic, thin-bedded, laminated, cross-laminated, massive, resistant.	1.5	1.5
	Total thickness of Upper Lynx.	90	
	SULLIVAN FORMATION		
2	Dolomite, grey, brown, microcrystalline, very silty, very thin-bedded, shaly, to thick-bedded, massive. Lenticles of pink siltstone and quartzite (silicified siltstone). Minor shale, purple-red, green. Moderately recessive.	7.5	22.5
1	Covered.	15	15
	Total thickness of Sullivan Formation.	22.5	
	WATERFOWL FORMATION		
6	Dolomite, as Unit 4.	4	61
5	Shale, very silty, dolomitic, weakly fissile, grades laterally from purple to yellow-grey.	2.5	57

Unit No.		Thickness in Feet Unit	Total from base
4	Dolomite, grey, purple-grey, red, pink, very fine-crystalline and microcrystalline, partly silty. Relict oolitic calcarenite fabric locally preserved, well preserved in rare lenticles of pink chert. Thin- and medium-bedded, with shaly partings, largely red. Moderately resistant.	14.5	54.5
3	Dolomite, light grey, fine-crystalline to microcrystalline, partly silty. Laminated, massive, resistant, weathers yellow-grey. Minor siltstone as below.	27	40
2	Shale, purple-red, fissile, with thin laminae of yellow siltstone; recessive.	2	13
1	Siltstone, light grey, mainly dolomitic, partly silicified (quartzite), laminated; cross-lamination and contorted laminations widespread. A resistant, cliff-forming unit.	11	11
	Total thickness of Waterfowl Formation.	61	
	Gradational contact.		
	ARCTOMYS FORMATION		
6	Shale and siltstone as below.	1	60
5	Covered.	14	59
4	Recessive, poorly exposed. Eighty per cent shale, grey, very dolomitic, fissile, silty, grading to dolomite, microcrystalline, very argillaceous. Abundant laminae of interlaminated white and black dolomitic siltstone. Twenty per cent siltstone, yellow, very dolomitic, and silty microcrystalline dolomite, very thin-bedded, platy.	14	45

Unit No.		Thickness in Feet Unit	Total from base
3	Thinly interbedded siltstone, yellowish to greenish grey, very dolomitic, and shale, greenish grey, dolomitic, fissile. Recessive.	15	31
2	Covered.	14.5	16
1	Conglomerate, rounded pebbles of grey microcrystalline dolomite in a matrix of grey, fine-crystalline dolomite.	1.5	1.5
	Total thickness of Arctomys Formation.	60	
	Contact poorly exposed, apparently concordant.		
	(Offset to AC-26 on base of Arctomys Formation).		

AC-26

PIKA FORMATION

Unit No.		Unit	Total from base
11	Weakly resistant, poorly exposed. Dolomite as below, but with abundant beds of flat-pebble conglomerate. Six-inch beds of oolitic dolomite occur 6 feet and 20 feet below the top. Unit weathers yellow-tan.	50	320
10	Dolomite, brownish grey to brown, very fine-crystalline, commonly mottled by darker, denser dolomite. Style of bedding and mottling identical with underlying limestones. Relict masses of undolomitized limestone as Unit 9 in the lower part of the unit. Unit is moderately resistant, weathers brownish grey.	44	270
	Irregular replacement contact.		
9	Limestone, as unit 7.	28	226

Unit No.		Thickness in Feet Unit	Total from base
8	Limestone, dolomite-mottled micrite, massive, resistant. Aligned mottling suggests thin bedding.	11	198
7	Limestone, calcisiltite and micrite, thin-bedded, flaggy, with partings and mottlings of dolomite, pale brown, very fine-crystalline and micro-crystalline, argillaceous. Bedding planes are figured by a variety of burrows and fucoid-like and coprolite-like markings. Unit contains three 2-inch to 6-inch flat-pebble conglomerate beds. Unit is resistant, weathers grey striped and mottled by light tan.	41	187
6	Covered.	7	146
5	Limestone, as unit 7. At the top, a 1-inch bed of flat-pebble conglomerate.	39	139
4	Shale, brown, micaceous, fissile, slightly calcareous. Abundant thin beds, nodular beds and lenses of calcisiltite and trilobite biocalcisiltite, partly argillaceous. Recessive.	16	100
3	Covered.	4	84
2	Limestone, as below, with numerous common beds up to 4 inches thick of lime-stone flat-pebble conglomerate. Trilobite fragments noted 8 feet below the top.	29	80
1	Limestone, micrite and subordinate cal-cisiltite, thin- and very thin-bedded, flaggy, with prominent partings and mottlings of dolomite, pale brown, very fine-crystalline and microcrystalline, commonly calcareous and argillaceous. Unit weathers grey, striped and mottled by light tan, forms a cliff less steep than the underlying Eldon cliffs and separated from them by a distinct ledge.	51	51

Unit No.		Thickness in Feet Unit	Total from base
	Total thickness of Pika Formation.	320	
	Conformable contact.		
	Offset to Section AC-28 on Eldon-Pika contact.		
	AC-28		
	ELDON FORMATION		
11	Limestone as below, very little dolomite. Unit becomes coarsely flaggy, less strongly cliff-forming in the uppermost 30 feet.	50	776
10	Ninety per cent limestone as below. Ten per cent dolomite, light brown and grey-brown, fine-crystalline, mottled with very fine-crystalline darker dolomite, in the style of dolomite-mottled limestone, in intervals 6 inches to 24 inches thick. Unit weathers grey, forms a continuous steep cliff with underlying units.	59	726
9	Limestone, mainly dolomite-mottled micrite, minor pelsparite; non-bedded, massive; thin bedding suggested by alignment of mottling.	23	667
8	Seventy per cent limestone, dolomite-mottled micrite, massive. Thirty per cent derived dolomite, brown, fine-crystalline, mottled. Recrystallization of limestone marked in this unit.	22	644
7	Limestone, dolomite-mottled micrite, massive. Minor intrasparite and secondary dolomite.	30	622
6	Interbedded limestone, dolomite-mottled micrite as above, and derived dolomite, brown, fine equicrystalline, mottled by very fine-crystalline darker dolomite.	40	592

Unit No.		Thickness in Feet Unit	Total from base
5	Dolomite as below, with minor relict masses of limestone, dolomite-mottled micrite and minor pelsparite. This unit is largely limestone on inaccessible cliffs nearby.	46	552
4	Mainly dolomite, partly brown, very fine-crystalline, mottled, partly grey to white, fine equicrystalline, with relict particulate fabric, either ex-intrasparite or ex-calcarenite. Minor intervals of limestone as below.	24	506
3	Limestone, 4- to 12-inch intervals of micrite, strongly mottled, with up to 50 per cent dolomite, light brown, very fine-crystalline, alternating with 1- to 2-inch beds of non-mottled pelsparite.	40	482
2	Limestone, mainly micrite with partings and mottlings of dolomite, light brown, very fine-crystalline; thin-bedded, mainly massive, but becomes flaggy on prolonged weathering. Unit forms steep, grey-weathered cliff.	426	442
1	Limestone, mainly dark argillaceous micrite, with partings and mottlings of dolomite as above; thin-bedded, flaggy. Minor beds of trilobite biocalcisiltite near the base. Weathers dark grey, moderately resistant, slopes steepening upward.	16	16
	Total thickness of Eldon Formation.	776	
	Gradational contact.		
	STEPHEN FORMATION		
9	Slumped outcrop, lithology as below.	17	71

Unit No.		Thickness in Feet Unit	Total from base
8	Shale, as below, with several 2- to 6-inch lenticular beds of massive oolite.	5.5	54
7	Shale, grey at base, deep green, waxy, highly fissile above. A thin stratum of maroon shale at the top. In the basal 3 feet, three 2-inch beds of limestone flat-pebble conglomerate. Recessive.	14.5	48.5
6	Limestone, mainly calcisiltite and trilobite biocalcisiltite, partly argillaceous, thin-bedded, flaggy to platy, with tan-weathering partings of argillaceous dense dolomite. At several levels, the upper surfaces of beds are littered with large cranidia, pygidia, and free cheeks of Glossopleura. At the base, the trace-fossil Bergaueria is well developed. Fossil collections G.S.C. Cat. Nos. 55323, 55328, 55329. Unit is moderately resistant, weathers light yellow-grey.	17	34
5	Covered.	2	17
4	Shale, yellowish grey, soft, earthy, very calcareous, rare trilobite fragments. Tan-weathering, recessive.	1	15
3	Limestone, yellow-grey, microcrystalline, very argillaceous, very thin-bedded, platy. Prominent partings of yellow-weathering grey calcareous shale. Scattered pygidia of Glossopleura. Weakly resistant, weathers yellow grey.	6	14
2	Covered.	7	8
1	Limestone, mainly calcisiltite and trilobite biocalcisiltite, with scattered intraclasts; thin-bedded. Fossil collection G.S.C. Cat. No. 55330.	1	1
	Total thickness of Stephen Formation.	71	

Unit No.		Thickness in Feet Unit	Total from base
	Abrupt, conformable contact.		
	CATHEDRAL FORMATION		
7	Limestone, mainly dolomite-mottled micrite, subordinate pelsparite and intrasparite. Massive, resistant, forms grey-weathering, tan-mottled cliffs. Bedding visible at a distance is alternating zones of strongly mottled and weakly mottled beds.	292	522
6	Limestone, mainly pelsparite and intrasparite, minor mottled micrite. Medium and thick bedded, massive, cliff-forming.	40	230
5	Limestone, mainly micrite, thin-bedded, with discontinuous thin irregular partings of very fine-crystalline dolomite; massive, resistant. Minor pelsparite and intrasparite.	27	190
4	Limestone, calcisiltite, biocalcitite and micrite, in regular thin and very thin beds with thin partings of dolomite as above; flaggy. Unit weathers dark grey, is moderately resistant, steepening upward. Fossil collection G.S.C. Cat. No. 55344:	8	163
	(Identifications by W.H. Fritz) Glossopleura sp. Inglefieldia ? sp.		
3	Covered. Interval yields float of shale, flat-pebble conglomerate, and trilobite biocalcisiltite.	20	155
2	Limestone, mainly micrite, strongly mottled with very fine-crystalline dolomite; bedding indistinct, massive. Unit forms grey-weathering cliffs.	85	135

Unit No.		Thickness in Feet Unit	Total from base
1	Limestone, thin-bedded, with dolomite partings as above. At the base largely intramicrite and intrasparite, with minor pelsparite; higher becomes mainly dolomite-mottled micrite. Unit forms dark grey-weathering cliffs.	50	50
	Total thickness of Cathedral Formation.	522	
	Gradational contact.		
	Offset to section AC-109 on base of Cathedral Formation.		
	AC-109		
	MOUNT WHYTE FORMATION		
5	Recessive, very poorly exposed. Shale, deep green, highly sheared, with abundant nodules of limestone, light grey, microcrystalline, and rare beds of flat-pebble conglomerate.	37	72
4	As unit 2, but shale present as partings only.	2.5	35
3	Limestone, micrite, strongly dolomite-mottled, massive, resistant.	1.5	32.5
2	Limestone, grey, dense, in fracture-cleaved, nodular thin beds, with interbeds of shale, brown, calcareous. Rare trilobites, G.S.C. Cat. No. 58857: (Identifications by W.H. Fritz) *Albertella* cf. *A. levis* Walcott; *Vanaxemella* sp.	8	31
1	Limestone, micrite and calcisiltite, partly argillaceous, thin-bedded with prominent partings and mottlings of		

Unit No.		Thickness in Feet Unit	Total from base
	fine-crystalline dolomite. Massive, moderately resistant, weathers mottled grey and orange.	23	23
	Total thickness of Mount Whyte Formation measured.	72	
	(Unit 1 overlies faulted outcrop of shale, green, highly sheared, with scattered thin beds of sandstone, green, rust-specked, dolomitic, glauconitic, very fine to medium grained. Burrows are prominent. Near the top of this disturbed unit are two thick beds of dolomite-mottled dense limestone, and minor calcarenite.)		

WELL LOGS

1. Log of Calstan Shell Moose Mountain 16-6-23-6. (O, Figs. 1, 3)

Location: l.s. 16, sec. 6, tp. 23, rge. 6, W. 5th mer.

Elevation of Kelly Bushing: 6,124 feet.

Well log prepared by the writer, based on ditch samples, depth adjusted to the gamma-ray log.

Depth (feet)	Lithology
	CAIRN FORMATION
2500-2550	Limestone; brown, dense, dolomitic, argillaceous, bituminous, slightly silty. Traces of white chert preserve pelleted fabric.
2550-2560	Siltstone; grey-brown, very dolomitic.
2560-2596	Limestone as above. At the base, partly altered to dolomite, brown, very fine-crystalline, calcareous.
	LYNX GROUP (UPPER DIVISION)
2596-2645	Dolomite; light grey, brownish white, pink, speckled, very fine- and fine-equicrystalline, mosaic, slightly argillaceous, trace silt. Trace of glauconite at base.
	SULLIVAN FORMATION
2645-2705	Siltstone, white, pink, green, dolomitic, trace glauconite. Subordinate shale, bright green, very pyritic, weakly fissile.
	WATERFOWL FORMATION
2705-2838	Dolomite, light yellow-grey, fine- and very fine-crystalline, tending to euhedral, with poor porosity. Local bitumin in porosity. At the top, relict oosparite and/or pelsparite fabric.

Depth (feet)	Lithology
	ARCTOMYS FORMATION
2838-2845	Siltstone; grey, brownish grey, dolomitic.
2845-2860	Dolomite, as above.
2860-2880	Siltstone, as above.
2880-2894	Shale, bright green, slightly dolomitic, pyritic; mud-cracks.
	PIKA FORMATION
2894-2930	Dolomite, grey-brown and brown, very fine-equicrystalline, minor fine-equicrystalline, very argillaceous, bituminous, very uniform. Limestone as below appears downward.
2930-3020	Limestone, argillaceous calcisiltite, and dolomite, light brown, very fine-crystalline, calcareous (probably dolomite-mottled limestone). Bituminous partings. Dolomite becomes very argillaceous downward, grading to shale.
3020-3097	Limestone, micrite and calcisiltite, variably dolomitic, with authigenic feldspar, and dolomite as above, very argillaceous, grading to shale.
3097-3139	Shale, brown and olive-brown, very dolomitic, variably fissile; rare trilobite remains. In the lower half, minor limestone, trilobite biocalcisiltite.
	ELDON FORMATION
3139-3345	Limestone, dolomite-mottled micrite, with subordinate pelsparite.
3345-3406	Limestone, mainly pelsparite, very dolomitic, trace of authigenic feldspar. Minor dolomite-mottled micrite. Many stylolitic bituminous seams.
3406-3465	Limestone, alternating dolomite-mottled micrite and pelsparite, very dolomitic.

Depth (feet)	Lithology
3465-3720	Limestone, mainly micrite, strongly dolomite-mottled. Subordinate pelsparite. Rare authigenic quartz.
3720-3897	Limestone, dolomite-mottled micrite, slightly argillaceous above, becoming more argillaceous downwards (see gamma-ray log). Rare beds of pelsparite.
3897-3992	Limestone, dolomite-mottled micrite as above. Dolomite, dark brown, very argillaceous, bituminous, grading to shale, dark brown, very dolomitic, non-fissile, probably occurs as partings.
	STEPHEN FORMATION
3992-4050	Mainly shale, bright green to grey-green, micaceous and waxy, slightly calcareous, partly glauconitic, weakly fissile. Twenty per cent limestone, dolomite-mottled micrite. Trace of biocalcarenite, grey, green, red, glauconitic and very glauconitic. Trace of siltstone, white, calcareous, micaceous, glauconitic.
	Fault to Eldon Formation.

2. Log of California Standard Parkland No. 4-12. (P, Figs. 1, 3)

Location: l.s. 4, sec. 12, tp. 15, rge. 27, W. 4th mer.

Elevation of Kelly Bushing: 3,309 feet.

Well log prepared by the writer, based on cores and ditch samples, depth adjusted to the gamma-ray log.

Depth (feet)	Lithology
	ELK POINT GROUP
10500-10518	Shale, green, dolomitic, non-fissile to weakly fissile; minor dolomite, pink, very fine-equicrystalline.

Depth (feet)	Lithology
10518-10570	Limestone, mainly micrite, with subordinate dolomite, light brown, fine-equicrystalline; subordinate green shale as above. Traces of anhydrite near the base.
	PIKA FORMATION
10570-10621	Limestone, mainly micrite, mottled with dolomite, brown, very fine-equicrystalline; subordinate calcisiltite and trilobite biocalcisiltite.
10621-10631	(Core) Limestone, dominant mottled micrite, subordinate trilobite biocalcisiltite, as above. Rare laminae contain scattered coarse pellets.
10631-10646	Limestone, as above.
10646-10678	Shale, green, mainly fissile, partly splintery.
10678-10705	Limestone, micrite and calcisiltite, with interbeds of green shale as above.
10705-10762	Shale, as above, with minor interbeds of limestone as above.
10762-10835	Interbedded shale as above and limestone, micrite, trilobite biocalcisiltite, and minor pelsparite. Minor dolomite, brown, very fine-equicrystalline.
	ELDON FORMATION
10835-10865	Limestone, pelsparite, very dolomitic, with rare oolites; minor micrite.
10865-10994	Limestone, micrite, mottled by dolomite, brown, very fine-equicrystalline.
10994-11184	Limestone, mainly dolomite-mottled micrite, minor calcisiltite. Thin (?) interbeds of shale, deep green, dolomitic, fissile, partly splintery.

Depth (feet)	Lithology
11184-11202	(Core) Interbedded micrite (dolomitic to very dolomitic, partly replaced by dolomite, pale brown, very fine-equicrystalline, calcareous), calcisiltite, and trilobite biocalcisiltite, with prominent mottlings and shaly partings of dolomite, brown, very fine-crystalline.
	STEPHEN FORMATION
11202-11232	(Core) At the top, 3 feet of dolomite, dark brown, shaly, bituminous, grading downward to shale, brown to olive, very dolomitic, with nodules of grey calcareous dolomite. Below this, shale, dull olive, dolomitic, micaceous, weakly fissile, with a few nodules of dolomite, light grey, very fine-crystalline, very calcareous. Fragments of trilobites and inarticulate brachiopods common.
11232-11280	Shale as above, with minor thin beds of dolomitic calcarenite and trilobite biocalcisiltite. Trace of glauconitic siltstone.
	CATHEDRAL FORMATION
11280-11443	Limestone, dolomite-mottled micrite.
11443-11454	(Core) Limestone, mainly trilobite biocalcisiltite, minor micrite, with partings and aligned mottlings of dolomite, brown, very fine-equicrystalline, bituminous.
11454-11475	Limestone as above, with (?) shale partings.
11475-11525	Limestone, micrite, dolomite-mottled as above.
	MOUNT WHYTE FORMATION
11525-11615	Shale, green, weakly to strongly fissile, dolomitic, partly very micaceous. Minor interbeds of dense limestone (?).
11615-11645	(Core) Siltstone, grey, glauconitic, very slightly dolomitic, very micaceous (biotite) and fine greensand, with

Depth (feet)	Lithology
	discontinuous films of purple shale. Subordinate shale, purple, dull olive-green. Burrows, mud-cracks; glauconite commonly altered to hematite. Minor white sandstone near base. Trilobites common, cf. *Albertella* (*see* Raasch and Campau, 1957).
11645-11684	No samples.
11684-11697	(Core) Interbedded shale, deep green, minor purple, micaceous, fissile, and siltstone and very fine-grained sandstone, pale green. Burrows, mud-cracks, cross-lamination, cut-and-fill. One erosion surface.
	BASAL SANDSTONE
11697-11723	(Core) Interbedded shale as above, locally sandy, and sandstone, white, pale green, very fine- to medium-grained (mainly very fine), partly clay cemented, partly silica cemented. Proportion of sandstone increases downward. At 11,714 feet, a 1-inch bed of sandstone-pebble conglomerate.
11723-11739	No samples.
11739-11789	(Core) Sandstone, white, quartzose, very fine- to very coarse-grained, moderately well sorted in a given lamina, roundness and sphericity low. Granules, and in lower part, pebbles widely scattered; quartz-pebble conglomerate common near base. Cement is partly white and green clay, partly silica, locally calcite. Crossbedded, many zones reworked by fauna.
11789-11792.5	(Core) Quartz-pebble conglomerate. Two outsized 2-inch quartzite pebbles.
	PRECAMBRIAN
11792.5-11836 (T.D.) (Core)	Feldspar-quartz-biotite gneiss, chlorite schist, biotite-quartz-feldspar schist, highly contorted.

3. Log of California Standard East Gilbey No. 4-5. (Q, Figs. 1, 4)

Location: l.s. 4, sec. 5, tp. 41, rge. 2, W. 5th mer.

Elevation of Kelly Bushing: 3,177 feet.

Well log prepared by the writer, based on ditch samples, depths adjusted to the gamma-ray log.

Depth (feet)	Lithology
	ELK POINT GROUP
10085-10140	Shale, dark to very light green, partly calcareous and silty, weakly fissile, containing abundant ostracods. Much limestone, brown micrite, and secondary very fine-crystalline dolomite. Minor light green siltstone and very fine-grained sandstone at the top.
10140-10150	Limestone, pale brown, minor greenish-grey, aphanitic, very argillaceous, with scattered pellets; partly sandy.
10150-10170	Sandstone, white, quartzose, fine- and very fine-grained, well sorted, very calcareous, trace of glauconite.
10170-10186	Dolomite, pale brown, very fine-crystalline and microcrystalline, mostly sandy, grading to sandstone. Excellent intracrystalline and micro-vug porosity.
10186-10205	Interbedded limestone, pale brown, aphanitic, and shale, green above, purple-red at base. Scattered quartz pebbles.
10205-10243	Mudstone, orange, silty, very dolomitic; minor interbeds of purple shale.
	LYNX GROUP (UPPER DIVISION)
10243-10280	Interbedded siltstone, white, pink, red, purple, micaceous, glauconitic, and shale, purple-red, bright green, fissile. Minor dolomite, brown, very fine-crystalline, at the top.
10280-10340	Siltstone, mainly white, minor green, partly red-mottled, calcareous, glauconitic, micaceous, with fragments of

Depth (feet)	Lithology
	chitinous brachiopods. Much shale, purple-red, minor bright green. Trace of trilobite remains.
10340-10375	Siltstone as above, almost entirely white, and shale as above. Trace of limestone, pebbly biosparite.
10375-10433	Mainly limestone, partly oolitic pelsparite, partly light brown, microcrystalline and very fine-crystalline, with traces of particulate fabric; minor secondary dolomite. Subordinate interbeds of siltstone, white, very micaceous.
	UPPER FINE CLASTIC UNIT
10433-10460	Siltstone and shale as above; traces of inarticulate brachiopods.
10460-10480	Limestone, very light brown, very fine-crystalline and microcrystalline, ex-oosparite or pelsparite. Minor siltstone and shale as above.
10480-10560	Shale, green predominant, red subordinate, fissile, locally calcareous and non-fissile. Minor thin beds (?) of limestone, both glauconitic oosparite and micrite. Minor dolomite, brown, very fine-crystalline, euhedral. Traces of siltstone as above.
10560-10650	Shale, green and olive-green, partly non-calcareous, fissile, and calcareous, non-fissile; partly very micaceous. Traces of siltstone and limestone as above.
10650-10828	Interbedded shale and siltstone. Shale, green, minor brown and purple-brown, locally glauconitic, locally containing fragments of inarticulate brachiopods. Siltstone, white, calcareous, micaceous, partly glauconitic. Traces of limestone, partly biocalcarenite, partly brown, green, microcrystalline.
10828-10840	Shale, green, minor purple-brown, fissile.

Depth (feet)	Lithology
	PIKA FORMATION
10840-10865	Shale, as above, with subordinate interbeds of partly recrystallized limestone; calcisiltite, conglomerate with siltite matrix, and pebbly oosparite.
10865-10910	Shale, green, minor purple-brown, fissile. Minor thin beds of limestone as above.
10910-10942	Limestone, brown to very pale brown, microcrystalline, very argillaceous; trace of secondary dolomite. Minor thin beds of shale as above.
10942-10991	Alternating shale, green, minor olive-brown, trace of purple-red, fissile, with minor siltstone (dominant), partly microcrystalline, very argillaceous (marlstone), partly glauconitic biocalcisiltite.
10991-11064	Shale, as above, with rare limestone beds as above. Trilobite fragments common.
	ELDON FORMATION
11064-11270 (samples poor)	Limestone, mainly micrite, slightly dolomitic, with minor biocalcisiltite, pelsparite, and secondary dolomite, light brown, very fine-equicrystalline, euhedral. Traces of fine calcarenite near the base.
	STEPHEN FORMATION
11270-11430	Shale, bright green, olive-green, minor purple-brown, partly calcareous, fissile. Rare beds of limestone, biocalcisiltite and trilobite biosparite.
11430-11560	Shale as above, partly purple-red, partly glauconitic. Minor interbeds of limestone as above and siltstone, white, glauconitic, calcareous, micaceous.

Depth (feet)	Lithology
	CATHEDRAL FORMATION
11560-11650	Limestone, mainly pebbly biocalcisiltite, dolomitic, partly glauconitic. Minor secondary dolomite, light brown, fine- and very fine-crystalline, mosaic.
11650-11665	Mainly dolomite as above; minor limestone as above.
	LOWER FINE CLASTIC UNIT
11665-11690	Shale, red, subordinate green, as above; minor interbeds of siltstone as above.
11690-11785 (T.D.)	Interbedded siltstone, white, dolomitic, glauconitic, micaceous, and shale as above. Siltstone-filled burrows are common.

4. Log of Imperial Leduc No. 530 (R, Figs. 1, 5).

Location: l.s. 8, sec. 17, tp. 50, rge. 26, W. 4th mer.

Elevation of Kelly Bushing: 2,373 feet.

Well log prepared by the writer, based on ditch samples, depths adjusted to the gamma-ray log. Sample quality is fair to poor.

Depth (feet)	Lithology
	ELK POINT GROUP
7550-7570	Mudstone, deep orange-red, locally grey-mottled, very dolomitic.
7570-7595	Interbedded gypsum and dolomite, pink, microcrystalline, argillaceous.
7595-7645	Shale, pale purple to purple-red, dolomitic, moderately fissile, grading downward to mudstone, orange-red, as above.

Depth (feet)	Lithology
	LYNX GROUP (UPPER DIVISION)
7645-7740	Shale, pale green, calcareous, dolomitic, variably fissile. Minor siltstone, pale green, calcareous, dolomitic, partly glauconitic, and dolomite, pale green, microcrystalline, silty. Fragments of chitinous brachiopods. (Assigned to the Ordovician by van Hees (1965).)
7740-7795	Siltstone, white to pink, with rare green laminae, calcareous, partly glauconitic. Subordinate limestone, mainly pelsparite, slightly siliceous, very locally glauconitic. Minor shale, green, micaceous.
	UPPER FINE CLASTIC UNIT
7795-7915	Interbedded siltstone, pinkish white, very glauconitic, and shale, deep green, fissile. Traces of limestone, pelsparite, biocalcarenite, and oolite. Brachiopod fragments in siltstone.
7915-8078	Shale, mainly green as above, minor purplish-brown; subordinate siltstone as above.
8078-8285	Shale, as above, with subordinate interbeds of siltstone as above. Purple-brown shale locally prominent. Brachiopods locally present.
	PIKA FORMATION
8285-8385	Mainly limestone, biocalcisiltite, calcisiltite, pelsparite, minor limestone-pebble conglomerate and biocalcarenite; partly glauconitic in lower half. Minor interbeds of shale as above.
8385-8585	Shale, grey-green, minor purple-red and purplish brown, calcareous and non-calcareous, fissile, partly micaceous. Rare trilobite impressions, glauconite pellets, and silt-filled burrows. Minor interbeds of siltstone as above (?).

Depth (feet)	Lithology
8585-8627	Interbedded shale (dominant), mainly purple-red, minor green, fissile, and subordinate siltstone and very fine-grained sandstone, light greenish grey, glauconitic, very micaceous, slightly dolomitic.

8627-Top of marker correlated with top of Eldon Formation.

LOWER FINE CLASTIC UNIT

8627-8750	Interbedded shale and siltstone as above. Rare trilobite fragments. Siltstone occurs in part as burrow-fillings.
8750-8785	Shale and siltstone as above, with traces of limestone as above, and derived dolomite, light grey, fine-equicrystalline, glauconitic, slightly silty.
8785-8850	Shale as above, mainly red.
8850-8943	Sandstone, white to deep pink, very fine- to medium-grained, ill-sorted, subangular, glauconitic, clay-cemented, interbedded with shale, mainly red, as above.
8943-8984	No samples. From geophysical logs, interpreted as sandstone.

PRECAMBRIAN

8984-8993.5 (T.D.)	No samples. Base of Cambrian interpreted from gamma-ray log.

5. Log of California Standard Gulf Kaybob No. 5-35 (T, Figs. 1, 7).

Location: l.s. 5, sec. 35, tp. 62, rge. 18, W. 5th mer.

Elevation of Kelly Bushing: 2,878 feet.

Well log prepared by the writer, based on cores and ditch samples, depths adjusted to the gamma-ray log.

Depth (feet)	Lithology
	GILWOOD SANDSTONE[1]
10215-10234	(Core) Sandstone, white, greenish white, brown, very fine- to coarse-grained, poorly sorted, subrounded; patchy cementation by calcite, anhydrite, and quartz. Porosity generally poor, locally fair to good. Porous zones oil-stained. At the top, minor laminae and thin layers of shale, bright green, pyritic, very sandy.
10234-10238.5	(Core) Sandstone, very light brown, quartzose, mainly fine-grained, minor medium- and coarse-grained, commonly pebbly. Pebbles are greenish grey siltstone (Cambrian ?) and coarse quartzite (Precambrian ?). Good oil-stained porosity. Basal 6 inches is very pebbly sandstone and quartzite pebble conglomerate, very angular.
	ELK POINT GROUP
10238.5-10257	(Core) Shale and mudstone, deep green, brown, greenish brown, calcareous, commonly silty and sandy. Rare ostracods, rare ? Chara.
10257-10260.5	(Core) Shale and mudstone as above, with minor layers of limestone, microconglomerate, with abundant ? Chara, largely pyritized.
10260.5-10274.5	(Core) Mudstone and minor shale as above, locally dolomitic, locally grading to dense argillaceous dolomite. Subordinate siltstone and very fine-grained sandstone, light green, dolomitic, with trace of glauconite.
10274.5-10282.5	(Core) Dolomite, pale green, pale brown, microcrystalline, calcareous, laminated, and subordinate shale, green, purple-brown, partly sandy. (Core partly missing.)
10282.5-10288	(Core) Interbedded sandstone and mudstone. Sandstone, greyish green, greenish white, white, mainly very fine-grained, medium-grained and pebbly at the base, poorly sorted, clay-cemented, primary lamination largely

[1] Reference: Canadian Stratigraphic Service Limited, Log No. 860.

Depth (feet)	Lithology
	destroyed by faunal reworking; fragments of ostracoderm plates. Mudstone, deep green, largely silty and sandy, dolomitic, grading to dense argillaceous dolomite. Very minor dolomite, cream, aphanitic, laminated, and dolomite breccia.
	Corroded contact. Sandstone penetrates dolomite, dolomite pebbles in base of sandstone.
	LYNX GROUP (UPPER DIVISION)
10288-10297	(Partly represented by core) At the top, 2 feet of intermottled dolomite, white, microcrystalline, calcareous and dolomite, pale brown, microcrystalline, nonporous. Below this, dolomite, light brown, cream, grey, very fine-equicrystalline, slightly calcareous, poorly preserved clastic fabric, including a trace of oolitic fabric. Pebbles common, 1 inch of pebble conglomerate near the top. Poor to good pin-point porosity.
10297-10389	Dolomite, very fine-inequicrystalline, very well preserved oolitic fabric, very calcareous, poor porosity. In lower half, interbeds of siltstone, white to dirty light brown, calcareous and dolomitic, micaceous.
	UPPER FINE CLASTIC UNIT
10389-10508	Siltstone, white, minor brown, dolomitic, partly micaceous, partly glauconitic, partly porous. Rare thin laminae of sandstone, very fine-grained, glauconitic.
10508-10541	(Core) Siltstone, grey, brown, partly glauconitic, partly dolomitic, partly pyritic, partly argillaceous, shaly. Largely laminated, with thin black shaly partings. Original lamination locally destroyed by intensive faunal reworking, "lebensspüren", mainly burrows, are widespread. In uppermost 3 feet, three medium beds of siltstone flat-pebble conglomerate. At 10,526 feet, a slumped horizon.
	Sharp contact.

Depth (feet)	Lithology
	PIKA FORMATION
10541-10563	(Core) Dolomite, yellowish and brownish white, very fine and microcrystalline, largely ex-fine to coarse calcarenite (microconglomerate ?), partly ex-laminated calcisiltite (microcrystalline part), pebbles common, one thin bed of flat-pebble conglomerate. Fair to good inter-crystalline and micro-vug porosity. Veinlets of anhydrite. Lamination locally disturbed by "slumping". Local thin partings of brown shale.
10563-10594	(Core) Dolomite, very light brownish grey, pale brown, cream, very fine-equicrystalline, minor microcrystalline, partly with relict very fine particulate fabric. Largely laminated and algal-laminated, contorted lamination common, locally passing to brecciation. Bituminous, stylolitic partings. Minor blebs and veinlets of anhydrite.
10594-10639	(Core) Interlaminated and inter-lensed siltstone and shale. Siltstone, light brown, yellow-white, white, pink, green, dolomitic, partly glauconitic. Shale, green, purple-red, brown, partly waxy, partly silty, pyritic. Mud-cracks throughout; some horizons intensively burrowed.
10639-10658	(Core) Mudstone, deep orange-red, silty, micaceous. Subordinate shale, deep purple-red, minor green. Trace of siltstone as above. Mud-cracks, "slump" structures.
10658-10663	(Core) Interlaminated siltstone and shale as above.
10663-10678	(Core) Shale, green, fissile, largely dolomitic, silty. Scattered fragments of chitinous brachiopods. In the middle, blebs of pink anhydrite.
10678-10683	(Core) Shale, yellow-green, dolomitic, moderately fissile. Minor thin beds of limestone, calcisiltite and trilobite biocalcisiltite; a 2-inch and a 6-inch bed of limestone-pebble conglomerate. Pebbles are coated with glauconite.
10683-10704	Mudstone, orange-red as above.

Depth (feet)	Lithology
10704-10816	Shale, mainly green, micaceous, fissile, slightly dolomitic, partly splintery. Subordinate shale, green, very dolomitic, silty, weakly fissile, crystalline-appearing. Trace of deep brown shale near the base.
	ELDON FORMATION
10816-10857	Interbedded siltstone, grey to brown, very dolomitic, and dolomite, brown, fine- and very fine-crystalline, sandy and silty, partly bituminous, ex-fine-grained calcarenite.
10857-10884	Sandstone and minor sandy dolomite, as below.
10884-10887	(Partly represented by core) Sandstone, yellowish white, very dolomitic, very fine-grained, very well sorted. Irregular laminations, stylolites.
10887-10890.5	(Core) Dolomite, very light brown, very fine-crystalline, very sandy, ex-sandy microconglomerate, grading to sandstone, very dolomitic, very fine-grained, well sorted, low sphericity and roundness.
10890.5-10897	(Core) Sandstone, yellowish white, greenish white, fine-grained, well sorted, low roundness and sphericity, variably dolomitic. One 8-inch non-cemented, porous zone. Near the top, laminae of siltstone and thin partings of dark grey silty shale. Sandstone passes downward into very dolomitic sandstone and dolomite, yellowish white, very fine-crystalline, very sandy, laminated, partly ex-pebbly microconglomerate.
10897-10902	(Core) Sandstone, white, greenish white, fine-grained, well sorted, variably dolomitic, locally silica-cemented and clay-cemented. Lenticular laminations, with partings of green to black clay. Cylindrical burrows intersect clay partings.
10902-10981	Sandstone, white to deep pink, quartzose, very fine-grained, very well sorted, rarely ferruginous. Minor interbeds (?) of shale, deep green, deep red, micaceous, fissile.

Depth (feet)	Lithology
	LOWER FINE CLASTIC UNIT
10981-11020	(Core) Interbedded mudstone, and sandstone. Mudstone, orange-red, purple-red, minor green, silty, sandy, grading to argillaceous sandstone. Sandstone, bright green, deep purple-red, white, mottled, fine-grained, mainly very argillaceous, grading to sandy mudstone; minor clean quartzose sandstone.
11020-11040	(Core) Shale, mainly deep purple-red, minor bright green, fissile, largely silty and sandy. Disturbed laminations, mud-cracks.
11040-11050	Shale as above.
11050-11117	Siltstone, greenish white, very glauconitic, partly sandy, quartzitic, micaceous; scattered brachiopod and pelmatozoan fragments. Minor interbeds of shale as above.
11117-11130	Sandstone, as below.
11130-11170	(Core) Sandstone, white, pale brown, pink, green, purple etc., very fine-grained, variably glauconitic, partly dolomite-cemented, partly silica-cemented, locally argillaceous. Partly crossbedded and cross-laminated, partly intensely reworked by fauna; partings of green and grey shale are typically "kneaded" into the adjoining sandstone. Very minor siltstone. At 11,137 feet, a 1 1/2-inch bed of greensand, 90 per cent glauconite.
11170-11230	(Core) Siltstone, white, pink, green, purple, glauconitic to very glauconitic. Subordinate sandstone as above. In part with thin interbeds and partings of green shale. Many intervals intensely burrowed and reworked.
11230-11244	Siltstone and sandstone as above.
	BASAL SANDSTONE
11244-11289	Sandstone, white, quartzose, fine-grained, poorly sorted, partly silty.

Depth (feet)	Lithology
11289-11300	Sandstone as above, largely very ferruginous, and sand, coarse, quartzose, unconsolidated, highly porous.
	PRECAMBRIAN
11300-11320	(T.D.) Gabbro, green, black, medium-grained. (Core 11310-11320)

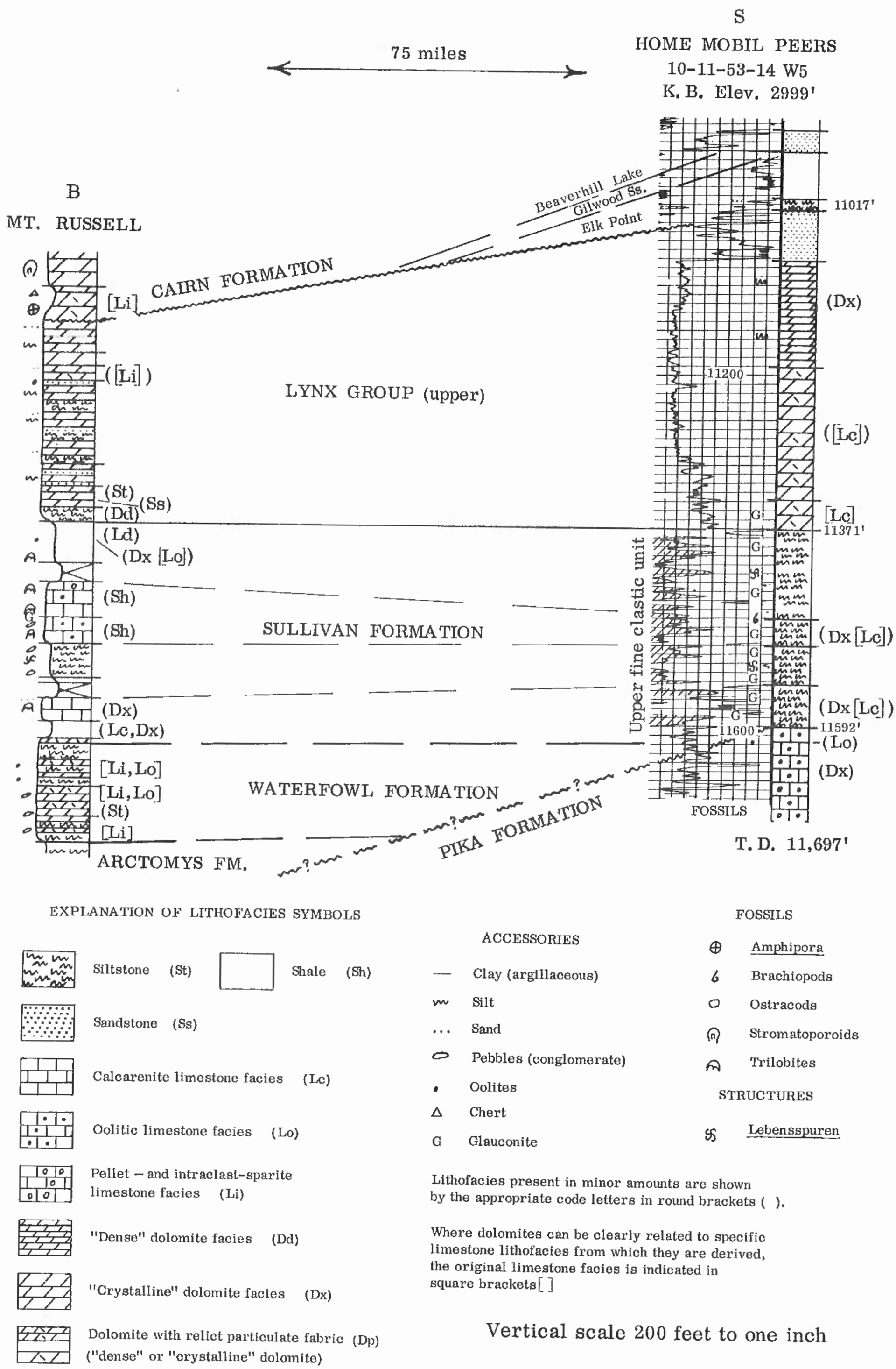

Figure 6. Stratigraphic cross-section B-S, Mt. Russell to Home Mobil Peers 10-11-53-14 West of 5th Meridian.

LIST OF WELLS STUDIED

California Standard Parkland No. 4-12
4-12-15-27W4
K.B. Elev. 3309'

B.A. Stettler Unit 10-16MU-38-20
10-16-38-20W4
K.B. Elev. 2715'
was SWANSON No. 10

Imperial Leduc No. 530
8-17-50-26W4
K.B. Elev. 2373'

Calstan Shell Moose Mtn 16-6-23-6
16-6-23-6W5
K.B. Elev. 6124'

Shell 2 Panther River 11-8-30-10
11-8-30-10W5
K.B. Elev. 6118'

Shell Panther 1
5-19-30-10W5
K.B. Elev. 5377'

Shell Burnt Timber 6-26-32-10
6-26-32-10W5
K.B. Elev. 5080'

Imperial Homestead Scalp Creek 9-16-32-12
9-16-32-12W5
K.B. Elev. 6316'

Hudson's Bay Ram River 8-2-37-11
8-2-37-11W5
K.B. Elev. 4610'

Mobil Leslieville 4-19MU-39-5
4-19-39-5W5
K.B. Elev. 3181'

California Standard East Gilbey No. 4-5
4-5-41-2W5
K.B. Elev. 3177'

Imp Calstan Nordegg 6-17-41-17
6-17-41-17W5
K.B. Elev. 5464'

Imperial Canadian Superior Norbuck No. 2-6-47-4
2-6-47-4W5
K.B. Elev. 3015'

Home Mobil Peers 10-11-53-14
10-11-53-14W5
K.B. Elev. 2999'

Fina Stanolind Hudsons's Bay Windfall No. 12-36
12-36-59-15W5
K.B. Elev. 2786'

Stanolind-Hudson's Bay Fina Marsh-Head A-1
15-1-59-21W5
K.B. Elev. 3667'

Mobil Carson Creek West 11-1-61-13
11-1-61-13W5
K.B. Elev. 2501'

California Standard Gulf Kaybob No. 5-35
5-35-62-18W5
K.B. Elev. 2878'

Imperial Virginia Hills 6-36-63-12
6-36-63-12W5
K.B. Elev. 3708'