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**GEOLOGICAL DATA AND NOTES OF THE STRATIGRAPHY  
OF THE INTERNATIONAL MINERALS AND CHEMICAL  
COMPANY'S K 2 SHAFT, AND THE SYLVITE COMPANY  
OF CANADA'S NO.2 SHAFT, IN THE ESTERHAZY -  
ROCANVILLE AREA, SOUTHEASTERN SASKATCHEWAN**

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ABSTRACT

The IMC KS and Sylvite potash shafts were constructed between the years 1963 and 1970 on the east side of the northern Williston Basin.

The Geological Survey of Canada maintained an observer at each site who noted and, where possible, photographed structural and stratigraphic features in the shaft wall and collected fossil and rock specimens.

Fossil locations and details of the lithologies are presented in the geological log, and are related to the geophysical curves in graphic profiles of the shafts. All photographs are listed with accession numbers and a few are reproduced in this report.

A brief geological summary notes some prominent features of the stratigraphy of the area. Most prominent is a southward-oriented salient of Jurassic nonmarine sand overlying a nearby structural ridge and encountered in the shafts as a Jurassic quicksand, which during construction was mistaken for the ubiquitous water-bearing Cretaceous "Blairmore" sand.

Overlying Cretaceous fluvio-deltaic beds are in consequence relatively thin, with an erosional unconformity at their top that marks the beginning of a remarkably complete sequence of transgressive, barrier island sediments deposited in the advancing Albian epeiric sea.

Fischer assays for oil content were run, based on a systematic sampling of the petroliferous Upper Cretaceous "white speckled" shale and adjacent barren shales. A gas chromatography study of the same oil shales (Boyne and Favel formations) was expanded to embrace a larger interval, and included Lower Cretaceous rocks (to the base of the Joli Fou Formation)

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Notes on the Stratigraphy of the International Minerals and Chemical K2 Shaft,  
and the Sylvite No. 2 Shaft in the Esterhazy - Rocanville Area,  
Southeastern Saskatchewan

During the sinking of the IMC K2 Shaft, constructed substantially throughout the years 1964 to 1966, the Geological Survey of Canada maintained an observer (Wolfgang Wiens) on the site, who noted and, where possible, photographed salient features of the stratigraphy of the shaft wall and collected fossils and rock specimens from the excavated material. Mr. Wiens was supported for a part of his tenure by funds and material from the Saskatchewan Department of Mineral Resources. C.E. Wright carried out the same work at the Sylvite shaft site from 1968 to 1970. This site has now been taken over by become the Saskatchewan Potash Corporation, Rocanville Division.

The Geological Survey owes a debt of gratitude to the International Minerals and Chemical Company and to the Sylvite Company of Canada, and their contractors and personnel for assistance and use of facilities. In particular, they are grateful to IMC, who were the first to extend the privilege of going into the shaft during construction..

IMC K2 Shaft is located in lsd. 7, sec. 27, tp. 19, rge. 32, WPM, 16 km due east of the town of Esterhazy; Sylvite No. 2 Shaft lies in lsd. 12, sec. 22, tp. 17, rge. 30, WPM, 158 m (520 ft.) south of the No. 1 Shaft which was constructed simultaneously and on the same site. The Sylvite site is 30 km (18 mi) southeast of the K2 Shaft and 16 km northeast of Rocanville townsite. The IMC K1 Shaft, constructed several years earlier, 9.6 km (6 mi) to the northeast of K2, constitutes a third and separate shaft site within the area. Geographic locations are shown in Figure 1.

Samples and fossil specimens were taken largely from freshly excavated material in the dump and, at Sylvite, much sampling was done at the headframe before material was dumped. All sampling was corroborated by direct daily inspection of the shaft wall. Lithologic samples ~~of~~ (<sup>weighing</sup>) ten to twenty pounds from each shaft were split three ways, one complete set <sup>each</sup> for deposit with ~~each~~ <sup>of Canada</sup> the Geological Survey at ISPG Calgary; the University of Saskatchewan at Saskatoon; and the Department of Mineral Resources, Regina. Fossils are curated with the Geological Survey, in Ottawa and Calgary. Reports on collections from the various intervals have been made by A.W. Norris, E.W. Bamber, A.C. Higgins, J.A. Jeletzky, A.E.H. Pedder and T.T. Uyeno of the Geological Survey.

Photography was with Kodachrome II diapositive film with black and white working prints, stored at ISPG, Calgary. Titles are given in Appendix III.

The lithologic logs are compiled from notes on observations of the freshly exposed rock, preliminary microscopic examination of excavated material at the shaft site and further examination at Calgary. The carbonate classification used on the logs follows Leighton and Pendexter (1962). The following notes outline a few stratigraphic features unique to the area that are demonstrated in the IMC K2 and Sylvite shafts.

The tectonic setting of the Esterhazy - Rocanville area (Fig. 1) places the IMC K2 and Sylvite shafts in the eastern side of Williston Basin, 240km (150 miles) from the eroded present eastern margin and 280km (180 miles) east of the central axis.

A north-south trending structure appears on the southwest-sloping sub-Mesozoic surface just east of the Saskatchewan - Manitoba border in the form of a broad ridge and valley. The Esterhazy - Rocanville shaft area lies within 15 km to the west of the axis of the ridge. The structure is reflected in sediments of Mississippian, Jurassic, and part of Lower Cretaceous time. It probably conforms to the present configuration of the eastern solution edge of the Elk Point Evaporite whether by cause or effect, or both.

#### DEVONIAN

##### Dawson Bay Formation

At Sylvite the Dawson Bay Formation is 46 m (150 ft) thick, displaying the prominent argillaceous limestone with thamnoporoid corals and stromatoporoids that is typical of the Dawson Bay and its equivalents. The limestone is less "bituminous" and lighter-coloured than in some occurrences and some

stromatoporoids in higher, calcarenitic beds are nucleated by thamnoporoids. The calcarenites and some associated dolomites are porous. In the Esterhazy area the Dawson Bay section is much less argillaceous, ranging from calcarenites to finely sucrose dolomite, some with very high porosity and permeability.

Fossils collected from various parts of the Dawson Bay, from the Cominco and Duval in the Saskatoon area, as well as at the Sylvite shafts, were examined by A.E.H. Pedder, whose observations follow:

Many elements in these faunas, particularly among the species of *Moravophyllum?*, *Tennophyllum?*, *Cylindrophyllum* and *Stringocephalus*, indicate a Givetian age. The occurrence of *Cylindrophyllum* points to a faunal link with the mid continent region in Givetian (Hamilton) time, while the species of *Tennophyllum* and *Stringocephalus* are of Cordilleran affinities. Rather surprisingly faunas from the subsurface Dawson Bay Formation of Saskatchewan have more in common with Ramparts and Sulphur Point faunas of the Mackenzie River region than with those of the Dawson Bay Formation of the Manitoba outcrop area.

#### Souris River Formation

##### *Member*

The equivalent of the Davidson in the area passes upward through time from a carbonate sequence to an increasing series of mudstone - carbonate - evaporite cycles. Like those of the underlying Dawson Bay, the lower carbonates of the Davidson are <sup>more</sup> dolomitic and porous at Esterhazy, becoming argillaceous and calcareous southeastward toward Rocanville. Anhydrites predominate in the lower part of the Harris Member, changing upward to carbonates in both shafts.

As in the lower units, the Harris carbonates, too, are markedly more argillaceous southeastward, toward Rocanville, than at Esterhazy, where the corresponding section is dolomitized and porous. Unlike the lower units, however, there is no discernible lateral trend in the argillaceous content or porosity of the carbonates of the Hatfield Member, but cyclic repetitions of evaporites at the base of the Hatfield continue later in the sequence at Esterhazy.

A.E.H. Pedder examined fossils from near the top of the Harris Member in the Sylvite Shaft, along with collections from the Saskatoon - Lanigan area. His comments on palaeontology follow:

*Eostrophalosia* sp., "*Atrypa*" cf. *oneidensis* and *Allanaria allani* (broad sense), which occur abundantly in some of the Souris River collections, are highly characteristic of the Waterways Formation of Alberta and its various correlatives. The Waterways fauna has long been recognized in the Snyder Creek Formation of Missouri and is now known in the west, from Powell Creek, near Norman Wells, to as far south as the Idaho-Utah border (*J. Paleont.* vol. 39, p. 21).  
vol. 39, p. 21).

A.W. Norris, who examined a collection from the same zone in the IMC shaft, notes correlation with the Moberly Member of the Waterways Formation and indicates an early Late Devonian (early Frasnian) age.

#### Duperow Formation

The four subdivision units of Dunn (Sask. Geol. Surv. Rept. #179) are shown on the IMC log along with the equivalents of the formal members of the Duperow recognized by Kent (Sask. Dept. Min. Res. Rept. #73) in southwestern

Saskatchewan. Thickness (169 m, or 555 ft) in IMC, and lithology vary only slightly between the Duperow Formation at Esterhazy and that at Rocanville. In the lower two-thirds of the Wymark Member, argillaceous content appears to be slightly higher toward the southeast site, although it should be noted that the difference is less pronounced than the draughting of the logs would indicate. Fossiliferous zones from a 33 m section in the lower part of the Duperow equivalent, including the Saskatoon, Elstow and basal part of the Wymark members were examined by A.E.H. Pedder, who noted correlation with a number of horizons of Frasnian age:

Faunas from low in the Duperow Formation in the Sylvite St. Marthe #2 shaft (GSC Locs. to C-6562 to C-6564) carry *Neocolomaria?* sp. nov. and *Allanaria* ex gr. *minutilla*. These suggest correlation with the lower part of the upper member of the Hollebeke Formation of the southern Alberta Rocky Mountains (*Bull. Can. Petrol. Geol.*, vol. 12, pp. 430-436) and with the Maligne Formation of the central Alberta Rocky Mountains. Higher Duperow faunas of the Elstow (GSC Locs. C-6537, C-6538) and Wymark Members (GSC Loc. C-6538) include *Mucrospirifer reidfordi* (broad sense), GSC Locs. C-6537, C-6538, which suggests correlation with the upper beds of the upper member of the Hollebeke Formation and with part of the Hay River Formation (base of outcrop) of southern District of Mackenzie. A.W. Norris examined a poorer, but longer-ranging collection from the IMC Shaft, including the Elstow, Wymark and Seward members, to within 15 m (50 ft) of the top of the formation, assigning an early Late Devonian (mid Frasnian) age.

### Birdbear Formation

The Birdbear Formation is 146 m (150') thick at IMC No. 2 Shaft, reduced to 33 m, or 100 feet at Sylvite, apparently through erosional thinning. At IMC the formation embraces a lower carbonate unit overlain by an anhydrite-carbonate unit containing dark brown "bituminous" partings and organic matter in the lower part. At Sylvite the "bituminous" equivalent of the lower part of the anhydrite - carbonate unit contains very little evaporite.

Fossils were collected from the lower unit in both shafts. Collections from the IMC Shaft were examined by A.W. Norris who noted an early Late Devonian, Late Frasnian age. Collections from the Sylvite Shaft, submitted to A.E.H. Pedder indicated a similar age.

### Torquay Formation

In the Sylvite Shaft the Torquay Formation is represented by 38 m of varicoloured yellow, red and green mudstone, largely dolomitic, with numerous intraformational breccias; a similar lithology, 3 m thicker occurs at IMC. Fossils from the Torquay Formation were confined to a single indeterminate fish plate.

### MISSISSIPPIAN

Mississippian strata are represented in the Esterhazy - Rocanville area by the thin basal Bakken Formation of lower and upper shale members separated by a medial sandstone, and overlying crinoidal carbonate. Aggregate thickness ranges from 79 m (258') at IMC, to 70 m (231') at Sylvite. The purplish pink lower shale, only 76 cm (2.5') thick at IMC, is missing at Sylvite through erosion beneath an unconformity within the medial sand (Christopher 1961, Fig. 27 p. 60). Thickness of the glauconitic medial sand and siltstone is also reduced at Sylvite by removal of the lower part of the sand beneath the unconformity.

Thickness of the overlying argillaceous carbonate is similarly limited by weathering beneath the sub-Jurassic unconformity in both shafts. The rocks have a purplish pink to grey and green cast, contain brachiopods, conodonts, and abundant crinoid fragments. A highly glauconitic zone within about 10 m or less of the base of the Souris Valley carbonate in the shafts is recognizable across much of the northern Williston Basin, the glauconite seen as replacement material in crinoid fragments.

Collections from the IMC No. 2 Shaft containing determinate fossils, according to E.W. Bamber are middle Tournaisian in age. A silicified fauna collected from the glauconitized crinoidal zone 9 m above the base of the Souris Valley argillaceous carbonate at Rocanville was examined by A.E.H. Pedder whose fossil lists and comments follow:

Depth(ft)	Fauna	GSC Locality
1655-1660 Souris Valley Fm. 9 m above base	<i>Palaeacis</i> sp. undet. <i>Cladochonus</i> sp. undet. <i>Metriophyllum</i> sp. undet. <i>Cyathaxonina</i> sp. undet. <i>Allotropiophyllum</i> sp. undet. <i>Amplexizaphrentis</i> sp. undet. <i>"Crania"</i> sp. undet. <i>Rhipidomella</i> sp. undet. <i>Rugosochonetes?</i> sp. undet. <i>Productina</i> sp. undet. <i>Ambocoelia</i> sp. undet. <i>Brachythyris?</i> sp. undet. <i>Bellerophon</i> sp. undet. bivalves, not studied trilobite pygidium, not studied age: early to middle Tournaisian	

According to Uyeno the conodont sample would be diagnostic of a middle Tournaisian age for these beds. His faunal list and comments follow:

Depth(ft)	Fauna	GSC Locality
1655-1600 Souris Valley, Formation 9 m above base	<i>Siphonodella obsoleta</i> Hass <i>Polygnathus longiposticus</i> Branson & Mehl <i>P. inornatus inornatus</i> Branson <i>P. symmetricus</i> Branson <i>P. communis communis</i> Branson & Mehl <i>P. communis communis</i> + <i>P. communis carinus</i> Hass <i>Spathognathodus abnormis</i> (Branson & Mehl) <i>S. macer</i> (Branson & Mehl) <i>Elictognathus laceratus</i> (Branson & Mehl) age: Tournaisian (Tnz) very probably <i>Siphonodella lobata</i> - <i>S. crenulata</i> Zone of Thompson & Fellows (1970), equivalent to Lower <i>Siphonodella crenulata</i> Zone of Sandberg & Klapper (1967).	C-6548

Most of the species listed above are restricted to the Kinderhook, with *Spathognathodus abnormis* restricted to the zone mentioned above. This zone is equivalent, at least in part, to the *Siphonodella-Polygnathus inornatus* Zone of Rhodes, *et al.* (1969) of the British Avonian sequence, and to the lower part of the *Pericyclus*-Stufe (cuII $\alpha$ ) (Voges, 1959) of Germany.

Klapper (1966), Sandberg and Klapper (1967), and Macqueen and Sandberg (1970) reported an equivalent of this zone from the basal Lodgepole Limestone of Montana. Correlation chart of Macqueen and Sandberg (*ibid.*, Fig. 4) also shows the lower part of Banff Formation as belonging to this zone.

The faunule is possibly assignable to Baxter's (1969) subzone I-A which occurs in the lower part of the Middle Member of the Banff Formation of southern Rockies. A further systematic study of the conodonts of the Mississippian section has been initiated by A.C. Higgins, of which a preliminary report appears in Appendix IV

#### Jurassic

The Jurassic sequence of the northern Williston Basin extends 160 km eastward of the shaft area, but a large reentrant appears in the northern limit of marine Jurassic rocks in the vicinity of the broad ridge, of the north-south north-south Manitoba-Saskatchewan "boundary structure". The nonmarine equivalent of the Jurassic units was discovered in all three shaft sites within the reentrant area during the course of the project, beginning with the collection in 1960 of ammonites at a depth of 1313 feet from overlying silty, marginal marine beds in the IMC K1 Shaft including *Kepplerites* cf. *K. Rockymontanus* Imlay (Frebold, 1964, p. 25). The fossiliferous zone is only 41 feet (12.5 m) below the top of the Cantuar beds and overlies 144 feet (44 m) of largely nonmarine Jurassic claystone and arenaceous beds including the troublesome quicksand customarily assigned to the Cretaceous Mannville or "Blairmore".

At K2 Shaft 9.3 km (5.8 miles) southeast of K1, the fossiliferous top-most beds are missing and the Jurassic is reduced to 27 m (89 ft) in thickness, and at Sylvite, 30 km (18.6 miles) farther southeast, the sandy Jurassic beds also are 27 m thick although the log shows includes 13.7 m (45 ft) of underlying clay and detritus within the Jurassic sequence (the clay at Sylvite also differs from sand above in direction and amplitude of dip). The change laterally is remarkably sharp from the arenaceous shoreline facies in K1 Shaft to the complete argillaceous marine Jurassic section cored 4.8 m (3 miles) to the northeast, in the IMC Yarbo No. 23 well (in lsd. 5, sec. 22, tp. 20, rge. 33, WPM) which also yielded the ammonite species found in K1 Shaft.

A deltaic interpretation of the Jurassic arenaceous area is indicated by the geographic outline and the implied valley in the eroded surface of Paleozoic rocks, however a further look at the details of sedimentary structure is necessary to distinguish between fluvial progradation and simple offshore shoaling against a topographic high.

#### Lower Cretaceous

Lower Cretaceous Cantaur rocks are thin to absent over parts of the eastern structural high; the thinning trend is evident in the Esterhazy - Rocanville area where thickness is only 24 m compared with an average of 90 m farther west.

From the scoured upper surface of the Cantaur and the base of the Pense, to lower Joli Formation the rocks represent a classic transgressive sequence from alluvial plain to marine facies. The sequence of environments proceeds from eroded foreland through foreshore lagoon and swamp vegetative barrier island, intertidal to subtidal shoreface, breaker (Fig. 7) and shoaling zones, and wave base to shallow marine. The transgressive sequence,

best illustrated in the K2 Shaft, is identified over a distance of 500 km, from the Swift Current area where the twin carbonaceous beds of the Cantuar Marker were first described by Cummings and Francis (1956), to the vicinity of Swan River, where carbonaceous beds of the basal Pense outcrop at the northeastern erosional limit on the Manitoba escarpment.

Upper Cretaceous

Favel Formation

### Favel Formation

The Favel Formation, with numerous bentonite beds and some limestone lenses, is 29.3 m thick at the Rocanville site, 25% thicker than the 23.8 m (781 feet) thickness at IMC k2 Shaft. The Favel thickens again, 25.9 m, or 85 feet at IMC k1 Shaft, 9.6 km, or six miles to the northwest. Fossils from the Favel are generally poorly preserved, except for the interval 837 feet at IMC k2 and 822 to 831 feet in the sylvite No. 2 Shaft in which Jeletzky identified Inoceramus labiatus Schlotheim, indicating the Lower Tournaisian Inoceramus labiatus zone of the lower (Keld) part of the Favel Formation.

### Vermilion River Formation

#### Morden Member

The Morden beds thicken slightly from 14.3 m to 15.5 m 29 km (18 miles) between Sylvite and IMC k2 Shaft. They thicken more rapidly between IMC k2 and the k1 Shaft, 9.6 km (6 miles) farther northwestward. The contact of the non-calcareous Morden shale with underlying Favel containing chalky calcareous white specks, is sharp, possibly representing a hiatus of slight duration (McNeil and Caldwell 1981, p. 58) which may account for some of the variation in thickness of the underlying Favel. Contact with the overlying Boyne or Niobrara equivalent is less well - defined.

Shale of the Morden is medium to dark grey and moderately fissile with numerous beds of bentonite. Many samples of this shale produce a copious efflorescence of a water soluble white salt on drying; some zones contain abundant carbonaceous specks. The white specks described in the Morden interval at Sylvite in appendix II are not the well-known chalky calcareous white specks, but bodies of white or brownish white clay in bands of what appear to be clasts, ranging in size from one or two millimetres in diameter to flattened pebbles two centimetres in length. Larger pebbles exhibit annular zonation analogous to weathering, the darker core containing finely disseminated marcasit or pyrite.

No fossils were found in the Morden beds.

Boyne Member

Considerable variation in thickness and lithology distinguishes the Boyne between the two IMC shafts and the corresponding section at Sylvite. The Boyne Member is 43 m (141 feet) thick at Sylvite, and 42.7 m (140 feet) thick at the IMC K1 Shaft, but only 23 m (76 feet) thick at IMC K2. A largely non-calcarious zone 14 m (45 feet) thick at the base of the unit at IMC K2 is only intermittently calcareous, with occasional partings showing the typical flattened calcareous white specks. A similar paucity of white specks occurs in a 7 m (23 feet) zone at the top of the member in which the white specks are found only in widely separated partings in otherwise non-speckled shale. The specks occur in normal abundance on these sparse partings, however.

Whereas the sparsely speckled zones at IMC K2 are merely a north-western facies equivalent of the uniformly calcareous white-speckled interval at Sylvite, the rapid disappearance of these zones over the much shorter distance farther northwestward from IMC K2 to the K1 Shaft less<sup>is</sup> easily explained. If the thinning of the underlying Morden Member from K1 southeastward to K2 occurs through a contribution to a sparsely calcareous facies equivalent in the overlying Boyne Member, this would account for only 4.3 m, or about a third of the sparsely speckled zone. In similar fashion, the disappearance northeastward of the sparsely speckled 7 m zone at the top of the Boyne at K2 corresponds (more accurately) with the 7 metre increase in thickness of the overlying Pembina Member. Alternatively, however, the disappearance of the lower and upper sparsely speckled zones between IMC Shafts may be attributed to stratigraphic onlap and erosion, on the respective lower and upper contacts.

Poorly preserved inocerami in the upper part of the Boyne Formation in the Sylvite No. 2 Shaft are considered by Jeletzky to resemble Inoceramus deformis Meek and to suggest the I. deformis and Scaphites preventricosus zone of the international standard stages. A somewhat better preserved assemblage in the lower part of the Boyne in IMC K2 Shaft supports this conclusion. However Jeletzky points out that I. cf subcardissoides found poorly preserved at the top of the sparsely speckled zone at IMC K2 13 m (45 feet) above the base of the member (GSC loc 66852), is not known to occur so low in the section. So far as known I. subcardissoides is confined to the top part of the Scaphites preventricosus zone where I. involutus does not occur.

At the top of the formation, within the upper sparsely speckled zone, Jeletzky found very poorly preserved ammonites resembling Haresiceras montanense Reeside and H. ex gr. fischeri-placentiforme Reeside. He notes that "In spite of unsatisfactory preservation of all representatives of the genus Haresiceras Reeside, GCS loc. 66883 appears to represent the widespread Scaphites hippocrepis, Haresiceras and Baculites aquilaensis zone of the Lower Campanian stage. This zone occurs in the Eagle sandstone of the U.S. western Interior and its equivalents ( Cobban and Reeside 1952 pp. 1019-20). In Canada the Scaphites hippocrepis zone is only known to occur : 1) At the base of the Lea Park Formation Lloydminster area (in the Western Potash shaft at Vera); 2) on Lower Athabasca, where it coincides with the basal part of the first specks zone; 3) at the base of the Riding Mountain Formation in the Manitoba Escarpment where it occurs closely above the top of the first specks zone."

Pembina Member

Thickness of the Pembina Member is variable, slightly over 20 m, at both Sylvite and IMC K1 (Yarbo) shafts, but only 13.4 m at the intervening IMC K2 (Gerald) location. The top of the formation coincides with a change upward from dark grey, somewhat fissile shale to medium light grey, blocky shale of the overlying Riding Mountain Formation. McNeil and Caldwell (1981, p. 68) consider this upper contact to be unconformable, a thesis supported by the comments of Jeletzky on fossils found at the base of the Pembina in the Sylvite No.2 Shaft (GSC loc. 83501): "Scaphites hippocrepis zone and lower Campanian substage of the international standard (see Jeletzky 1968, pp 43 - 45 for further details).

According to the latest data of W. A. Cobban (USGS Prof. Paper 619, p. 6) the fine-ribbed form of Scaphites (Hoploscaphites) hippocrepis and Haresiceras natronense are diagnostic of the latest part of (a subzone) of the broad Scaphites (Hoploscaphites) hippocrepis zone as used by Jeletzky (loc. cit.). In Canada this youngest lower Campanian subzone (through a recent find of Haresiceras natronense) is otherwise known only to occur in the uppermost beds of the Boyne Member in the Manitoba Escarpment. GSC Loc. 66883, (from the top of the Boyne Member in IMC K2 Shaft) appears to represent the next older subzone of the Scaphites (Hoploscaphites) hippocrepis zone and so may be somewhat older than GSC loc. 83501."

### Riding Mountain Formation

Riding Mountain sediments range from 181.6 m (or 596 feet thick at IMC K2 (Gerald) Shaft, to 125 m (410 feet) at Sylvite, but are only 83 m (272 feet) at IMC K1 (at Yarbo, 9.6 km, or six miles northeast of No. 1). The difference in thickness results from glacial or preglacial erosion and possible channelling, where till and other Quaternary material overlie the Riding Mountain bedrock shale to a depth three times greater at Yarbo than at the other two locations.

At Sylvite, the entire section of Riding Mountain consists of moderately, fissile or blocky, medium light olive-grey shale, whereas the much thicker section at Gerald reverts to sandstone 16.2 m or 53 feet below the bedrock - till interface. The sand is surmounted by another 5.1 m (17 feet) of silty mudstone at the top of the bedrock section.

The blocky shale yielded numerous fossil collections, those of significance beginning at about 15 m (50 feet) above the base of the formation upward in IMC K2 Shaft. Jeletzky found baculites comparable with Baculites gregoryensis 97.2 m (319 feet) above the base of the formation in the same shaft, and also in the upper sandy zone within 3.4 m (11 feet) of the top. Scaphites (Hoploscaphites) gilli is found throughout the entire fossiliferous zone both in this shaft, and in the much shorter fossiliferous interval at Sylvite. Jeletzky remarks that this interval represents the zone of Scaphites (Hoploscaphites) gilli, mid-upper Campanian (Cobban and Jeletzky, 1965) and may represent the Baculites gregoryensis zone if the tentative identification of Baculites cf gregoryensis is correct.

There is no evidence in the shafts of Upper Cretaceous shoaling over the high of the Saskatchewan - Manitoba "boundary structure". Petrolierous Boyne and Favel shales near the base of the Upper Cretaceous were of much interest in the shafts. Those at IMC, which ignited spontaneously in the dump were analyzed for oil shale content, while at sylvite, where workers encountered a strong odour of volatile hydrocarbons, samples of fresh material were sealed in cans and the gases analyzed. Results are shown in Tables 1, 2 and 3, and in Figures 2 to 5.

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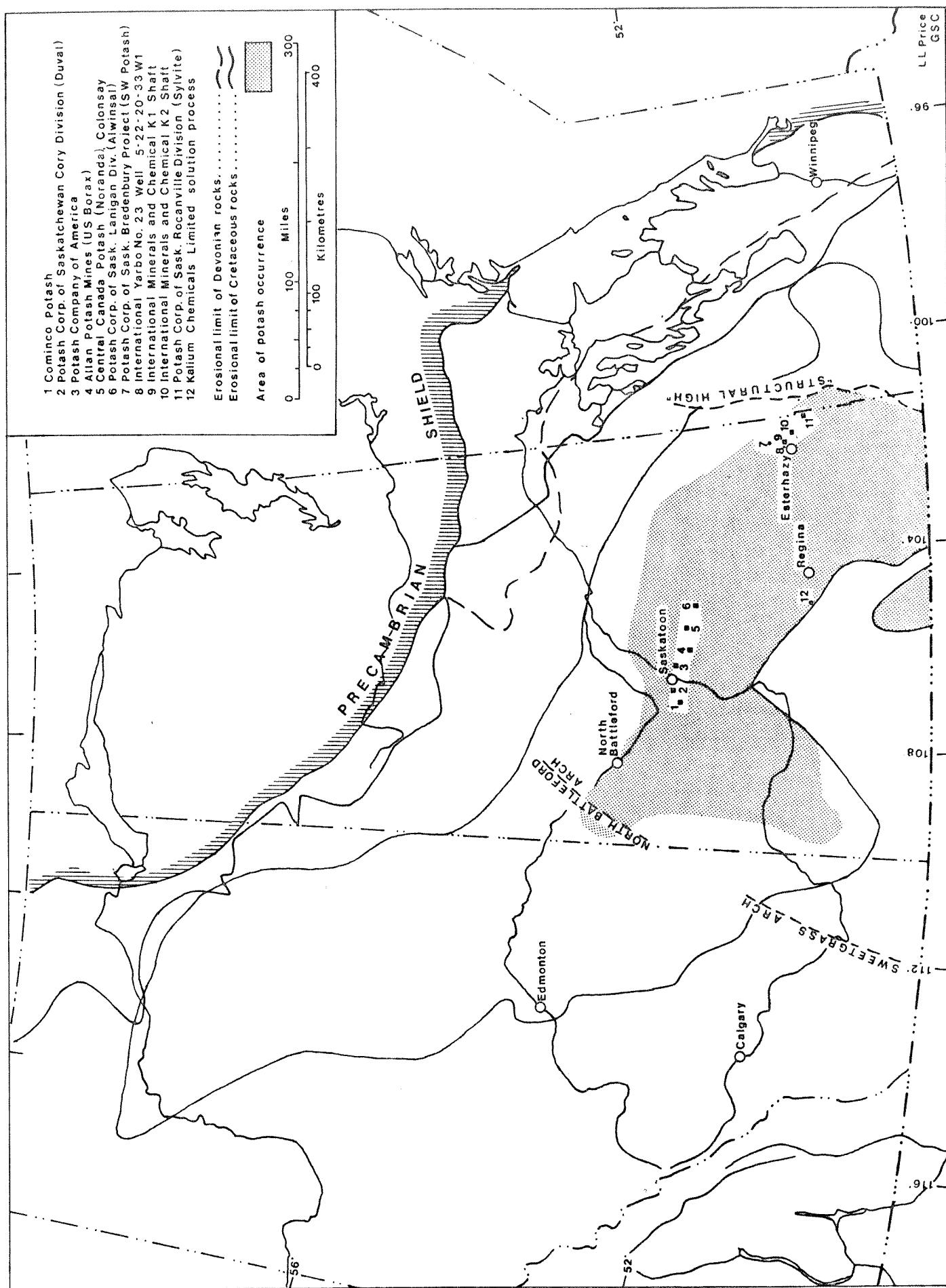


Figure 1. Index map of potash exploitation sites in Western Canada Sedimentary Basin

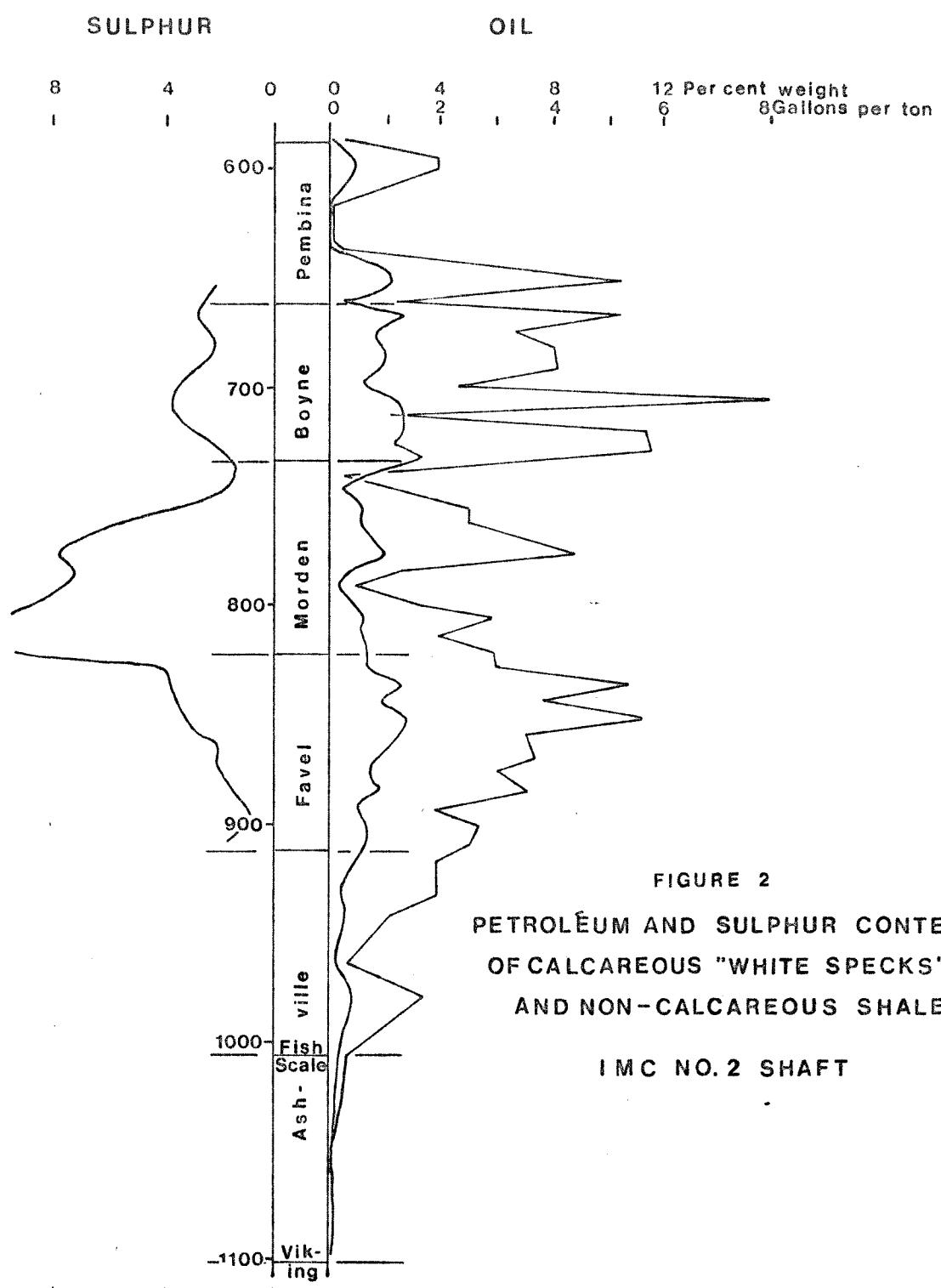


FIGURE 2  
PETROLEUM AND SULPHUR CONTENT  
OF CALCAREOUS "WHITE SPECKS"  
AND NON-CALCAREOUS SHALE  
IMC NO. 2 SHAFT

LL Price  
GSC 1975

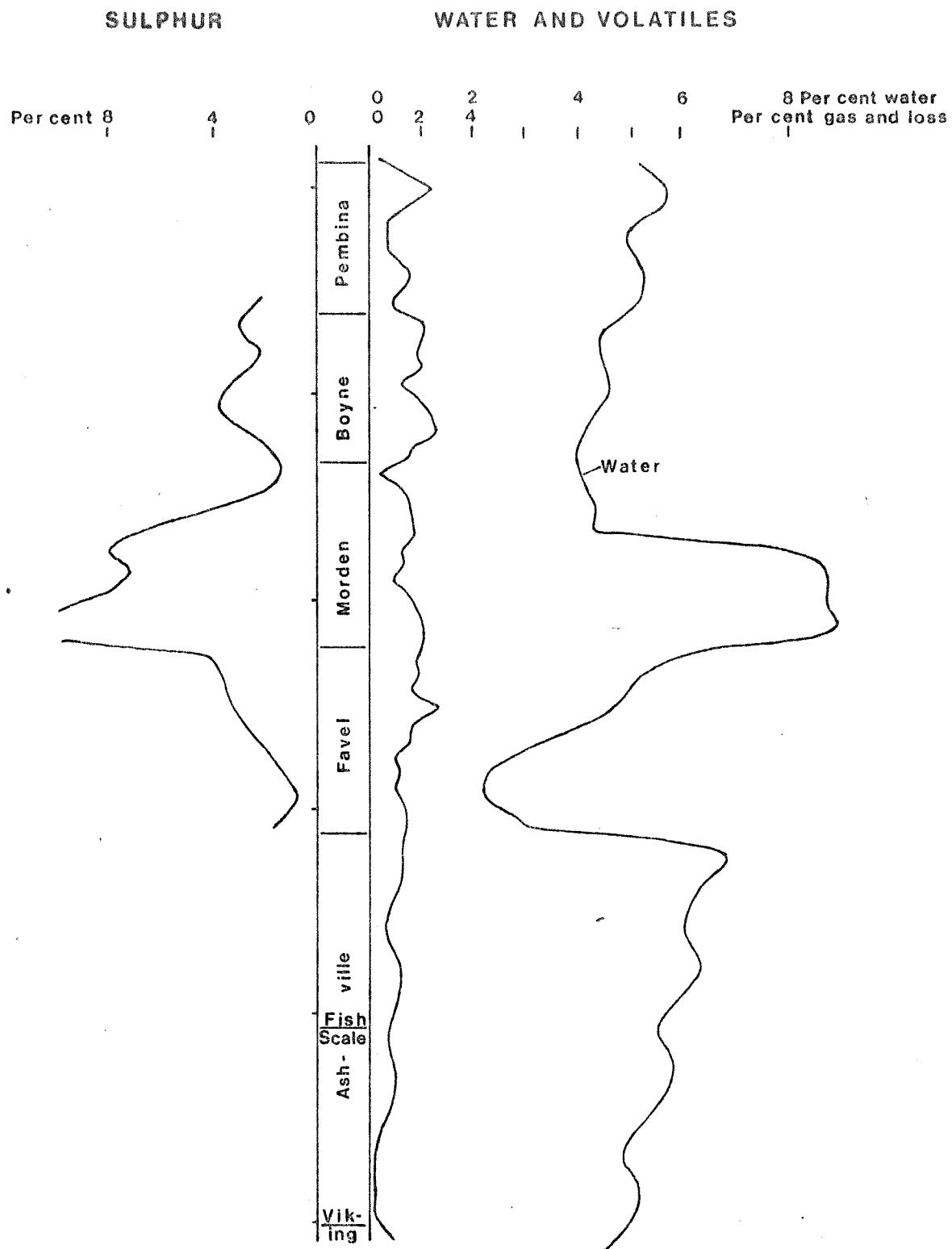


FIGURE 3.

GAS AND WATER LOSS DURING RETORT OF PETROLIFEROUS  
WHITE SPECKLED, AND NON-CALCAREOUS SHALE  
IMC NO.2 SHAFT  
ESTERHAZY SASKATCHEWAN

LL Price  
GSC 1975

Per cent gas by volume in headspace  
Depth      1    2    3    4    5    6    7    8    9    10

FIGURE 4. GASEOUS HYDROCARBONS  
IN FRESHLY EXCAVATED SHALE

Methane, ethane, propane,  
i-butane, n-butane in  
headspace of sealed containers

SYLVITE  
SHAFT NO. I

Riding Mountain

Formation

Pembina  
Member

Vermilion

Boyne  
River  
Member

River

Morden  
Member

Formation

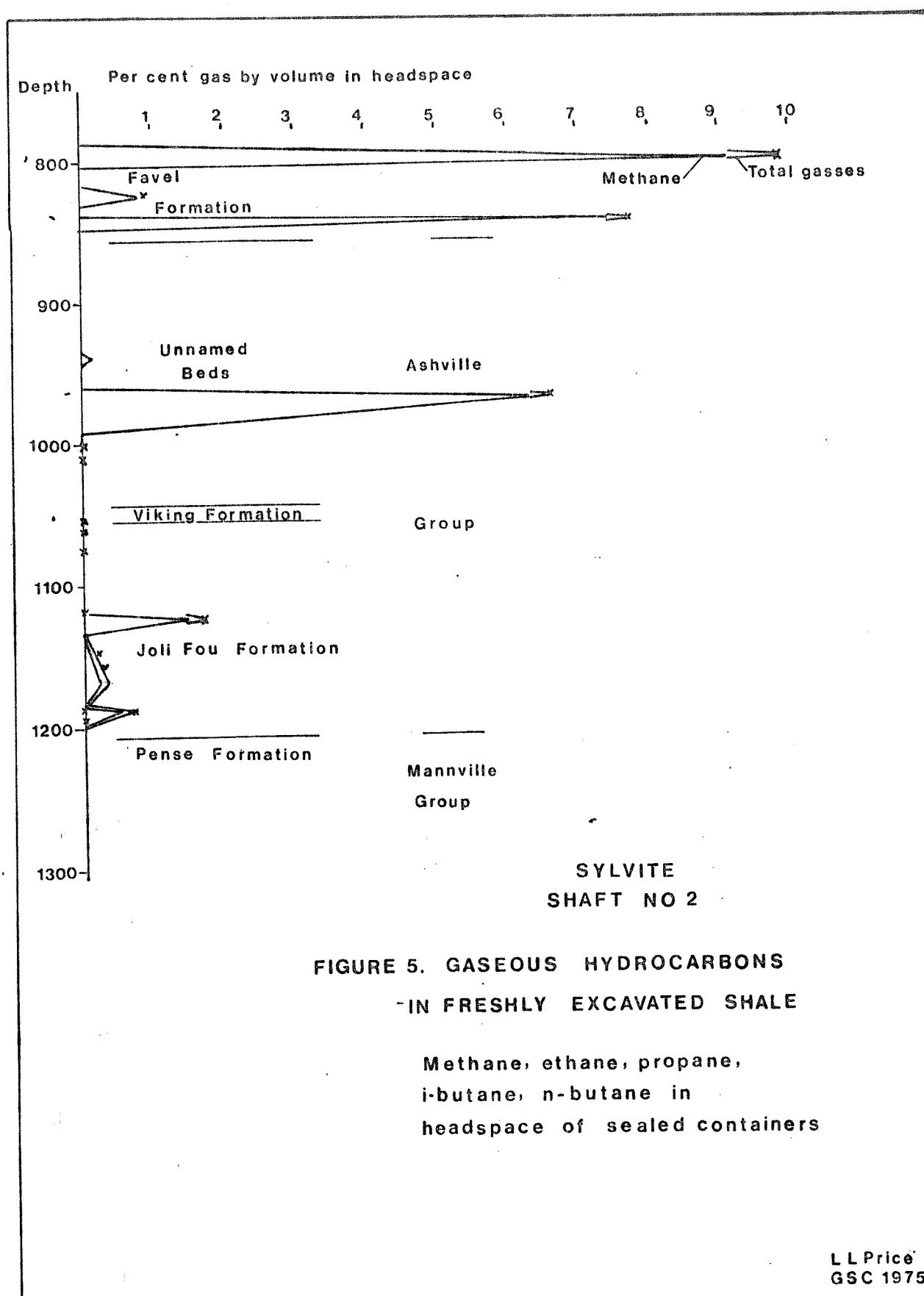
Favel

Formation

Ashville  
Group

Methane

Total gases



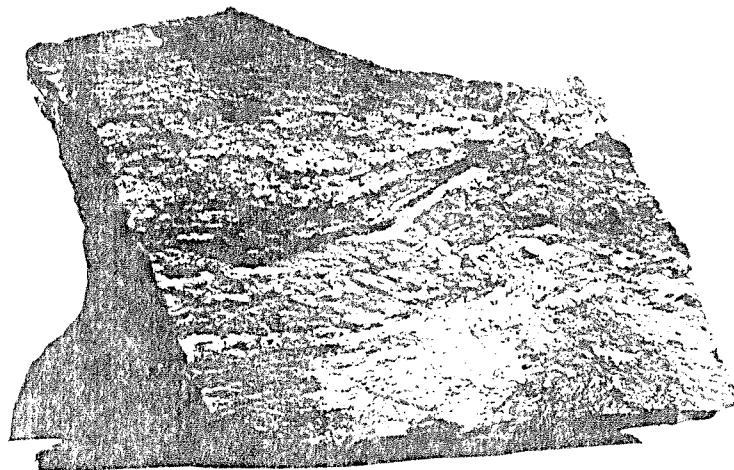


FIGURE 6. 1005'

Load Deformation

Fish Scale Sand

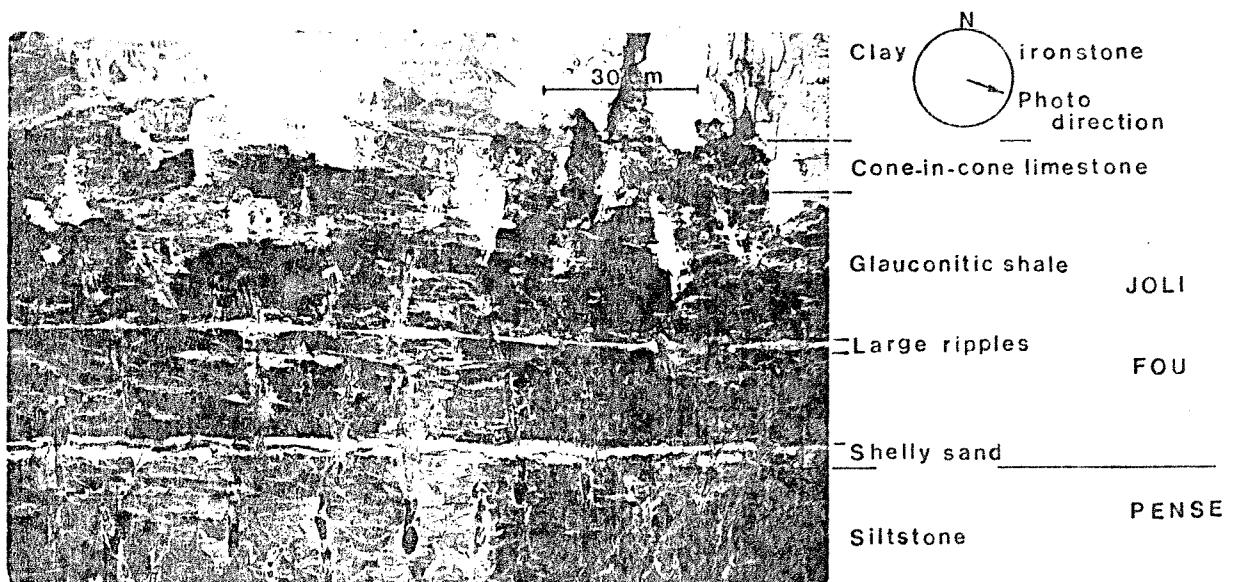
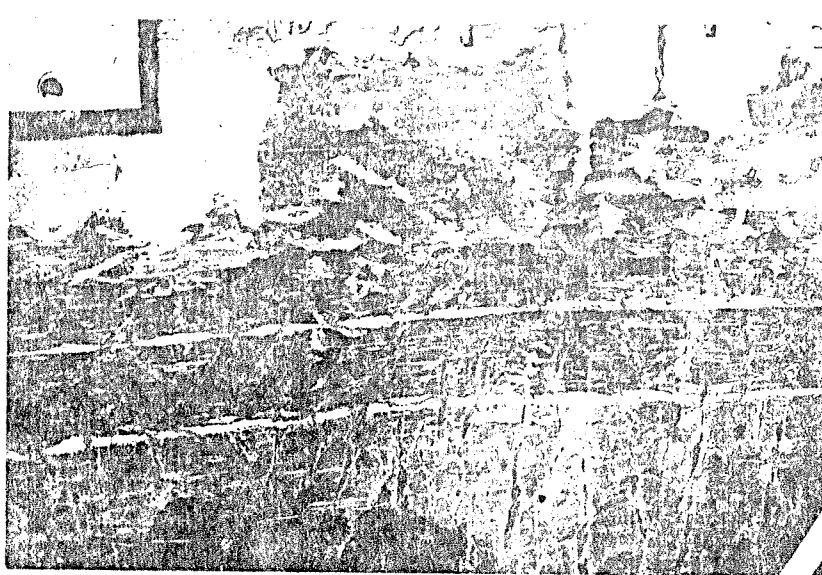


FIGURE 7. 1275'

IMC K2 SHAFT

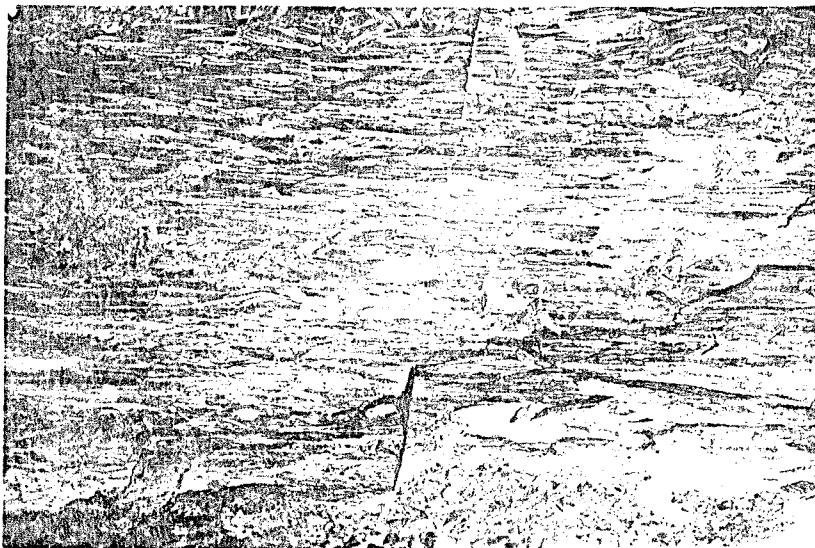


N  
Photo direction

JOLI FOU

PENSE

FIGURE 8. 1275'



Subtidal wavy and  
lenticular bedding

PENSE FM

FIGURE 9. 1285'

IMC K2 SHAFT

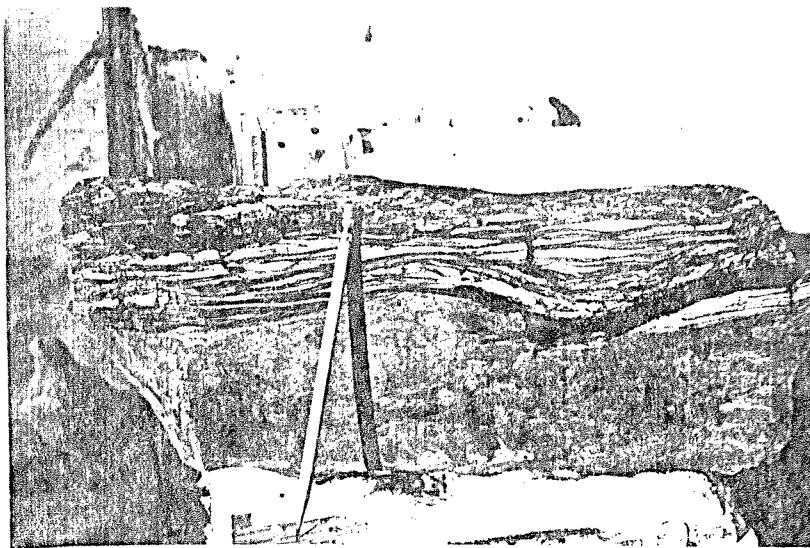


FIGURE 10. 1313

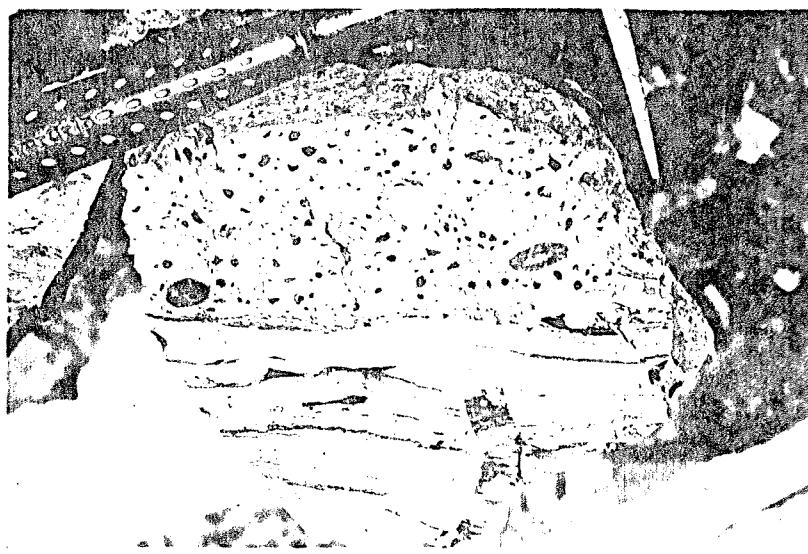


FIGURE 11. 1396'

IMC K2 SHAFT

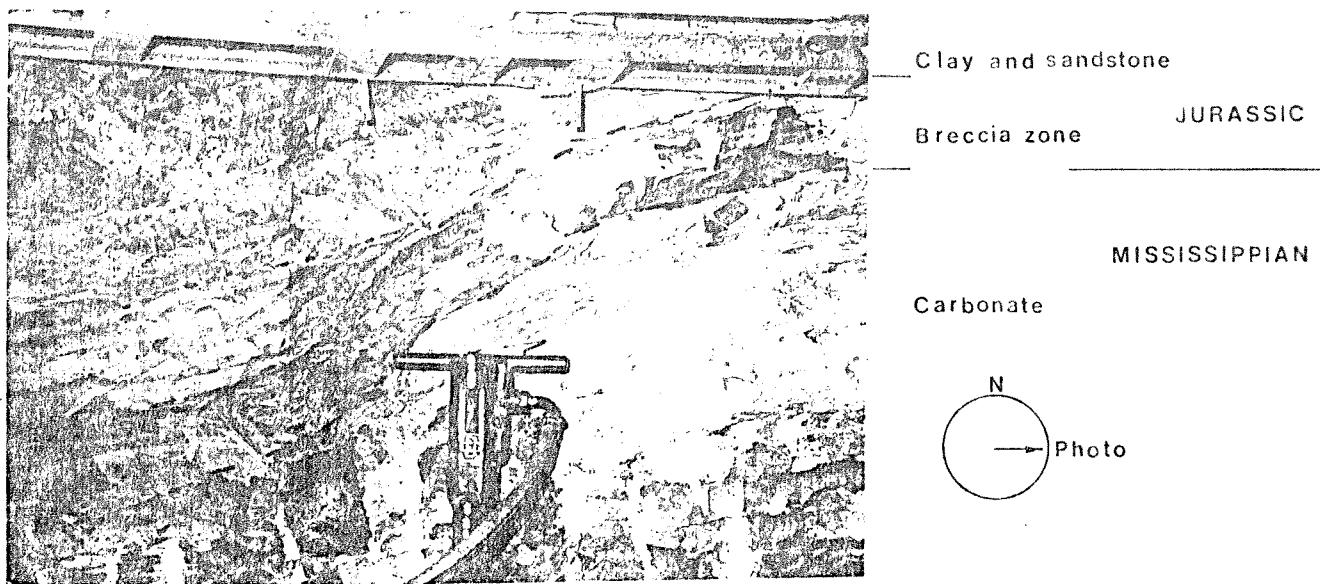


FIGURE 12. 1464'

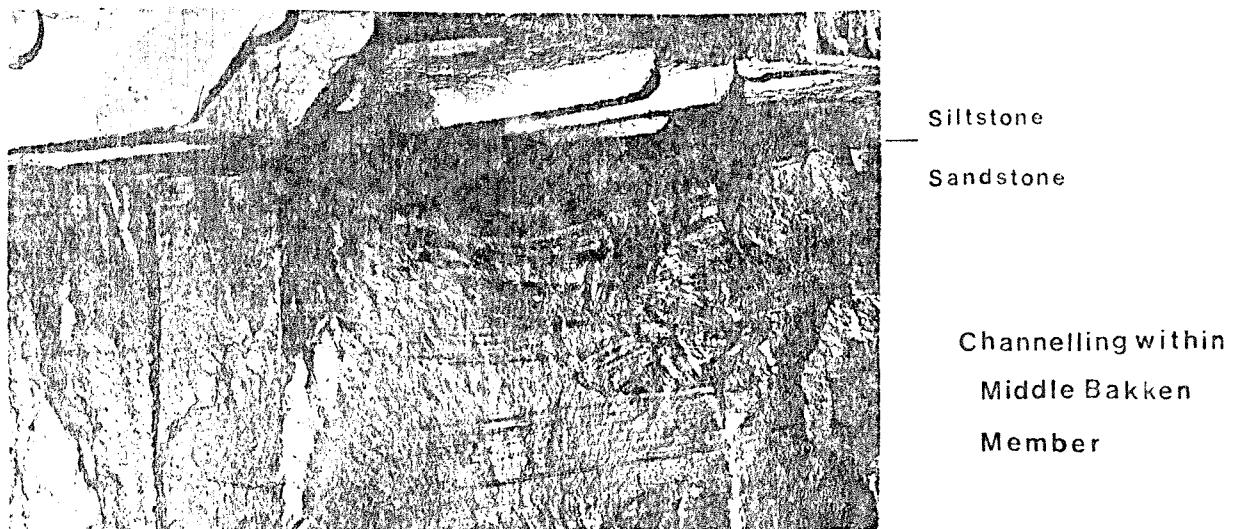


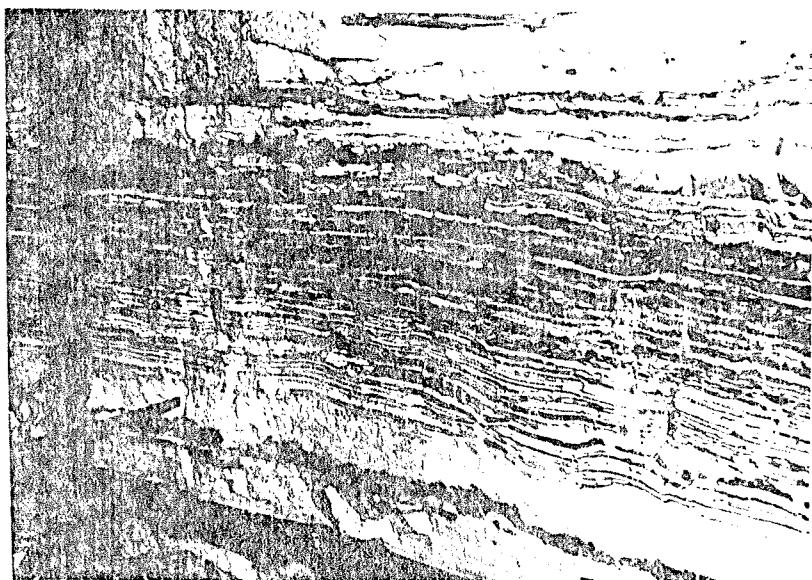
FIGURE 13. 1738.5'

IMC K2 SHAFT



Collapse breccia  
Torquay Formation

FIGURE 14. 1765'



Interbeds of  
silty dolomite,  
in red and green  
mudstone

Torquay

FIGURE 15. 1801'

IMC K2 SHAFT

Table 1. Analysis of 29 oil shale samples submitted by Dr. J.F. Caley, Geological Survey of Canada for Fischer Assay (Samples from  $7\frac{1}{2}$  foot intervals covering all of the section from the base of the Riding Mountain down to the Viking at I.M.C. #2 shaft. Originated by L.L. Price, Calgary.)

Depth in Shaft	% Spent Shale	% Water	% Gas & Loss	% Oil	Oil-S.G. 60/60°F	Imp. Gallons per ton*
582.5'- 590.0'	95.8	3.8	0.4	Nil	---	Nil
596'- 597.5'	95.1	4.2	0.7	Trace	---	Trace
590'- 597 $\frac{1}{2}$ '	92.0	5.6	1.5	0.9	---	1.9
597 $\frac{1}{2}$ '- 605'	89.8	7.0	2.3	0.9	---	1.9
605'- 612.5'	92.7	5.7	1.3	0.3	---	0.6
612.5'- 620'	94.2	5.2	0.6	Trace	---	Trace
620'- 627 $\frac{1}{2}$ '	95.4	4.1	0.5	Trace	---	Trace
625'- 632 $\frac{1}{2}$ '	94.4	5.2	0.4	Trace	---	Trace
632 $\frac{1}{2}$ '- 640'	93.9	5.0	0.9	0.2	---	0.4
640'- 647 $\frac{1}{2}$ '	92.6	4.0	1.5	1.9	0.944	4.0
647 $\frac{1}{2}$ '- 655'	91.5	5.2	1.1	2.2	0.938	4.7
655'- 662 $\frac{1}{2}$ '	92.8	5.8	0.9	0.5	---	1.1
662 $\frac{1}{2}$ '- 670'	91.4	4.1	2.0	2.5	0.966	5.2
670'- 677 $\frac{1}{2}$ '	91.4	5.0	2.0	1.6	0.966	3.3
677 $\frac{1}{2}$ '- 685'	92.5	3.8	1.8	1.9	0.954	4.0
685'- 692 $\frac{1}{2}$ '	92.0	4.1	1.9	2.0	0.949	4.2
692 $\frac{1}{2}$ '- 700'	93.0	3.9	1.5	1.6	0.956	3.3
	92.1	5.8	1.2	0.9	---	1.9

Table 1. (cont'd)

Depth in Shaft	% Spent Shale	% Water	% Gas & Loss	% Oil	Oil-S.G. 60/60°F	Imp. Gallons per ton*
700'- 707½'	92.2	3.5	1.9	2.4	0.969	5.0
707½'- 715'	88.6	3.9	2.4	5.1	0.965	10.6
	93.2	5.3	0.8	0.7	---	1.5
715'- 722½'	89.9	4.7	2.7	2.7	0.951	5.7
722½'- 727½'	92.2	4.0	1.6	2.2	0.943	4.7
727½'- 735'	91.2	3.9	1.5	3.4	0.959	7.1
735'- 742½'	95.7	4.0	0.3	Trace	---	Trace
772½'- 780''	87.9	8.7	1.4	2.0	0.942	4.4
780'- 787½'	89.7	8.5	1.2	0.6	---	1.3
787½'- 795'	89.3	9.1	1.4	0.2	---	0.4
795'- 802½'	88.9	9.0	1.3	0.8	---	1.6
802½'- 810'	88.7	8.2	1.8	1.3	0.943	2.8
810'- 818'	86.9	10.0	2.0	1.1	0.964	2.3
818'- 825½'	89.3	7.3	2.0	1.4	0.954	2.9
825½'- 833'	90.8	5.5	2.3	1.4	0.949	3.0
832'	92.4	4.4	1.7	1.5	0.947	3.2
833'- 840½'	89.4	6.1	1.9	2.6	0.959	5.4
849'	92.9	3.8	1.5	1.8	0.955	3.8
856½'	88.4	6.2	2.7	2.7	0.961	5.6
865'	91.5	4.4	1.6	2.5	0.956	5.1
873'	93.5	3.2	1.5	1.8	0.955	3.7

Table 1. (cont'd)

Depth in Shaft	% Spent Shale	% Water	% Gas & Loss	% Oil	Oil-S.G. 60/60°F	Imp. Gallons per ton*
881'	95.8	1.9	0.9	1.4	0.956	3.0
890'	94.2	3.0	1.1	1.7	0.958	3.6
897'	96.8	1.4	0.9	0.9	0.957	1.9
905'	95.2	2.3	1.2	1.3	0.962	2.7
913'	95.0	2.4	1.4	1.2	0.946	2.5
921'- 929½'	91.3	6.6	1.2	0.9	0.954	1.9
937'	91.4	7.0	1.2	0.4	---	0.9
944'	92.6	5.8	1.1	0.5	---	1.1
960½'- 968½'	93.6	5.7	0.6	0.1	---	0.3
975'- 983½'	91.6	6.5	1.1	0.8	---	1.7
991'- 1001'	92.6	6.0	1.0	0.4	---	0.8
1005'	93.8	5.4	0.6	0.2	---	0.3
1031'- 1091'	93.0	6.0	0.9	0.1	---	0.2
1051'- 1061'	94.9	4.8	0.3	Trace	---	Trace
1071'- 1081'	95.3	4.5	0.1	Trace	---	Trace
1093'- 1103'	94.6	5.2	0.2	Trace	---	Trace
1103'- 1123'	94.9	4.3	0.8	Trace	---	Trace
757½'- 765'	93.4	4.0	1.5	1.1	---	2.3
765'- 772½'	92.6	4.1	1.8	1.5	---	3.2

\*Imperial gallons oil per ton = (Weight % x 2) ÷ Specific Gravity.

Note: where gravity not determined use 0.95.

Table 2. Gaseous hydrocarbons in freshly excavated shale (canned samples), lower part of Riding Mountain, Vermilion River and Favel "White Specks", and upper part of Ashville Group unnamed shale; samples from Sylvite No. 1 Shaft, submitted to L.R. Snowdon, GSC Calgary. Percent gas by volume in tin can headspace.

DEPTH	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	iC <sub>4</sub>	nC <sub>4</sub>	TOTAL
174	.0001					.0001
210	.0001					.0001
282	.0003					.0003
306	.0003					.0003
316	.4911	.0097	.0012	.0004	.0006	.5030
321	.0005	.0001	.0000			.0007
334	.0002					.0002
342	.0003					.0003
356	.0003					.0003
362	.0616	.0008	.0004	.0001	.0003	.0630
380	.0004					.0004
394	.0002					.0002
401	1.0600	.0221	.0008	.0006	.0006	1.0891
422	.0002					.0002
472	.0005					.0005
480	.0007	.0001				.0008
488	.0006					.0006
495	3.6148	.0400	.0062	.0020	.0020	3.6659
505	5.8785	.0571	.0036	.0016	.0017	5.9426
533	6.1926	.0937	.0104	.0082	.0067	6.3117
546	.0012	.0001				.0013
549	6.7437	.1417	.0237	.0131	.0098	6.9319
578	8.4800	.4046	.2478	.0292	.0236	9.1852
607	7.4074	.4046	.1167	.0273	.0199	7.9759
615	7.8459	.7291	.1192	.0342	.0240	8.7525
624	7.9526	.6011	.0849	.0293	.0204	8.6883
631	8.5630	.8046	.1449	.0488	.0340	9.5952
642	4.6815	.0754	.0179	.0073	.0077	4.7897
653	3.8104	.0686	.0111	.0031	.0038	3.8963
658	5.2385	.0869	.0144	.0054	.0064	5.3515
664	.0006	.0001	.0000			.0007
667	6.2222	.0983	.0300	.0100	.0106	6.3711
676	6.0267	.1920	.0280	.0083	.0081	6.2630
688	7.1941	.3863	.0467	.0274	.0231	7.6775
699	7.1239	.4091	.0789	.0337	.0295	7.6801
711	7.8696	.5851	.1344	.0312	.0266	8.6470
732	7.8104	.6217	.1328	.0373	.0371	8.6392
754	2.1304	.1406	.0740	.0268	.0344	2.4061
760	3.6563	.4292	.1359	.0451	.0493	4.3163
763	1.7615	.2840	.1320	.0321	.0398	2.2544
769	4.2904	.4034	.1440	.0396	.0389	4.9162
773	.0030	.0004	.0004	.0007	.0012	.0056
777	6.2815	.2057	.0736	.0319	.0268	6.6194
806	7.4193	.5509	.0752	.0406	.0138	8.0997
824	.0646	.0016	.0005	.0004	.0004	.0675
827	.0109	.0012	.0023	.0047	.0027	.0218
976	8.6104	.5252	.1072	.0414	.0263	9.3109

TABLE 3

Gaseous hydrocarbons in freshly excavated shale (canned samples),  
 Ashville Group (includes lower part of Favel "White Specks" to  
 base of Joli Fou Formation): Samples from Sylvite No. 2 Shaft,  
 submitted to L.R. Snowdon, G.S.C. Calgary

DEPTH	$C_1$	$C_2$	$C_3$	$C_4$	$nC_4$	TOTAL
738	.0007					.0007
800	9.1141	.6469	.0784	.0331	.0135	9.8859
805	.0007	.0000	.0000	.0001	.0001	.0010
817	.0009	.0001	.0000	.0000	.0000	.0012
822	.0859	.0023	.0003	.0001	.0000	.0886
831	.0003					.0003
834	.0004					.0004
842	7.4989	.1806	.0472	.0217	.0113	7.7096
849	.0007	.0001				.0007
861	.0009	.0000	.0001	.0000	.0001	.0011
909	.0009	.0000				.0009
918	.0006	.0000	.0001			.0007
924	.0053	.0003	.0002	.0003	.0002	.0062
937	.2030	.0263	.0019	.0010	.0022	.2343
941	.0003	.0000				.0003
962	.0770	.0044	.0088	.0052	.0068	.1023
968	6.3407	.1737	.0402	.0222	.0218	6.5986
990	.0006	.0000	.0000	.0000	.0000	.0007
1001	.0004	.0000	.0000			.0004
1014	.0007	.0001	.0001			.0008
1055	.0002					.0002
1061	.0005					.0005
1076	.0003	.0000	.0000			.0003
1122	.0015	.0002	.0002	.0000	.0001	.0020
1128	1.4533	.0114	.0036	.0010	.0013	1.4706
1141	.0010	.0000				.0010
1147	.6489	.0123	.0033	.0012	.0011	.6668
1158	.7556	.0086	.0027	.0009	.0009	.7686
1162	.6563	.0051	.0017	.0005	.0006	.6641
1168	.7111	.0097	.0025	.0007	.0009	.7249
1185	.0013	.0002	.0002	.0000	.0001	.0017
1188	.6296	.0066	.0026	.0007	.0006	.6400
1198	.0005	.0001	.0001	.0000	.0001	.0009
1207	.3059	.0024	.0010	.0003	.0003	.3099

Per cent gas by volume in tin can headspace.

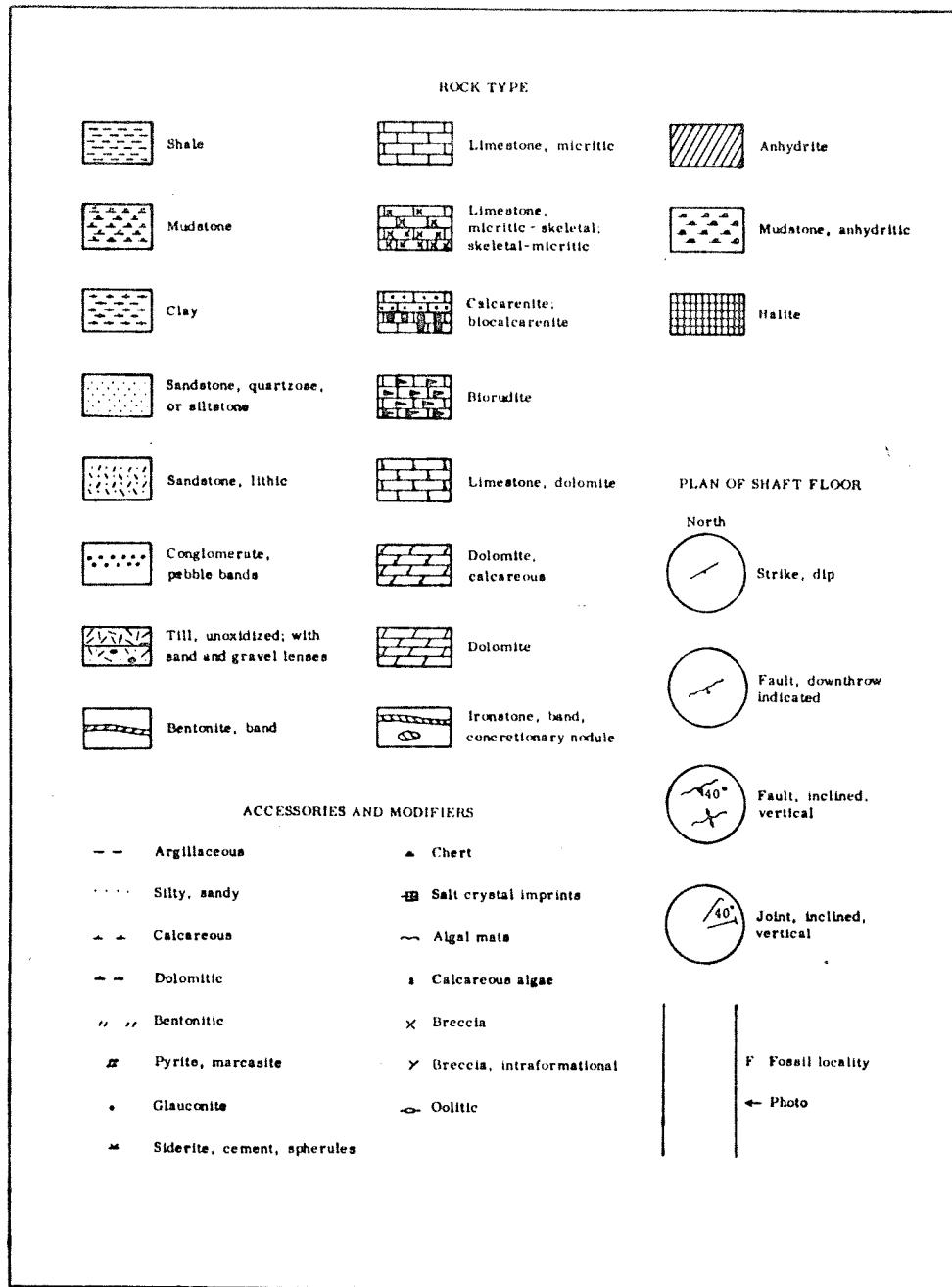


Figure 16. Generalized Legend for lithologic logs  
of Appendices I and II

APPENDIX I

IMC K2

Geological Log



INTERNATIONAL MINERALS AND CHEMICAL COMPANY K2 SHAFT

Lsd. 7, Sec. 27, Tp. 19, Rge. 32, WPM

Elevation of Shaft Collar (Datum) 1,655.85

Geology of shaft wall by Wolfgang Wiens and L.L. Price

Depth ft	Lithology
<u>CENOZOIC</u>	
QUATERNARY	
0 - 15	Clay: light brown, unsorted sand, gravel and boulders
15 - 17	Clay: light brown to chocolate brown with unsorted sand, gravel and boulders, firmer than above
17 - 19	Clay: chocolate brown to blue-grey, containing pebbles
19 - 41	Clay: blue-grey silty to sandy with unsorted pebbles and boulders in clay matrix
41 - 42.5	Sand and gravel: poorly sorted sand grading to pea gravel
42.5 - 45	Clay: blue-grey containing poorly sorted sand and gravel; impermeable
45 - 83.5	Clay: blue-grey without sand or gravel; impermeable
83.5 - 92	Mudstone: blue-grey, silty, impermeable
<u>MESOZOIC</u>	
CRETACEOUS	
Riding Mountain Formation	
92 - 106	Mudstone: light grey, sandy to silty, about 40% quartz sand; no permeability; fossils collected from 0' to 107', <i>Scaphites</i> sp. indet., <i>Baculites</i> sp. indet., GSC loc. 64963; from 104' to 105', indeterminate pelecypods, GSC loc. 64999; from 105' to 107', indeterminate pelecypods, GSC loc. 64958

The following notes are based on direct observations of W. Wiens

106 - 109	Mudstone: very sandy (quartzose), light grey; sericite; carbonized organic specks; specks of red clay; oxidized pyrite after horizontal animal burrows and plant fragments; ironstone concretions, ellipsoidal to round, 7.5 cm to 0.6 m in diameter, with radial calcite-lined fissures, some calcite with botryoidal appearance; fossils collected from 94' to 109', indeterminate marine pelecypods, GSC loc. 64957; from 105' to 110', <i>Baculites</i> cf. <i>compressus</i> Say (s. lato), GSC loc. 64959
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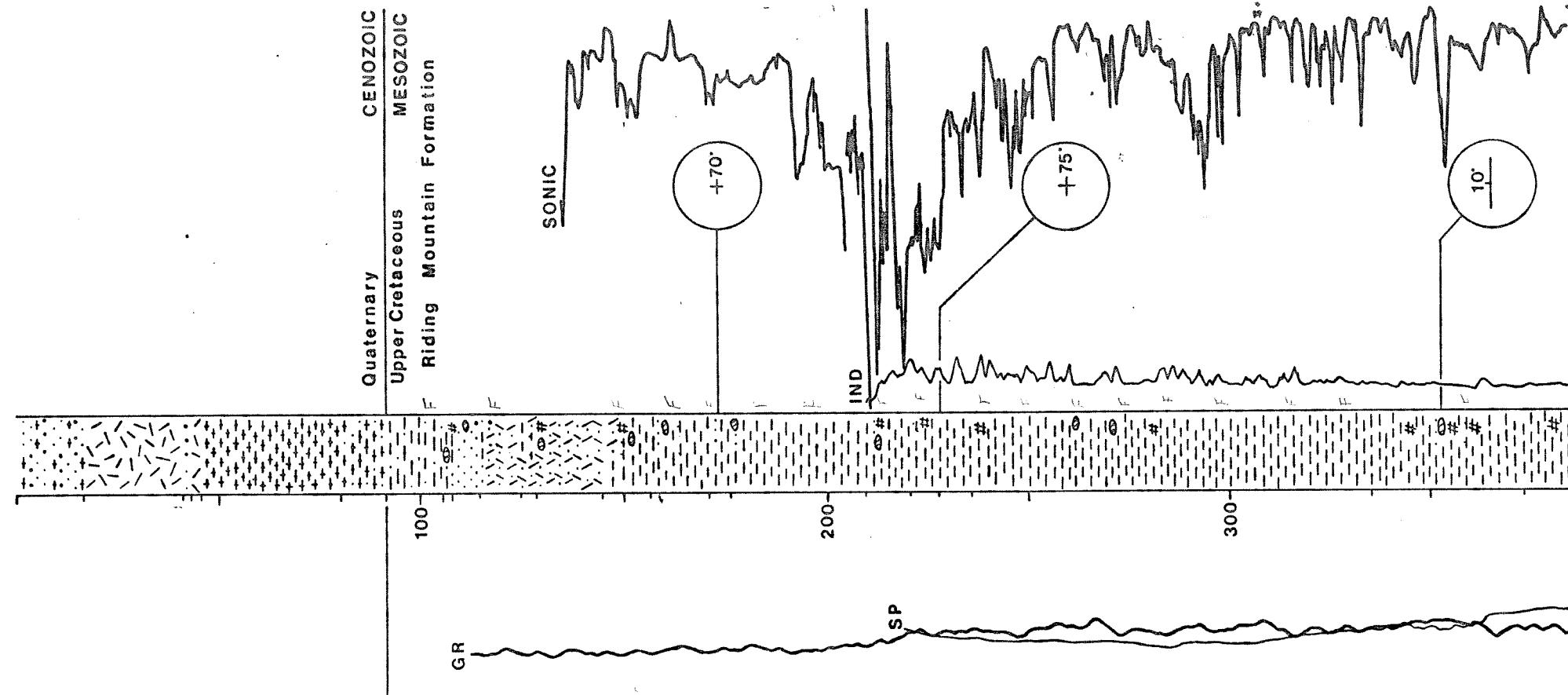
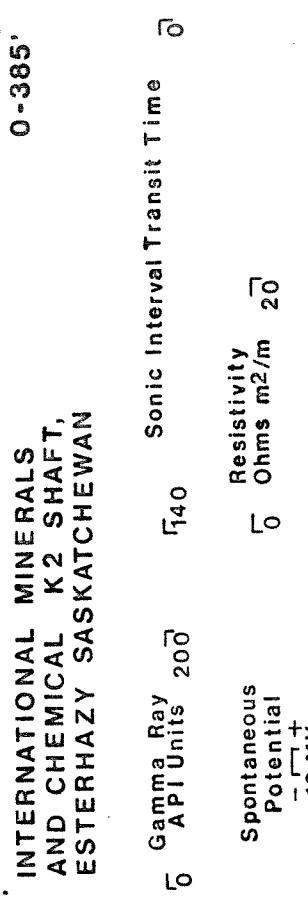
Depth ft		Lithology
109	- 115	Sandstone: light grey with green cast, argillaceous, poorly indurated, with hard calcite-cemented zones; mica; yellow-green glauconite; biotite; carbonized organic specks; patches and streaks of finely divided pyrite; ironstone concretions
115	- 125	Sandstone: lithic, argillaceous, green-grey glauconitic, very fine-grained, with abundant dark chert (?) grains; biotite; altered clay grains, white, brown, red; carbonized organic specks; inclusions of non-sandy clay, some with nodular (faecal pellet) structure; fossils collected from 118' to 120', <i>Lingula</i> sp. indet., GSC loc. 64956; from 120' to 125', <i>Baculites</i> cf. <i>gregoryensis</i> Cobban, <i>Inoceramus balticus</i> Böhm (s. lato), GSC loc. 64997
125	- 129	Sandstone: lithic, argillaceous with granular labile component as above; calcareous lenses with cone-in-cone structures; fossils collected from 125' to 129', <i>Baculites</i> sp. indet., indeterminate pelecypods, GSC loc. 64955
129	- 145	Sandstone: lithic, as in 109' to 115', ironstone concretions; pyrite after animal tracks at base; fossils collected from 129' to 135', <i>Baculites</i> sp. indet., indeterminate pelecypods, GSC loc. 65003 and GSC loc. 65006; from 132' ± 1' to 135', <i>Inoceramus</i> cf. <i>balticus</i> Böhm (s. lato), <i>Baculites</i> sp. indet., GSC loc. 65005; from 135' to 138', <i>Baculites</i> sp. indet., <i>Inoceramus</i> sp. indet., indeterminate pelecypods, GSC loc. 64969; from 138' to 142', indeterminate pelecypods, <i>Baculites</i> sp. indet., GSC loc. 65002; from 142' to 145', indeterminate marine pelecypods, GSC loc. 64998; from 142' to 145', <i>Scaphites (Hoploscaphites)</i> cf. <i>gizilli</i> Cobban and Jelletzky, indeterminate pelecypods, GSC loc. 65000
145	- 157	Mudstone, or blocky shale: medium light-grey, irregularly sandy (very fine, lithic) or silty; oxidized pyrite after animal tracks and fossil fragments; abundant aggregates of faecal pellets 0.8 mm long, partly pyritized; chlorite; sericite; flattened specks of red clay (rare); scattered concretions (non-septarian) calcareous lenses; fossils collected from 145' to 150', indeterminate shell fragments, GSC loc. 65007; from 150' to 155', <i>Inoceramus balticus</i> Böhm (s. lato), <i>Baculites</i> sp. indet., <i>Scaphites</i> sp. indet., cf. <i>Hemister</i> sp. indet. (an irregular echinoid), indeterminate pelecypods, GSC loc. 65004; from 155' to 157', <i>Inoceramus</i> cf. <i>balticus</i> Böhm (s. lato), <i>Baculites</i> sp. indet., GSC loc. 64974

Depth ft	Lithology
157 - 171	Mudstone or blocky shale: silty or very finely sandy, conchooidal-fracturing; as in 145' to 157' but more blocky; concretions 157' to 166'; calcareous lenses 161' to 166'; shale from 161; to 166' 17 to 18% water content by weight; Foraminifera; fossils collected from 157' to 161'; <i>Baculites</i> cf. <i>gregoryensis</i> Cobban, <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm (s. lato), GSC loc. 64970; from 161' to 166', <i>Scaphites (Hoploscaphites) cf. n. sp. ex aff. gilli</i> Cobban and Jeletzky, <i>Inoceramus cf. balticus</i> Böhm (s. lato), gastropod, genus and sp. indet., Rhynchonellid brachiopod, genus and species indet., GSC loc. 64972
171 - 176	Shale: silty or very finely sandy; jointing plane dipping 70°; fossils collected from 166' to 176', <i>Scaphites (Hoploscaphites) cf. gilli</i> Cobban and Jeletzky, <i>Pholadomya</i> sp. indet., indeterminate pelecypods, <i>Dentalium</i> sp. indet., <i>Inoceramus balticus</i> Böhm (s. lato), GSC loc. 64976; from 171' to 176', <i>Inoceramus balticus</i> Böhm (s. lato), <i>Baculites</i> sp. indet., <i>Pholadomya cf. mcleani</i> Landes, <i>Dentalium</i> sp. indet., GSC loc. 65014
176 - 210	Shale blocky or mudstone: silty; small ironstone concretions; small concretions above 192'; fossils collected from 176' to 182', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites) sp. indet.</i> , <i>Baculites</i> sp. indet., <i>Inoceramus balticus</i> Böhm (s. lato), GSC loc. 64973; from 182' to 191', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites) n. sp. ex aff. gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Goniomya</i> sp. indet., <i>Pholadomya cf. mcleani</i> Landes, indeterminate gastropods, GSC loc. 65008; from 192' to 198.6', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites) n. sp. ex aff. gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Pholadomya cf. mcleani</i> Landes, <i>Inoceramus balticus</i> Böhm (s. lato), <i>Polinices</i> sp. indet., indeterminate pelecypods, GSC loc. 64944; from 198.6' to 207', <i>Scaphites (Hoploscaphites) n. sp. ex aff. gilli</i> Cobban and Jeletzky, <i>Scaphites</i> sp. indet., <i>Pholadomya cf. mcleani</i> Landes, irregular echinoid, genus and species indet., <i>Dentalium</i> sp. indet., GSC loc. 64965
210 - 221	Mudstone or blocky shale; finely silty, micaceous; sericite; streaks of pyrite after flattened animal trails and burrows, slightly oxidized; ironstone concretions, some septarian from 12 mm to 1 m across at top of interval, becoming smaller and less numerous downward; fossils collected from 210' to 216', <i>Scaphites (Hoploscaphites) n. sp. ex aff. gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Inoceramus balticus</i> Böhm (s. lato), <i>Baculites mcleani</i> Landes, indeterminate pelecypods, GSC loc. 64947; from 216' to 221', <i>Scaphites (Hoploscaphites) sp. indet.</i> , <i>Pholadomya cf. mcleani</i> Landes, <i>Polinices</i> sp. indet., gastropods sp. indet., GSC loc. 64966

Depth ft		Lithology
221	-	Shale: medium grey with brown cast (5 Y 6/1), blocky with irregular fissility; pyritic streaks, oxidized, after animal tracks; traces of faecal pellets; fossils collected from 221' to 225', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites)</i> n. sp. ex aff. <i>gilli</i> . Cobban and Jeletzky, indeterminate pelecypods, indeterminate gastropods, GSC loc. 64949; from 225' to 228', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> Cobban and Jeletzky, <i>Inoceramus</i> sp. indet., Pelecypod, genus and sp. indet., gastropods, genus and sp. indet., <i>Dentalium</i> sp. indet., GSC loc. 64964
228	-	Shale: blocky as above; jointing planes, dipping 75°; fossils collected from 228' to 236', <i>Pholidomya</i> sp. indet., <i>Inoceramus</i> sp. indet., indeterminate pelecypods, indeterminate gastropods, GSC loc. 64953
236	-	Shale: medium light-grey, blocky; irregular fissility, carbonized organic specks; pyritized animal traces; single concretion about 261'; fossils collected from 236' to 245', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> Cobban and Jeletzky, indeterminate pelecypods, indeterminate gastropods, GSC loc. 64950; from 245' to 253', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus</i> cf. <i>balticus</i> Böhm (s. lato), indeterminate pelecypods, GSC loc. 64951; from 253' to 261', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm (s. lato), indeterminate pelecypods, indeterminate gastropods, <i>Dentalium</i> sp. indet., GSC loc. 64945; from 261' to 269', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Inoceramus</i> sp. indet., indeterminate pelecypods, indeterminate gastropods, <i>Dentalium</i> sp. indet., GSC loc. 64948
269	-	Shale: medium grey; abundant concretions with light brown rim and dark centre, isolated and coalescing in bed 7.5 to 10 cm thick, thinning between concretions; fossils collected from 269' to 277', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites)</i> n. sp. ex aff. <i>gilli</i> Cobban and Jeletzky. <i>Inoceramus</i> sp. indet., <i>Baculites</i> sp. indet., indeterminate pelecypods, indeterminate gastropods, <i>Dentalium</i> sp. indet., GSC loc. 64954
277		

Depth ft	Lithology
277 - 335	Shale: medium light grey, blocky; minute carbonaceous specks; pyritized animal traces, partly oxidized; siliceous worm tubes; fossils collected from 261' to 285', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus cf. balticus</i> Böhm (s. lato), indeterminate pelecypods, <i>Dentalium</i> sp. indet., indeterminate gastropods, GSC loc. 64952; from 277' to 285', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> Cobban and Jeletzky, <i>Inoceramus cf. balticus</i> Böhm (s. lato), GSC loc. 64961; from 285' to 295', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites)</i> sp. indet., <i>Inoceramus balticus</i> Böhm (s. lato), GSC loc. 64968; from 295' to 303', <i>Baculites cf. gregoryensis</i> Cobban, <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus cf. balticus</i> Böhm (s. lato), indeterminate pelecypods, GSC loc. 64946; from 303' to 307', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Inoceramus</i> sp. indet., indeterminate pelecypods, <i>Polinices</i> sp. indet. (marine gastropod), GSC loc. 64967; from 307' to 313', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm (s. lato), indeterminate pelecypods, GSC loc. 65009; from 313' to 321', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Inoceramus</i> cf. <i>balticus</i> Böhm (s. lato), GSC loc. 65010; from 321' to 325', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., GSC loc. 65013; from 325' to 327', <i>Scaphites (Hoploscaphites)</i> cf. <i>gilli</i> , <i>Baculites</i> sp. indet., GSC loc. 64983; from 327' to 335', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm (s. lato), <i>Baculites</i> sp. indet., GSC loc. 64996
335 - 343	Shale: medium grey, blocky; abundant fossils, all fragmented; fossils collected from 335' to 343', <i>Inoceramus cf. balticus</i> Böhm (s. lato), <i>Scaphites</i> sp. indet., <i>Baculites</i> sp. indet., GSC loc. 64987
343 - 350	Shale: medium light-grey, blocky; minute carbonaceous specks; pyritized fossil traces; fossils collected from 343' to 350', <i>Baculites</i> sp. indet., indeterminate pelecypods, GSC loc. 64995
350 - 354	Shale: medium light grey, blocky, with fossil traces as above; rare horizontal silt-filled burrows; zone of silt laminae; concretionary bed, lenticular, dips 10°N, fish bone fragments; fossils very rare; fossils collected from 350' to 354', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, GSC loc. 64988
354 - 357	Shale: medium-grey, blocky; pyritized fossil traces

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Depth ft		Lithology
357	- 373	Shale: blocky with pyritized fossil traces; lenses of fibrous calcite up to 25 cm thick and 2 m long containing shaly partings; fossils very rare, some fish bones; oxidized pyritic aggregates; spheriules of yellow copiapite and acicular crystals of white mineral (both crystallized in part from formation fluid); abundant biotite in surrounding shale; fossils collected from 365' to 373', fish scales, GSC loc. 64992
373	- 418	Shale: medium-grey, blocky; pyritized animal traces; siliceous worm tubes (horizontal); scattered fish scales; macrofossils rare, poorly preserved ammonites, pelecypods; fault at 401', slickensided, strike NNW, dip 50°W, defined by brecciated zone 15 cm wide, offset about 20 cm; fossils collected from 373' to 378', fish spines and scales, GSC loc. 64977; from 394' to 403', <i>Scaphites (Hoploscaphites)</i> sp. indet., fish scales, GSC loc. 64993; from 403' to 410', fish scales, GSC loc. 64994
418	- 425.5	Shale: medium light-grey, blocky, pyritized animal tracks; scattered ferruginous concretions; lens of ironstone 15 cm thick at 424', dipping 5°E, intersected by two slickensided faults on west wall of shaft with 1.2 m displacement
425.5	- 433	Shale: medium light grey, blocky, smooth-textured; rare concretions; streaks and inclusions of pyrite (tarnished), some with limonite after animal burrows and other traces; fossils collected from 425.5' to 433', fish scales, GSC loc. 64986
433	- 440	Shale: medium light grey, with irregular fissility, as above, rare pyritized animal burrows, traces, some limonitic; no concrections; fossils collected from 433' to 440', fish scales, GSC loc. 64978
440	- 447.5	Shale: medium light grey, blocky; animal traces pyritic and limonitic; silt partings; fossils collected from 440' to 447.5', <i>Pteria</i> sp. indet., GSC loc. 64981
447.5	- 455	Shale: Medium light grey, blocky; rare animal traces; fragmented fish remains
455	- 462.5	Shale: blocky, conchoidal-fracturing, with rare silt partings; band of green-grey bentonite, 2.5 to 5 cm thick at 460'; nodules of pyrite or marcasite in radiating crystal pattern about 10 mm in diameter; fossils collected from 455' to 462.5', fish scales, GSC loc. 64982
462.5	- 470	Shale: medium light grey, blocky; a few concretions; widely scattered, minute silt lenses; fish scales; fossils collected from 462.5' to 470', <i>Scaphites (Hoploscaphites) grilli</i> Cobban and Jeletzky, GSC loc. 65011

Depth ft	Lithology
470 - 477.5	Shale: blocky, with abundant silt partings and concretions, ferruginous animal trace fossils; burrows with faecal pellets at 473'; a few beds of bentonite and lenses of fibrous calcite containing many shale partings and cone-in cone structure; calcite lens 15 cm thick, 0.8 m long at 474', with radiating and concentric structure; bentonite bed 10 mm thick about same depth; fossils collected from 470' to 477.5', <i>Scaphites (Hoploscaphites) cf. gilli</i> , fish scales and spines, irregular echinoid, genus and species indet., GSC loc. 66835; photograph GSC Cat. 149415
477.5 - 485	Shale: blocky, with silt partings; fibrous calcite in part with cone-in-cone; pyritized trace fossils, fish scales; fossils collected from 477.5' to 485', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, GSC loc. 66840
485 - 492.5	Shale: blocky, conchoidal-fracturing, with abundant silt partings as above; large ironstone concretions; fish scales, fossils collected from 485' to 492.5', <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, GSC loc. 66832
492.5 - 507.6	Shale: medium light grey, blocky; finely granular pyrite, tarnished, after fossil traces; ferruginous trace fossils; ironstone concretions occurring singly and joined into beds; foraminifera; fossils collected from 492.5' to 500', <i>Baculites</i> sp. indet., <i>Scaphites</i> sp. indet., GSC loc. 66885; from 500' to 507.6'. <i>Scaphites (Hoploscaphites) cf. gilli</i> Cobban and Jeletzky, fish scale and spines, GSC loc. 66842
507.6 0 515	Shale: blocky, as above; no concretions; fish scales; fossils collected from 507.6' to 515', <i>Scaphites (Hoploscaphites) cf. gilli</i> Cobban and Jeletzky, fish scales and spines, GSC loc. 66833
515 - 522.5	Shale: medium light grey, blocky, conchoidal-fracturing; specks of blackened pyrite and/or carbon; ferruginous concretionary zones with gradational boundaries, some nodular, others flat, discontinuous, parallel to bedding; fossils collected from 515' to 522.5', fish scales and spines, GSC loc. 66834
522.5 - 537.5	Shale: blocky; abundant pyritic streaks after animal traces; pyritic nodules 1 to 4 mm across; discontinuous ferruginous laminae; rare fish scales, Linguloid brachiopod (too fragile for collection); fossils collected from 522.5' to 530', indeterminate ammonite ( <i>Scaphites</i> sp. indet.?), fish scales, GSC loc. 66844; from 530' to 537.5', <i>Lingula</i> sp. indet., fish scales and spines, GSC loc. 66837
537.5 - 545	Shale: medium light grey, blocky, abundant pyritized worm(?) tracks; bands of concretions with indefinite boundaries as in 515' to 522.5'; bands of harder, dark concretions; fossils collected from 537.5' to 545', <i>Scaphites (Hoploscaphites) gilli</i> , fish scales and spines, GSC loc. 66843

Depth ft	Lithology
545 - 552.5	Shale: with concretions as in 537.5' to 545' above; slickensided fractures, strike NNE, dip 65°W; fibrous calcite lens with partings of shale and grey-green bentonite
552.5 - 568	Shale: blocky, as above; ironstone concretions; slicken-sides; fossils collected from 552.5' to 560', indeterminate ammonite ( <i>Scaphites</i> sp. indet?), GSC loc. 66841
568 - 575.5	Shale: blocky, but more fissile than above; concretions; pyritized-burrows or other animal traces, (up to 10 mm in diameter)
575.5 - 582.5	Shale: medium grey, moderately fissile; animal traces, pyritized; bed of bentonite 3.5 cm thick with sharp lower contact, upper contact gradational; fish scales
582.5 - 590	Shale: medium grey, fissile; ironstone concretions; irregular inclusion of microgranular pyrite; bentonite beds at 587' and 588'; fish scales
590 - 596	Shale: medium grey, moderately fissile; abundant pyritized animal traces; irregular inclusions of pyrite up to 2.5 cm across; <i>Baculites</i> , poorly preserved

#### Vermilion River Formation

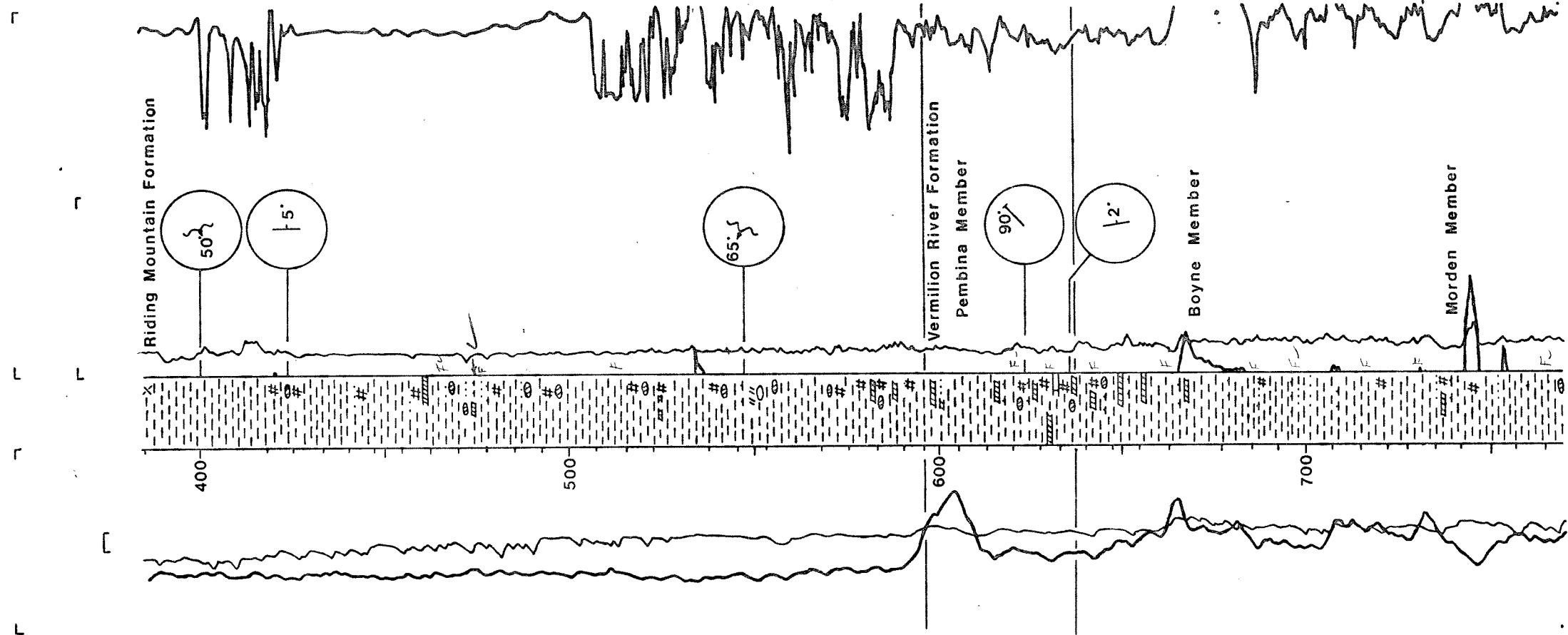
##### Pembina Member

596 - 597.5	Shale: dark grey, more fissile than above; three thin beds of bentonite with gradational contact upward; light grey (bentonitic?) grains in shale near top of interval; great abundance of fish scales in shale close to bentonite beds; petrolierous odour, no animal burrows or trace fossils; fish scales, spines and vertebrae, GSC loc. 66848
597.5 - 605	Shale: dark grey, fissile, silty, hard; bentonite beds; fish scales and spines, GSC loc. 66847
605 - 612.5	Shale; dark grey, fissile as above; petrolierous layers; bitumen; fish bone fragments, scales
612.5 - 620	Shale: dark grey with smaller proportion of petrolierous material than above; many bentonite beds, with concentrations of mica and calcite grains along lower contacts; trace fossils numerous in non-oily shale, but lacking in petrolierous layers which contain only fish scales; fossils collected from 605' to 615.5', fish vertebrae and scales, GSC loc. 66882; from 612.5' to 620', fish scales, spines, and vertebrae, GSC loc. 66853

Depth ft	Lithology
620 - 627.5	Shale: dark grey, resembling shale in 582.5' to 590' but less fissile, slightly oily; abundant trace fossils; numerous pyrite inclusions; lens of fibrous calcite 6 mm thick, 25 mm from bed of ferruginous concretions; bed of bentonite, light green, streaky at base, grading upward to yellowish white; jointing strike NE-SW, dip vertical, fewer fish scales than above; large <i>Inoceramus</i> resembling <i>I. deformis</i> Meek more than any other species known to the writer, fish vertebrae, GSC loc. 66880
627.5 - 632.5	Shale: dark grey, fissile, slightly petrolierous; pyrite; fibrous calcite in contact with yellowish-white bentonite; abundant trace fossils; rare fish scales
632.5 - 640	Shale: medium dark to grey, with petrolierous odour; granular pyrite marking trace fossils, trace fossils lacking in darker shale; concretions; bentonite beds, striking 100°, dipping 2°ENE (15 cm in 6.7 m); cf. <i>Prionocyclus</i> ( <i>Collignoniceras</i> ) ex gr. <i>woolgari-hyattii</i> pelecypods, genus and species indet., GSC loc. 66881
640 - 647.5	Shale: with petrolierous odour as above but with less pyrite, bentonite and ironstone; one or more thin beds of shale with calcareous white specks; cf. <i>Haresiceras montanaense</i> Reeside, poor ammonite resembling <i>Haresiceras</i> ex gr. <i>fischeri-placentiforme</i> Reeside but not identifiable with certainty even to the genus, <i>Scaphites</i> ( <i>Hoploscaphites</i> ?) sp. indet., <i>Baculites</i> ex gr. <i>ovatus</i> Say?, <i>Pteria nebrascana</i> Evans and Shumard, <i>Pteria</i> sp. indet., fish vertebrae, GSC loc. 66883
647.5 - 655	Shale: dark grey; greater proportion with petrolierous odour than above; two or three thin beds of silty bentonite; bed of calcareous white speckled shale 10 cm thick at 651 feet, medium brownish grey, containing pelecypods, <i>Baculites</i> and comminuted fish remains; yellow-brown calcareous inclusions 10 mm across, and disseminated pyrite below 646'; some brown inclusions contain voids leached of broken fish remains; material is probably a phosphate mineral like svanbergite; <i>Baculite</i> cf. <i>Ovatus</i> (large form), <i>Anomia</i> sp, indet., <i>Pteria</i> spp. indet., pelecypods, genus and species indet., GSC loc. 66831
655 - 663	Shale: dark grey, with odour of oil; three or four thin beds of silty bentonite at 655.5'; brown earthy inclusion 10 to 25 mm across (svanbergite?); rare trace fossils; <i>Inoceramus</i> collected from white-speckled layer; fossils collected from 655' to 662.5', pieces of fish bone, GSC loc. 66884

Depth ft	Lithology
663 - 677.5	Shale: medium grey, calcareous, speckled with chalky white calcareous specks; no trace fossils or worm tracks; bentonite blue-grey, some with petrolierous odour; beds of thick-shelled pelecypods; fish bone fragments and scales, concentrated at one place along the upper contact; fossils collected from 662.5' to 670', <i>Ostrea</i> sp. indet., <i>Inoceramus</i> sp. indet., fish vertebrae, GSC loc. 66830; from 670' to 677.5', <i>Ostrea</i> cf. <i>congesta</i> Conrad (mass occurrence), GSC loc. 66855
677.5 - 685	Shale: medium grey with brown cast; calcareous white specks concentrated in discontinuous bands parallel to bedding; noncalcareous zones; sharp contact at 683' with dark grey shale containing abundant fish fragments and a few white specks; a few trace fossils, pyritized in part; <i>Ostrea</i> cf. <i>congesta</i> Conrad, <i>Inoceramus</i> sp. indet., GSC loc. 66857
685 - 692.5	Shale: dark grey, slightly calcareous, white speckled in random bands parallel to bedding planes; micaceous silty partings; a few trace fossils (worm tracks?), macrofossils found in groups of many individuals, pyritized in part; <i>Ostrea</i> cf. <i>congesta</i> Conrad (mass occurrence), poor <i>Inocerami</i> probably belonging either to <i>Inoceramus</i> ex group <i>cordiformis</i> Sowerby or to <i>Inoceramus</i> ex group <i>Zobatus</i> , GSC loc. 66856
692.5 - 700	Shale: dark grey, very calcareous, white-speckled; noncalcareous beds without white specks, more prominent than above; silt partings, slight petrolierous odour; calcareous brown phosphate inclusion about 10 mm across; trace fossils in speckled and non-speckled shale (absent in some beds), macrofossils scattered throughout shale (unlike groups above); <i>Inoceramus</i> cf. <i>cordiformis</i> Sowerby, (s. lat), <i>Inoceramus</i> spp. indet., <i>Baculites</i> sp. indet., pelecypods, genus and species indet., GSC loc. 66849
700 - 707.5	Shale: dark grey, largely noncalcareous; few white specks; silt partings; oily odour; yellow-brown phosphatic inclusions as above; specks of organic matter; a few trace fossils, foraminifera, abundant comminuted fish remains, abundant shells; <i>Ostrea</i> cf. <i>congesta</i> Conrad, GSC loc. 66861
707.5 - 715	Shale: calcareous, with more white specks than above; no silt partings; fewer fish remains and other fossils than above; <i>Scaphites</i> cf. <i>preventricosus</i> Cobban, <i>Baculites</i> sp. indet?, <i>Inoceramus</i> cf. <i>deformis</i> Hall and Meek, <i>Inoceramus</i> cf. <i>involutus</i> Sowerby (right valve only), GSC loc. 66851
715 - 722.5	Shale: with fewer white specks than above; pyrite replacing abundant pelecypods; fossils collected from 715' to 722.5', <i>Inoceramus</i> cf. <i>cordiformis</i> Sowerby, (s. lato), <i>Scaphites</i> (Scaphites?) cf. <i>depressus</i> (Reeside), GSC loc. 66850

Depth ft	Lithology
722.5 - 727.5	Shale: medium light grey and dark grey; lighter grey shale calcareous, white speckled, mainly in well defined layers; <i>Ostrea</i> cf. <i>congesta</i> Conrad, indeterminate ammonite, GSC loc. 66858
727.5 - 735	Shale: dark grey, and lighter grey white-speckled shale, with sharp contact between (not observed in place); no trace fossils or fish remains at contact
735 - 742.5	dark grey smooth-texture (bentonitic?) shale non-calcareous; silt-partings; fragments of minute pelecypods and <i>Inoceramus</i> cf. <i>subcarinatissoides</i> , Schlüter; <i>Inoceramus</i> cf. <i>deformis</i> Siek, GSC loc. 66852
742.5 - 750	Shale: grey, darker and more fissile in upper part, grades to highly calcareous shale with abundant trace-fossils ("worm tracks"); concretion-like structures with disseminated pyrite, overlying shale bed 25 cm thick with abundant pyrite inclusions; septarian concretion; comminuted fish remains; <i>Inoceramus</i> sp. indet., GSC loc. 66864
750 - 757.5	Shale: dark grey, highly calcareous and blocky at top with pyrite inclusions; rare partings with calcareous white specks; minute light grey tubes resembling worm tubes, most oriented parallel to bedding; concretionary bed 45 cm thick with septarian structures: fossils collected from 745.5' to 750', <i>Inoceramus</i> sp. indet., GSC loc. 66862
757.5 - 765	Shale: darker than above, more fissile, non-calcareous; silt partings; no concretions or white specks; trace fossils; pyritized worm (?) tubes; fish scales and spines, GSC loc. 66866
765 - 772.5	Shale: dark grey, fissile, blocky white-speckled layers; inclusion of light yellow-brown calcareous (phosphatic?) material; petriferous odour; <i>Inoceramus</i> sp. indet., GSC loc. 66865
772.5 - 780	Shale: dark grey, fissile; a few partings with calcareous white specks; septarian concretions; thin bentonitic band up to 1.5 m in diameter; yellow-brown inclusions as above, found in both shale and concretion; <i>Inoceramus</i> cf. <i>Lamarecki</i> Parkinson, GSC loc. 69316; <i>Inoceramus</i> cf. <i>Lamarecki</i> Parkinson, GSC loc. 66863
780	Shale: dark grey, fissile; a few partings with calcareous white specks; septarian concretions; thin bentonitic band about 74' (core); yellow-brown phosphatic (svanbergite) inclusions containing fish bones; <i>Inoceramus</i> sp. indet., GSC loc. 69317



Depth ft	Lithology
780 - 787.5	Morden Member Shale: dark grey, fissile, smooth-textured; phosphatic inclusions; strong petrolierous odour; no trace fossils; fish scales, GSC loc. 69318
787.5 - 795	Shale: dark grey, as above; no fossils
795 - 810	Shale: dark grey, fissile; a few thin beds of bentonite; scattered fish remains; fossils collected from 795' to 802.5', fish scales, GSC loc. 69319; from 802.5' to 810', fish scales, GSC loc. 69320
810 - 818	Shale: dark grey, fissile; bed of fibrous calcite from 5 to 25 cm thick with cone-in-cone structure; two beds of bentonite; bitumen; scattered fish remains including tooth; fish scales and spines, GSC loc. 69321
	Depth adjustment in shaft: 0.5 feet
818 - 830.8	Shale: dark grey, fissile, smooth-textured, petrolierous; several beds of bentonite (one discontinuous); pyrite inclusions; cubic pyrite crystals up to 3 mm across; silt partings, scattered fish remains
	Favel Formation
830.8 - 833	Shale: calcareous, medium grey, harder than above, blocky; lense with calcareous white specks; petrolierous and sulphurous odour; yellow-brown phosphatic (svanbergite) bed 10 mm thick, with fish bones; <i>Inoceramus</i> sp. indet., GSC loc. 66874; <i>Inoceramus</i> cf. <i>Lamarckii</i> Parkinson, GSC loc. 69322, collected between depths 825.5 and 833 feet.
833 - 840.5	Shale: calcareous, dark grey, fissile, rough-textured; lenses with calcareous white specks; <i>Ostrea</i> sp. indet., <i>Inoceramus</i> sp. indet., GSC loc. 66870
840.5 - 849	Shale: calcareous, dark grey, white-speckled in part; bed of argillaceous limestone 35 cm thick containing abundant fish remains but few other fossils; fossils in shale abundant in discontinuous concentrations along selected bedding planes, thin shells badly fragmented; <i>Inoceramus</i> sp. indet., <i>Ostrea</i> sp. indet., GSC loc. 66869
849 - 856.5	Shale: calcareous, dark grey, less fissile and with white specks more uniformly distributed than above; limestone bed 7.5 cm thick at 854', argillaceous, calcarenitic; two beds of bentonite 10 mm thick, within basal 16 cm of shale overlying limestone, bentonitic shale within 20 cm below; fish scales and spines, GSC loc. 66873
856.6 - 865	Shale: calcareous, dark grey, white-speckled, fewer fish remains and other fossils than above; fish scales, <i>Inoceramus</i> sp. indet., GSC loc. 66868

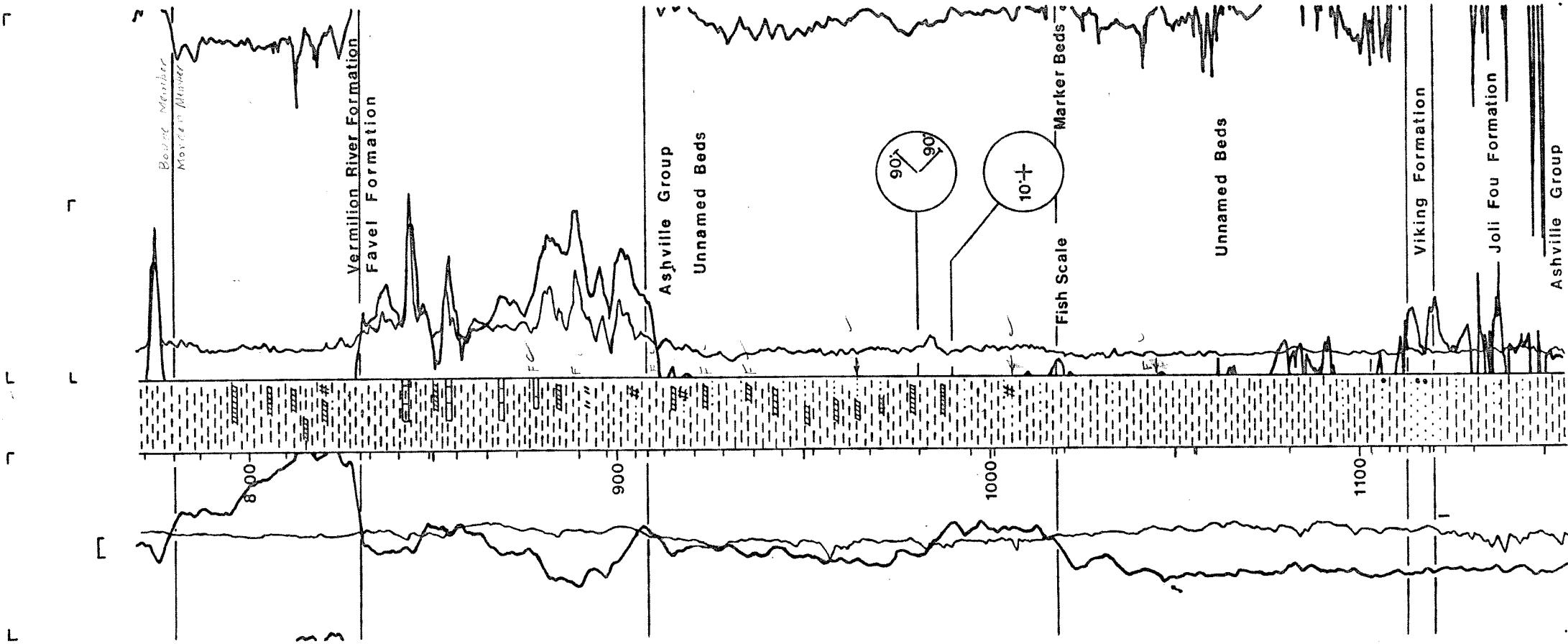
Depth ft	Lithology
865 - 873	Shale: calcareous, dark grey, white-speckled, harder beds of highly calcareous shale or argillaceous limestone; bands of concentrated white specks; few fossils; <i>Inoceramus</i> sp. indet., fish scales, GSC loc. 66872
873 - 890	Shale: calcareous, dark grey, harder than above, rough-textured with sparse shaly partings; bed of limestone 0.3 m thick, argillaceous, grading to calcarenite in lower part of limestone; several bentonite beds 10 mm thick near base of interval; fossils collected from 873' to 881', <i>Inoceramus labiatus</i> Schlotheim, GSC loc. 66867; from 881' to 890', <i>Inoceramus labiatus</i> Schlotheim, GSC loc. 66859
890 - 897	Shale: calcareous, dark grey, white-speckled; brown phosphatic inclusions; bentonite beds (in upper part of interval); fossils abundant, comminuted fish remains including large "bone plates"; <i>Inoceramus labiatus</i> Schlotheim, GSC loc. 66860
897 - 905	Shale: calcareous, dark grey, more fissile than above, with fewer white specks, unspckled shale softer; brown phosphatic inclusions; septarian concretions; petrolierous odour; few fossils, carbonized wood, scattered fish remains, single animal track; <i>Inoceramus</i> sp. indet., vertebrate bone, GSC loc. 66871
905 - 909	Shale: dark grey, calcareous in part, with white specks, as above; bentonitic beds at top of interval; (core shows two fracture planes, one slickensided, dipping 45°)
Ashville Group	
Unnamed Beds	
909 - 913	Shale: dark grey, blocky, conchooidal-fracturing; pyrite inclusions, laminations of silt with crossbedding; faint petrolierous odour; yellow-brown phosphatic (?) inclusions at upper contact; fossils partly pyritized; fossils collected from 905' to 913', same ammonite as in 65859 (944.9-952.2) in somewhat worse state of preservation, Barissjakoceras sp. indet., <i>Inoceramus</i> sp. indet., pelecypods, genus and sp., indet., fish scales GSC loc. 66875
913 - 921	Shale: dark grey, blocky, very smooth textured; silt partings; pyrite or marcasite inclusions; septarian concretions; faint petrolierous odour; fossils abundant; <i>Acanthoceras</i> cf. <i>athabascense</i> Warren and Stelck, <i>Borissjakoceras</i> sp. indet., <i>Inoceramus</i> cf. <i>fragilis</i> Meek, <i>Ostrea</i> sp. indet., GSC loc. 66878
921 - 929	Shale: dark grey, blocky, smooth textured, fossils abundant; cf. <i>Acanthoceras athabascense</i> Warren and Stelck, <i>Borissjakoceras</i> sp. indet., <i>Inoceramus</i> cf. <i>fragilis</i> Meek, <i>Inoceramus</i> ex aff. <i>rutherfordi</i> Warren and Stelck, <i>Ostrea</i> sp. indet., GSC loc. 66879

	Depth ft		Lithology
929	-	930.2	Bentonite: light blue-grey; slickensided fracture dipping 40°
930.2	-	937	Shale: dark grey, as above; fossils abundant; fossils collected from 929.1' to 937', same ammonite as in GSC loc. 65859, (944.9-952.2') <i>Borissjakoceras</i> sp. indet., <i>Inoceramus</i> sp. indet., GSC loc. 66876
937	-	945	Shale: dark grey, blocky, smooth textured, fossils abundant; collected from 937' to 944.9', same ammonite as in 65859 in equally poor state of preservation, a representative of family <i>Binneyitidae</i> Reeside resembling <i>Borissjakoceras</i> Arkhangelsky 1916 more than any other genus of the family, however, its reference to <i>Binneyites</i> Reeside, 1927 cannot be ruled out; <i>Inoceramus</i> cf. <i>fragilis</i> Hall and Meek, <i>Inoceramus</i> sp. indet., <i>Ostrea?</i> sp. indet., pelecypods, genus and species indet., GSC loc. 65856
945	-	953	Shale: dark grey, blocky; fossils abundant, including an ammonite resembling <i>Acanthoceras athabascense</i> Warren and Stelck 1955 more than any other, but not identifiable with certainty either generically or specifically, in particular it is impossible to rule out its reference to <i>Prionocyclus (Collignonoceras)</i> ex qr. <i>Woolgari-nyatti</i> , <i>Inoceramus</i> sp. indet., pelecypods, genus and species indet., fossils collected from 944.9' to 952.2', GSC loc. 65859
953	-	960.5	Shale: dark grey, blocky; fossils fewer than above; cf. <i>Borissjakoceras</i> Arkhangelsky 1916, <i>Inoceramus</i> sp. indet., GSC loc. 65855
960.5	-	968.4	Shale: dark grey, blocky; fossils few, very few fish scales; hind part of fish (photograph not figured); cf. <i>Borissjakoceras</i> sp. indet., <i>Inoceramus</i> cf. <i>fragilis</i> Meek, GSC loc. 69323; photograph GSC Cat. 133279-B
968.4	-	981	Shale: medium dark grey, conchoidal-fracturing; slight petriferous odour; a few silt partings; jointing planes near base, with near-vertical dip, most striking NE, secondary planes striking SE; bentonite bands in basal 4 m of interval, some containing sulphide; fossils becoming more scarce downward, disappearing at base
981	-	995	Shale: dark grey, flaky to blocky, smooth-textured; abundant silt partings; bed of blue-grey bentonite 2.5 cm thick at base of interval; rare fish remains
995	-	1,005	Shale: medium dark grey, blocky conchoidal fracturing, very smooth-textured, repeated slickensides at 1,001', dipping about 10°; ferruginous (?) yellow-stained band at 996.4'; silt partings; "worm tubes"; comminuted fish remains

Depth ft	Lithology
Fish Scale Marker Beds	
1,005 - 1,005.4	Shale and sandstone: shale, medium dark grey, smooth-textured, blocky, with irregular and discontinuous thin beds and parting of crossbedded silt and sandstone containing pyrite and abundant comminuted fish remains; (Fig. 6; photograph GSC Cat. 149416)
1,005.4 - 1,017.5	Shale: medium grey, blocky; silt partings
1,017.5 - 1,018	Sandstone: slightly calcareous, comprised largely of fishbone fragments; fine grains of clear quartz; pyrite, bitumen; cross-bedded and interlaminated with smooth-textured shale as above
Unnamed Beds	
1,018 - 1,055	Shale: medium dark grey, conchoidal-fracturing, smooth-textured, petrolierous bands up to 1,051.5'; some silt partings; zones with pyrite streaks; beds of bentonite 12 mm thick at 1,031.4'; fish remains in a bed of hard arenaceous shale and a dark carbonaceous bed 1.5 cm thick near centre of interval; selenite(?) veins or fracture fillings; smoothly curved animal traces, pyritized; large "worm tubes (?)" scattered fish remains; jaw of an ichthyosaur cf. <i>Myopterygius</i> sp. undet., between 1,041.5' and 1,051.5', Nat. Mus. Can. loc. 10424, photograph GSC Cat. 113277-C
1,055 - 1,055.5	Shale: medium grey; silty laminae near base becoming coarser downward, grading to fine-grained sandstone with abundant fish remains
1,055.5 - 1,081	Shale: medium grey, conchoidal fracturing, blocky, smooth-textured; rare pyrite streaks (animal traces?); no fish remains; "worm tubes" near base of interval; fossils collected from 1,061.5' to 1,071.5', ammonite fragment, GSC loc. 65848
1,081 - 1,108	Shale: medium grey, blocky as above, smooth-textured, partly bentonitic in lower 0.6 m of interval; silt-filled burrows at 1,091'; some selenite(?) veins; light yellowish brown concretions; silt partings near bottom of interval; fossils collected from 1,081.5' to 1,091.5', indeterminate ammonite, crab fragments, GSC loc. 65849
1,108 - 1,111	Shale: silty in part, blocky, medium light grey; abundant silt lenses and partings with comminuted fish remains
1,111 - 1,113.5	Shale: medium grey, blocky; scattered partings of silt, some with pyrite

IMC K2 SHAFT

770-1155'



Depth ft	Lithology
Viking Formation	
1,113.5 - 1,117	Sandstone: very fine-grained, argillaceous with irregular partings and lenses of shale; yellow-green glauconite; some yellowish-brown concretions with dark brown centre; silt-filled "worm tubes"; some fish remains
1,117 - 1,119.2	Siltstone or silty shale: highly argillaceous; discontinuously interlaminated lenses of shale and silt; yellow-green glauconite; "worm tubes"
1,119.2 - 1,120.1	Sandstone: brownish grey, argillaceous, massive with abundant yellow-green glauconite, biotite, quartz grains predominant; current bedding; a few dark grains of chert (?); abundant fish remains; "worm tubes"
Joli Fou Formation	
1,120.1 - 1,123	Shale: silty with abundant irregular partings and laminae of lighter grey silt; minute anastomosing animal burrows or tracks
1,123 - 1,123.3	Bentonite: pale grey, impure
1,123.3 - 1,131	Shale: medium grey, blocky, silty in part with non-calcareous grey specks (after microfossils?); minute nodules of microgranular pyrite; silty animal burrows; zones with a few irregular lenses of siltstone or very fine-grained sandstone; nodules 3.5 cm long, of quartzose, fine-grained white sandstone at 1,129.9'
1,131 - 1,162.3	Shale: medium light grey, conchooidal-fracturing with scattered small lenses and laminae of silt; calcareous concretions, rare small animal burrows; very few fish remains; photograph 1157, GSC cat. 113275E, I
1,162.3 - 1,173	Shale: blocky as above, with abundant partings of light grey silt containing quartz, biotite, disseminated pyrite, fragments of minute shells (possibly carbonized fish bone fragments); slightly slickensided fracture plane dipping 45° at 1,165'; partings with yellow-green glauconite grains of very fine sand size; scattered dark chert (?) grains; a few small animal burrows; indefinite bleached ferruginous zone at 1,166'
1,173 - 1,191	Shale: medium dark grey, blocky, faintly banded with scattered silt laminae; abundant lenses and partings of light grey silt in basal 1'

Depth ft	Lithology
1,191 - 1,194.3	Shale: dark grey as above; small lenses and animal burrows with silt or very fine sand; two irregular bands, 10 mm thick, of light grey siltstone with yellow-green glauconite; finely disseminated sulphides in the silt; yellowish-brown concretions with dark centre, occurring in a zone with abundant silt partings; discontinuous band of chert pebbles, very irregular in shape, ranging in size from 3 to 50 mm in diameter in a light grey, rough-textured matrix
1,194.3 - 1,204.5	Shale: medium dark grey, blocky, with scattered silt partings; small lenses of medium grained sandstone with glauconite and abundant fish bones at 1,196.9'; yellowish-brown concretions with dark centre some of the septarian type; finely disseminated sulphides; no fossils
1,204.5 - 1,217.5	Shale: medium to medium dark grey, blocky as above, with scattered discontinuous silt laminae; few small yellowish-brown ferruginous concretions, approx. 15 cm in diameter
1,217.5 - 1,222.4	Shale: medium dark grey, blocky; two sets of joints, one striking N 60°W, dipping 42°NE, second set striking N 80°E dipping 40°S; a few yellowish brown concretions, hard layer concretions have long axes parallel to bedding plane
1,222.4 - 1,228.9	Shale: medium grey, blocky, with abundant irregular lenses and burrows containing light grey silt, grading in part to shaly siltstone; yellow-green glauconite; yellowish concretions transected by uninterrupted bedding planes
1,228.9 - 1,231	Shale: medium grey, blocky; inclusions of microgranular pyrite; irregular partings and burrows with silt; comminuted fish remains; minute pelecypods
1,231 - 1,235.5	Shale: medium dark grey; zones of silt partings and lenses; slickensided fractures dipping 80°N, second set dipping 80°NW
1,235.5 - 1,236.1	Shale: very sandy, or shaly sandstone, greenish grey, highly glauconitic, grading downward to ferruginous sandstone; irregular bands of cemented silt and shale containing small chert pebbles similar to pebbles at 1,191' to 1,194.3'; basal contact sharper than top, dipping 20°
1,236.1 - 1,248.5	Shale: medium dark grey, blocky; abundant lenses and partings of light grey silt; lenticular concretionary bed 15 to 25 cm thick; several sets of jointing planes, first set strikes S 20°W, dips 62°SE; second set strikes N 43°W, dips 38°NE; third set strikes N 7°E, dips 39°E; fourth set strikes S 20°W, dip NW; fish remains, single fossil; fossils, collected from 1,224.6' to 1,238.2', <i>Lingula</i> sp., indet., indeterminate pelecypod fragments, GSC loc. 65851; from 1,245' to 1,248', fish scales, <i>Lingula</i> sp. indet., GSC loc. 65854; photographs, 1241', 1246', GSC cat. 113275-B, 113277-A, G, D, 113273-M

Depth ft	Lithology
1,248.5 - 1,250	Shale: very silty, blocky, highly glauconitic in part with green cast; slickensided fractures dipping 70°, at base of interval; indefinite banding; pyrite streaks
1,250 - 1,257	Shale: medium dark grey, blocky with indefinite beds and discontinuous partings of silt; joint dipping NW; fault dipping NE (?); elongated ironstone concretions with light brown nucleus and dark grey body occur in beds, individual concretions up to 1.3 m in length with long axes oriented in a NE-SW direction; fossils collected from 1,248' to 1,253', indeterminate shell fragments, <i>Lingula</i> sp. indet., GSC loc. 65850; photographs, GSC Cat. 113277F, 113279D, E
1,257 - 1,271	Shale: medium grey, blocky; fault striking N, dipping 58°E; zones of silt partings, some glauconitic(?); a few soft light brown and hard yellowish brown concretions, some with bedding planes passing through; fossils collected from 1,258' to 1,263', fossil wood, GSC loc. 65852
1,271 - 1,273	Shale: medium dark grey, conchoidal-fracturing, with scattered silt partings; brown ferruginous layers 5 cm thick at top of interval; lenses of coarse polished quartz grains in basal 5 cm of interval
1,273 - 1,273.8	Ironstone: non-calcareous, grey, fine-grained, hard, massive; septarian structures; zone of chert pebbles, some showing bedding, some covered with a light green material; pebbles surrounded in places by medium to coarse sand grains; light yellowish brown ferruginous inclusions; pyrite or marcasite inclusions; a very few fragments of small gastropods
1,273.8 - 1,274	Limestone: argillaceous, grey, crystalline with layers of cone-in-cone; undulating and discontinuous pyrite or marcasite nodules up to 2.5 cm in diameter (Fig. 7,8)
1,274 - 1,275.1	Shale: medium grey, blocky to flaky; silt lenses becoming more common toward base; yellow-green glauconite; marcasite nodules as above near top; basal contact defined by undulating band of silt 10 mm thick, light grey, crossbedded, at places containing sand grains $\frac{1}{4}$ to $\frac{1}{2}$ mm in diameter, cemented in part by marcasite; animal burrows; abundant carbonized plant fragments (Fig. 7,8)
1,275.1 - 1,275.8	Shale: dark grey, blocky, splintery in part, slightly carbonaceous at top; silt partings; base defined by two bands 10 to 25 mm thick of calcareous marcasite-cemented sand, quartz and chert grains in matrix of yellowish brown silt; animal burrows; small gastropod, other poorly preserved shell fragments; photographs, GSC Cat. 113277-J, K, 113278-C, D, E, F, I, K, L, (e.g. Fig. 7,8)

Depth ft	Lithology
Pense Formation	
1,275.8 - 1,277.8	Siltstone: argillaceous, finely mottled; grey silty shale in top 5 cm; less shaly, poorly indurated below top 30 cm of interval; marcasite nodules 10 mm long at top of interval; carbonized wood fragments in silt; abundant burrows; fossil wood, GSC loc. 65858
1,277.8 - 1,288	Shale: dark grey, interlaminated with silt beds, discontinuous and crossbedded; sandstone interbed at 1,282', 10 to 30 mm thick, showing cut-and-fill structures, cross-bedding, some graded bedding and marcasite nodules up to 2.5 cm in diameter; animal burrows; photographs GSC cat. 113280-C, 113278-J,-A, 113277-L (Fig. 9)
1,288 - 1,289.8	Sandstone: quartzose mostly unindurated, with coarse subangular grains, some silt, varying in thickness from 128-22 cm; lense with calcite cement 3 mm across, marcasite-cemented nodules up to 18 cm across
1,289.9 - 1,299.5	Shale: dark grey, with abundant silt partings, largely crossbedded; bed of light grey silt with abundant plant remains; photograph, GSC cat. 113280C
<u>"Cantuari marker beds"</u>	
1,299.5 - 1,300	Lignite: fragments 2.5 to 5 cm across
1,300 - 1,303	Shale: silt-laminated, ferruginous and concretionary in part; carbonaceous stringers perpendicular to bedding planes; silt laminations discontinuous, less than 10 cm long, 5 mm thick
1,303 - 1,312	Siltstone: argillaceous, current-laminated; animal burrows; inclusions of brown silt and clay in basal 10 cm
Cantuari Formation	
1,312 - 1,313	Claystone: silty, pale grey with brown cast, soft; upper surface regular except for shallow channelling resembling cut-and-fill structures; photograph GSC cat. 113273G (Fig. 10)
1,313 - 1,317	Claystone: light grey, waxy, soft, upper contact regular except for shallow channelling occasional fragments of carbonized wood to 20 cm long
1,317 - 1,320	Claystone: darker grey than above, soft, finely laminated; ferruginous zones; upper contact undulating, amplitude up to 25 cm; dip 5°N

Depth ft	Lithology
1,320 - 1,324	Claystone: silty, medium grey, soft, very finely bedded, crossbedded; carbonized plant remains; upright tree stump 0.4 m high, 12 cm in diameter
1,324 - 1,329	Siltstone: medium grey-brown, clayey, faintly banded to massive, with very little crossbedding; bands of yellowish brown ferruginous inclusions 1 to 5 cm across; fragments of carbonized wood 5 to 8 cm long
1,329 - 1,334	Siltstone: medium grey-brown; gradational to concretionary zone, calcareous, ferruginous; lenses with faint banding
1,334 - 1,339	Siltstone: clayey, medium grey-brown, soft, finely banded; very little crossbedding; soft yellowish brown ferruginous inclusions 5 to 10 mm in diameter; carbonized wood fragments; fault dipping 60° NE
1,339 - 1,349	Claystone: grey, silty, massive, soft, faintly banded with light grey silt; soft yellow-brown ferruginous inclusions, mostly gradational with the surrounding clay; much carbonized wood, fragments parallel to silt partings, up to 10 cm long
1,349 - 1,354	Claystone: grey with brown cast, soft, silty, faintly banded; dip 6° E; yellow-brown inclusions as above; carbonized wood fragments up to 20 cm in diameter, both parallel with and inclined to bedding; two parallel faults 25 to 30 cm apart, dipping 10° S; space between faults occupied by hard ferruginous rock containing abundant carbonized wood fragments and well preserved leaves; rock has irregular fractures containing a white chalky material; <i>Gleichenites nordenskiöldii</i> (Heer) emend. Seward, GSC Plant loc. 7305
1,354 - 1,359	Claystone: grey with brown cast, soft, very silty, faintly banded; bedding dips eastward; soft yellow-brown ferruginous inclusions; carbonized wood fragments, ranging in length up to .30 cm, mainly parallel to bedding, photographs, GSC Cat. 113272A, H
1,359 - 1,360.2	Claystone: olive grey, waxy, splintery, soft; abundant light grey silt partings; upper contact displays undulating lenses 10 mm thick, up to 3 m long of faintly banded yellow-brown indurated silt; a few similar silt lenses occur in the waxy clay below; lacks carbon in contrast to clay above; upper surface dips E; photographs GSC Cat. 133273D, I, J, K, L, 133274J
1,360.2 - 1,364	Siltstone: greenish grey, friable, interbedded with light grey silt, chloritic grains; carbon fragments up to 5 mm long; light grey silt grades to very fine grained indurated sand with minute siderite spherules and carbon specks along some bedding planes; upper contact sharp

Depth ft	Lithology
1,364 - 1,369	Siltstone: olive grey, friable, interbedded with light grey silt; grading to dark olive grey splintery clay, interlaminated with light olive grey silt containing abundant flat ferruginous inclusions conforming to bedding planes
1,369 - 1,374	Siltstone and shale: dark olive grey, soft, highly fissile shale interlaminated with light olive grey friable silt exhibiting some crossbedding and containing abundant flat ferruginous inclusions, as above; olive grey silt containing a little clay in lower part of interval
1,374 - 1,379	Claystone: soft, with interbeds of silt, some up to 10 cm thick; abundant ferruginous inclusions; zones of crossbedding; distorted bedding (creep or flow structure), similar to structure found above (1,364'-1,369'?) but less extensive, limited to predominantly silty beds
1,379 - 1,386	Shale: dark olive grey, soft, fissile, interlaminated with light olive grey silt; abundant ferruginous inclusions
1,386 - 1,387	Shale: with laminae and lenses of dark brown, unsorted quartzose sand and silt, moderately indurated in part, containing abundant carbonaceous fragments 10 cm long; marcasite nodules up to 25 mm in diameter
1,387 - 1,391	Claystone: brown grey, massive, soft interlaminated with olive clay containing a few silt partings
1,391 - 1,394	Shale: or olive grey claystone with silt partings
1,394 - 1,395.5	Shale: as above irregularly interbedded with yellowish brown silty clay; a few large wood fragments at base; long axes inclined to bedding plane
1,395.5 - 1,396	Conglomerate: ranging in thickness from 10 to 15 cm, consisting of: 80-85% tan-coloured, massive clay matrix, 10% coarse grained, poorly sorted quartz grains ranging in size up to 14 mm, 5-7% brown cemented inclusions of unsorted sand, ranging in size from 2 to 15 mm, concentrated along 2 bands within the conglomerate bed, 1% subangular to angular chert pebbles ranging in size up to 84 mm, 1% pebbles other than chert pebbles ranging in size up to 63 mm, 1% marcasite-cemented sand nodules commonly associated with yellowish brown cemented sand; ferruginous concretions; conglomerate grades upward into coarse-grained unconsolidated sand which makes irregular contact with clay above; most large pebbles are found where coarse grained sand grades into conglomerate; wood fragments occur in brown silt with reddish cast of uncertain position in this interval (Figure 11)

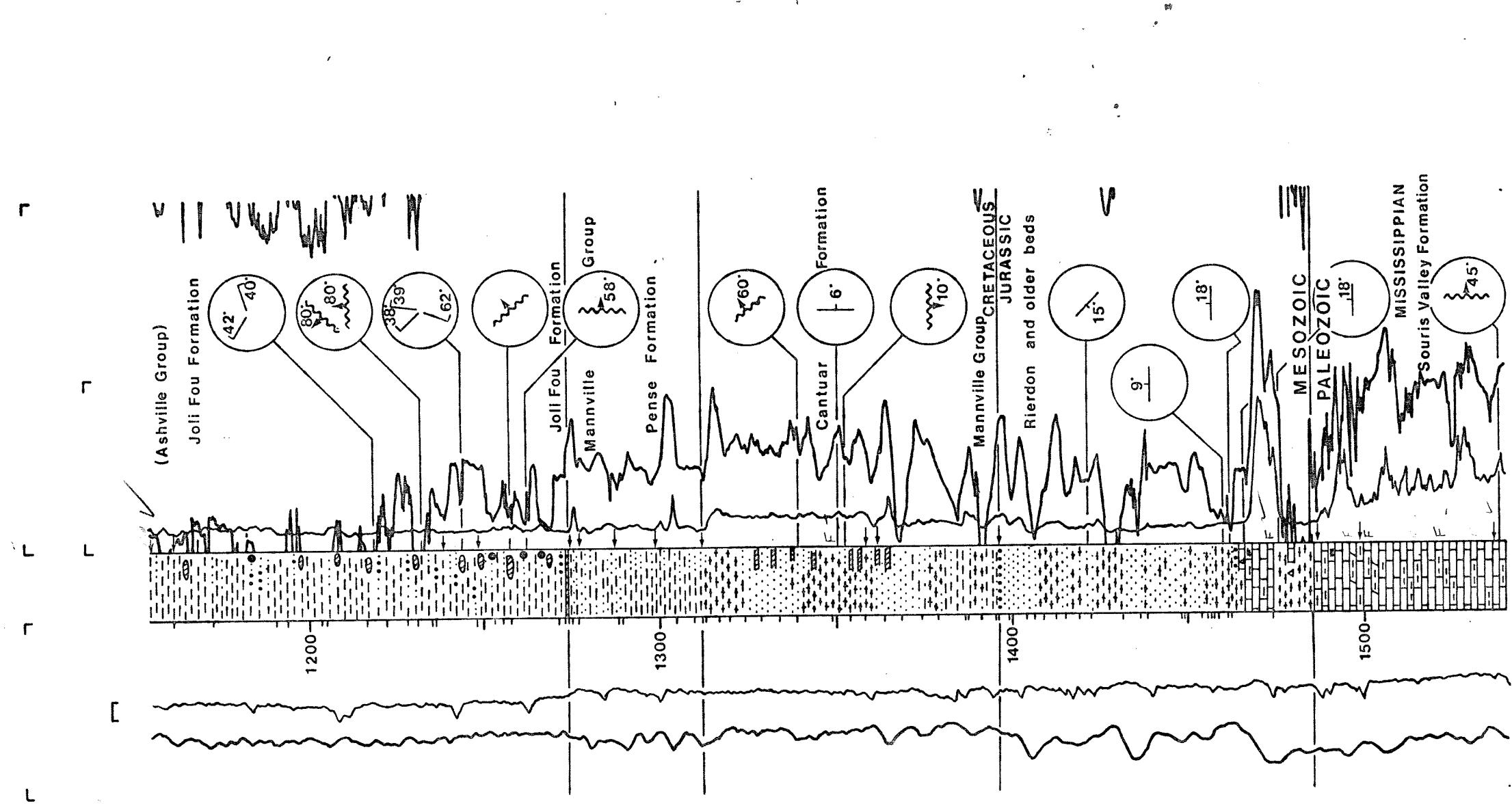
Depth ft	Lithology	
JURASSIC		
Rierdon Formation		
1,396 - 1,399	Siltstone: light grey; abundant carbonized wood fragments up to 10 cm long, largely parallel to bedding within 10 cm of top; (in contrast to few wood fragments observed above the conglomerate), bedding is regular, slightly undulating, with no apparent crossbedding (in contrast to irregular bedding above the conglomerate); grades near base to dark silt with up to 50% wood fragments; see photograph, Figure 11	
1,399 - 1,399.6	Lignite	
1,399.6 - 1,400	Siltstone: friable; abundant carbonized wood fragments	
1,400 - 1,404	Sandstone: containing carbonized wood fragments; contact with siltstone above irregular, photographs, GSC cat. 149363, 4, 113257D, J, S	
1,404 - 1,406	Sandstone: grey, fine to medium grained, unindurated, massive, containing carbon fragments 10 to 12 cm long; discontinuous bands up to 25 cm thick with abundant minute carbon particles	
1,406 - 1,409	Claystone: sandy, green, soft; upper contact marked at places by a thin yellowish brown cemented sandstone containing marcasite nodules up to 5 cm in diameter	
1,409 - 1,412	Claystone: medium dark green, soft, massive, waxy; siderite spherules	
1,412 - 1,415	Sandstone: quartzose, light grey, 60% with green cast, fine grained, massive, well sorted, subangular, poorly indurated; chlorite(?) flakes; no carbon fragments; upper contact marked by lenses 5 mm thick and 5 to 10 cm long cemented with marcasite and a very little siderite(?)	
1,415 - 1,419	Claystone: silty interlaminated with silt; clay, silty, medium dark green, soft, in laminae up to 10 mm thick having gradational boundary with silt; silt in laminae up to 5 mm thick, with scattered chlorite(?) flakes; no carbon fragments	
1,419 - 1,422	Sandstone interbedded with interlaminated clay and silt: sand, quartzose, light grey with green cast, massive, well sorted, subangular to subrounded, porous, poorly indurated; bed 5 to 15 cm thick, continuous throughout diameter of shaft, dipping 10°-20°SW; beds of interlaminated silt and clay 2 to 20 cm thick, similar to beds in 1,415'-1,419' above, continuous across shaft; lowest clay and silt bed, 20 cm thick, in contact with variegated clay below	

Depth ft	Lithology
1,422 - 1,431	Claystone: reddish brown to yellowish brown, soft, variegated in top 3 feet (0.9 cm), grading to yellowish green clay in 1' (0.3 m) interval below; lowest 5' (1.6 m) clay interval is green in colour, flaky with abundant slickensides; a few silt and sand laminae 5 mm thick, some containing marcasite and chlorite(?) flakes; upper contact is gradational over 1 to 5 mm interval
1,431 - 1,436	Sandstone: quartzose, light grey with slight green cast, medium to fine grained, massive, moderately sorted, sub-angular, porous, unconsolidated; upper contact is sharp and the sand contains dark stringers of marcasite-cemented sand
1,436 - 1,438	Claystone: silty, olive-grey, soft, interlaminated with silt; laminae are discontinuous and indistinct with silt-filled burrows 2 mm to 10 mm in diameter
1,438 - 1,448	Sandstone: interbedded with interlaminated clay and silt; sand, quartzose, light grey with slight green cast, very fine to fine grained, massive, moderately sorted, sub-rounded to subangular, unconsolidated, porous; clay, silty, olive-grey, interlaminated with silt, becoming more clayey and waxy toward bottom of interval; dip above 1,440' is SW; below 1,445' dip is NW
1,448 - 1,449	Claystone: silty, greyish brown, finely laminated, soft; carbon fragments up to 5 cm in diameter
1,449 - 1,454	Siltstone: light grey; rare, well defined clay laminae, dark olive-grey, waxy; photograph, GSC cat. 149365
1,454 - 1,455.5	Claystone: green; upper contact gradational
1,455.5 - 1,456.5	Siltstone: clayey, brown
1,456.5 - 1,457.6	Siltstone: clayey, black carbonaceous; upper contact gradational; photographs GSC cat. 14970, 1, 2, 3
1,457.6 - 1,458.3	Claystone: green; soft; thickness of bed varies from 0 to 5 cm around the shaft; upper contact sharp
1,458.3 - 1,461.5	Claystone: green and yellowish brown variegated, soft; thickness of bed varies appreciably around the shaft; upper contact gradational, dips 9°N
1,461.5 - 1,462	Claystone: greyish green soft with regular grey silt interbeds 2 to 5 cm thick; upper contact sharp and slightly undulating; dips approximately 18°N; photograph, GSC cat. 149366

Depth ft	Lithology
1,462 - 1,462.5	Claystone: green and sandstone, quartzose, light grey, poorly sorted, subrounded, porous, calcareous, in places cemented by pyrite or marcasite; abundant chert pebbles tan to brown, angular to rounded up to 10 cm in diameter; rounded pebbles of crinoidal chert up to 25 cm in diameter; limestone fragments; photographs, GSC Cat. 113257A, B, C, E, H, (Fig. 12)
1,462.5 - 1,474	Limestone: fine to medium grained, pink, much brecciated in upper 4' of interval; green clay between fragments and some bedding planes is petrolierous(?) in places; chert lenses 25 cm long or more occur in upper 1.3 m; pink limestone in contact with dark grey silicified limestone grading to milky, white and dark grey chert; surfaces of some limestone fragments carry adhering pyrite crystals; a few vugs lined with calcite crystals; dips approximately 18°N; <i>Spirifer</i> sp. cf. <i>Snowleyi Weller</i> , GSC loc 67550
1,474 - 1,485	Claystone: calcareous, soft, light grey to light greyish green; irregular discontinuous bands of yellowish brown, minute (0.1-0.2 mm) spherules (of siderite?) with waxy luster, greyish white chalky chert fragments, light grey to pink; photograph, (large fragments of excavated material) GSC Cat. 149374
MISSISSIPPIAN	
Souris Valley Formation	
1,485 - 1,487	Limestone: argillaceous, pinkish tan, micritic, in beds 5 to 10 cm thick, containing clay-filled tubes 20 mm x 1.5 mm, small fractures lined with pyrite and calcite crystals, crinoid(?) fragments, other fossils; interbedded with clay, light olive-grey, both calcareous and non-calcareous, in beds 5 to 10 cm thick pyrite crystals at contacts between limestone and clay beds and in limestone; crinoid(?) fragments; erosional upper surface is very irregular, with the highest partly-eroded stratified limestone and clay beds occurring at approximately 1,485', lowest part of contact, at 1,497'; clay with siderite(?) spherules as in interval above occupies depressions in limestone with bedding conforming to the erosion surface, contains many rounded limestone fragments up to 0.6 m in diameter, pink to tan, apparently with surfaces slightly altered; 4 photographs, GSC Cat. 149375, 6, 7, 8
1,487 - 1,509	Limestone: very argillaceous or calcareous mudstone, olive-grey, microcrystalline, interbedded and forming irregular contact with tan dolomite, argillaceous, micritic; no apparent dip; <i>Spirifer</i> cf. <i>snowleyi Weller</i> , echinoderm columns, fenestrate bryozoa, conularid indet., GSC locs. 67551-67553 from 1495-1578', conodonts (see Appendix IV), C-108378; photographs GSC Cat. 113276G, 149362.

IMC K2 SHAFT

1155-1540'



Depth ft	Lithology
1,509	1,540.8 Limestone: argillaceous, greyish green to purplish red, brown-stained, finely laminated; regular bedding with no apparent dip; finely disseminated pyrite between 1,515' and 1,520'; intermittent zones containing tubes 20 mm x 1.5 mm filled with lighter-coloured limestone; fossiliferous zone between 1,509' and 1,525' with bed of brachiopods 5 cm thick in lower part; lenses of bioclastic limestone between 1,535' and 1,540'; fault dipping 45° E cuts shaft between 1,535' and 1,540'; <i>Spirifer cf. rowleyi</i> Weller, fenestrate bryozoa, 1510-1515'; GSC Loc. 67555; <i>Unispirifer minnewankensis</i> Shimer,? Ovata sp., 1520-1525, GSC Loc. 67556; photographs, 1,537, GSC Cat. 149383.4
1,540.8 - 1,541.5	Mudstone: calcareous, greyish green, waxy texture when wet; gradational upper contact
1,541.5 - 1,549.5	Limestone: greyish tan, very fine grained, massive, very hard; pyrite nodules, up to 6 mm across and pyrite crystals scattered throughout; some tubes as in 1,509' down to 1,540.8'; very few brachiopods
1,549.5 - 1,555.2	Limestone: greyish tan, very fine grained, hard, in bed 30 to 35 cm thick, interbedded with darker tan beds and greyish green argillaceous limestone; pyrite nodules up to 6 cm in diameter; inclusions of chert; calcite veins up to 2 cm wide, bed of coarser grained limestone, 8 cm thick, grey with brown cast, containing crinoid fragments and a few brachiopod fragments; bed of olive-green limestone at 1,555', 5 cm thick
1,555.2 - 1,572	Limestone: argillaceous, light grey, with green cast, stained red-brown in part, micritic to micritic-skeletal; chert
1,572 - 1,607	Limestone: slightly argillaceous, tan, fine to medium grained, laminated, interbedded with argillaceous limestone, greenish grey, micritic skeletal; minute fractures and vugs filled with coarsely crystalline calcite; pyrite crystals in nodules up to 8 mm in diameter in limestone and on jointing surfaces; vertical jointing strikes N.W.; random light grey chalky streaks in tan limestone; after fossils(?) : rare indeterminate brachiopods
1,607 - 1,612	Limestone: argillaceous, greyish green with discontinuous dark purple banding, micritic
1,612 - 1,628	Limestone: argillaceous, light red-brown to maroon with very few greenish grey bands and mottling, micritic
1,628 - 1,660	Limestone: argillaceous, light red-brown to maroon, 15 to 20 cm bands and mottling of grey; micritic; calcite veinlets with pyrite crystals
1,660 - 1,669	Limestone: argillaceous, light red-brown to maroon with greenish grey banding and mottling, micritic

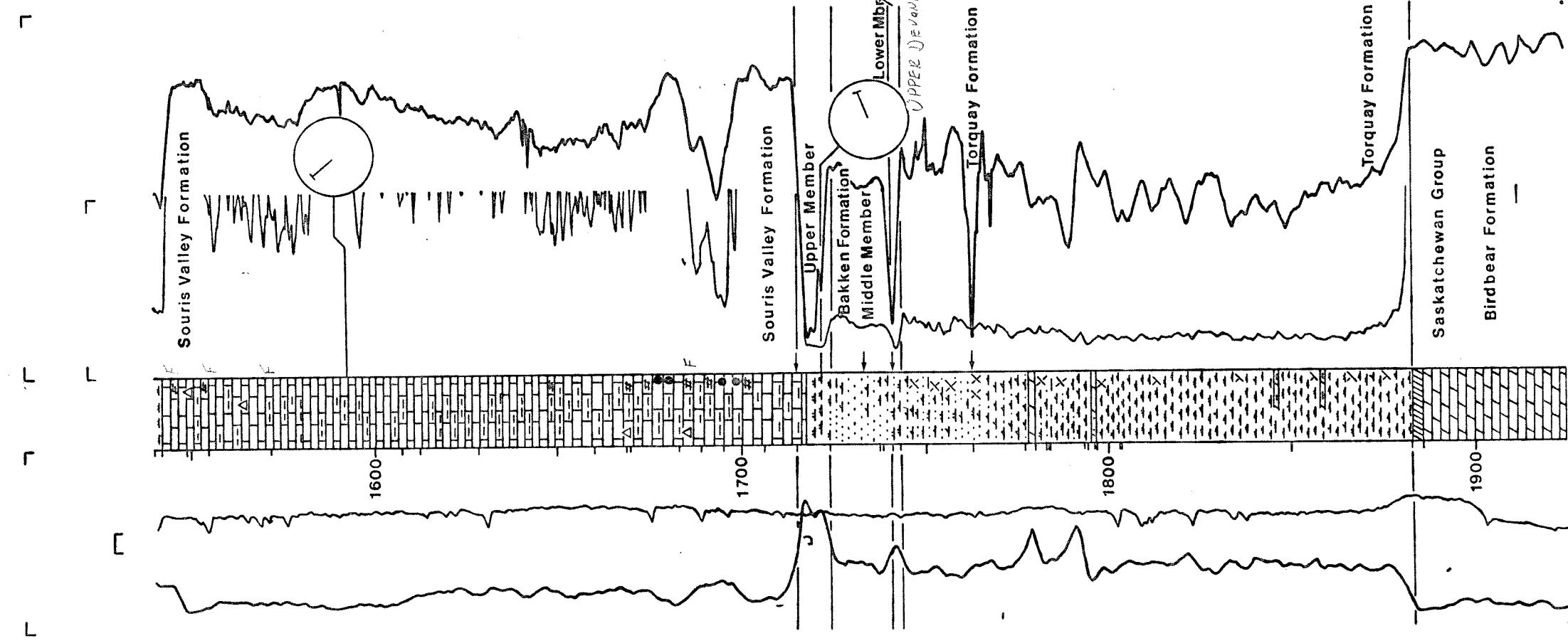
Depth ft	Lithology
1,669 - 1,670	Limestone: tan with green cast, micritic; zones of discontinuous 5 mm beds of white tripolitic chert; scattered minute pyrite crystals
1,670 - 1,683	Limestone: argillaceous, light red-brown to maroon with greenish grey bands and mottling, micritic; interbedded with limestone, tan with green cast, fine to medium grained; zones 10 cm thick of porous crinoidal limestone; zone with inclusions of white chert 5 cm across; minute pyrite crystals; scattered glauconite grains in lower half of interval
1,683 - 1,689	Limestone: argillaceous, purplish green with red-brown stains, micritic, finely laminated to coarsely bedded; fractures lined with calcite crystals; interbedded with limestone, crinoidal, greenish to brownish tan, medium grained; glauconite grains; pyritized zone, 25 mm thick, irregular inclusions of white chert; a few laminae of very calcarous green mud; fossils possibly collected as deep as 1,703!, <i>Unispirifer mannewankensis</i> Shimer,? <i>Schizophoria</i> sp. brachiopod, horn coral, indet., GSC loc. 70675
1,698 - 1,695	Limestone: argillaceous, brownish green with red-brown stains, finely laminated to coarsely bedded; interbedded with limestone; slightly argillaceous, greenish tan with red-brown streaks; glauconite grains
1,695 - 1,698.5	Limestone: very argillaceous, greenish tan with red-brown to purple mottling, micritic; irregular bedding at places; yellow-brown mud in streaks 10 to 20 cm long or as irregular inclusions; glauconite grains; crinoid fragments; fossils (possibly from as deep as 1,715'), <i>Composita</i> sp., spiriferid and chonetid brachiopods indet., caninid corals indet., nautiloid indet., GSC loc. 70681
1,698.5 - 1,706	Limestone: greenish tan, crinoidal-micritic, hard, glauconitic; green shale partings oriented at random; pyrite; a few fossils
1,706 - 1,715	Limestone: tan with grey to purplish cast, yellowish and brown streaks, crinoidal in part; interbedded every 8 to 12 cm with green to maroon calcareous, wavy-laminated shale containing nodules of limestone; photographs GSC cat. 149389-91
1,715 - 1,716.8	Limestone: greyish tan, crinoidal
Bakken Formation	
<u>Upper Member</u>	
1,715.8 - 1,724	Mudstone: slightly fissile, or blocky shale, red-brown, greyish blue and green; yellow-brown streak forming faint discontinuous bands and mottling, very smooth-textured to waxy, non-calcareous; upper contact is sharp and regular; two slightly wavy beds of green waxy mudstone 8 - 12 cm thick with a 5 mm band of white silt in the center, at 15 and 45 cm respectively, above the gradational lower contact; joint striking ENE, dipping almost vertically; 2 poorly preserved brachiopods, not collected separately; photographs GSC cat. 149389-91

Depth ft	Lithology
<u>Middle Member</u>	
1,724 - 1,737.5	Siltstone: argillaceous, slightly dolomitic, green with a little purplish mottling; photograph GSC cat. 149393 (Fig. 13)
1,737.5 - 1,738.5	Siltstone: dolomitic to calcareous, regular and continuous maroon, yellowish brown, red-brown and grey-green, laminations; indurated at top, but becoming sandy and less indurated toward base of interval; zone of calcareous siltstone containing vugs up to 5 cm in diameter lined with calcite crystals; photograph GSC cat. 149392
1,738.5 - 1,741	Sandstone: quartzose, dolomitic, very fine grained, faintly laminated grey-green and light grey with intermittent reddish brown streaks in upper part; upper contact sharp with a marked decrease in colour bands; bedding regular, except for a single cut-and-fill structure on NNE(?) side of shaft; photograph, GSC cat. 149393-8
<u>Lower Member</u>	
1,741 - 1,741.5	Mudstone: silty, dolomitic in part, purplish pink, with non-silty lenses increasing downward; elongate hard phosphatic nodules up to 11 mm long; conodonts(?) and minute bone-like fragments with internal hematite-filled vesicular structure and compact exterior, replaced by soft, waxy porcelain-like white clay; many fragments surrounded by earthy hematite, pseudomorphic after pyrite
1,741.5 - 1,743.5	Mudstone: non-dolomitic, purplish pink with green-grey lenses and streaks; smooth, almost waxy texture, indeterminate fish plate, GSC loc. 70682
Upper Devonian	
<u>Qu'Appelle Group</u>	
Torquay Formation	
1,743.5 - 1,763.3	Siltstone: dolomitic, pale yellow-brown, finely porous with wavy laminae of green and red, smooth-textured mudstone, easily disintegrated in water, quartzose; angular quartz 60%; euhedral dolomite 35%; voids 5%, a few beds 5 to 25 cm thick of green-laminated red mudstone with lenses of tan dolomitic siltstone; photographs, GSC cat. 149405-7
1,763.2 - 1,777	Breccia: matrix consists of red-brown to green-brown and some light green mudstone, slightly dolomitic in part, and tan silty dolomite with contorted bedding; fragments of tan to brownish tan dolomitic siltstone and red-brown, slightly dolomitic mudstone; siltstone fragments range up to 45 cm in diameter; sharp upper contact; upper 1.6 m of interval much brecciated; lower half banded in part; minor jointing and slickensiding; photographs GSC cat. 149399-407, (Fig. 14)

Depth ft	Lithology
1,777 - 1,780	Dolomite: silty, light grey-brown, silt much finer-grained than above, containing laminae of green argillaceous siltstone, interbedded and inter-grading with green and red-brown, slightly dolomitic mudstone; interbedded intraformational breccias mostly consisting of tan to brown dolomite and green dolomitic mudstone fragments in a red-brown dolomitic matrix; some tan siltstone fragments are surrounded by a "halo" of green dolomitic mudstone; zones with small (up to 1.7 mm in diameter) rust-brown, vugs, more numerous in the green argillaceous laminae
1,780 - 1,783	Mudstone: slightly dolomitic, silty, redbrown, with scattered soft, green slightly dolomitic inclusions up to 5 mm in diameter disintegrating readily in water (bentonitic?)
1,783 - 1,783.6	Breccia: matrix consists of slightly dolomitic, red-brown mudstone, fragments of greenish argillaceous, dolomitic siltstone and green mudstone; upper and lower contact are undulating
1,783.6 - 1,793	Mudstone: as between 1,780' and 1,783' but grading downward to massive, soft, red-brown, slightly dolomitic mudstone; contains much quartz varying from very fine sand to coarse silt
1,793 - 1,794	Mudstone, green, slightly dolomitic with a few laminae of tan, silty dolomite; upper contact is sharp and wavy; lower contact gradational
1,794 - 1,796	Dolomite, argillaceous, pale brown, silty-banded, with abundant laminations of green dolomitic mudstone
1,796 - 1,796.5	Mudstone: dolomitic, red-brown, interlaminated with brownish tan dolomite; contorted bedding; breccia, with matrix of soft red-brown, slightly dolomitic-mudstone, fragments of brownish tan dolomite and green dolomitic mudstone
1,796.5 - 1,799.2	Mudstone: slightly dolomitic, dark red-brown, soft, a few green spots; contact sharp
1,799.2 - 1,800.6	Mudstone: dolomitic, red-brown, silty, soft, very fine wavy laminae of green mudstone, some containing layers of tan argillaceous dolomite
1,800.6 - 1,802.8	Mudstone: slightly dolomitic, smooth-textured, even interbedding up to 10 cm wide of dark red-brown and green mudstone, laminae with streaks of finely porous, silty-banded argillaceous, tan dolomite, photographs GSC cat. 149408, 9, Figure 15
1,802.8 - 1,803.6	Mudstone: dolomitic, with dark red-brown and green patches, some containing tan argillaceous dolomite; contorted laminae

IMC K2 SHAFT

1540-1925'



Depth ft	Lithology	
1,803.6 - 1,882	Mudstone: dolomitic, dark red-brown and purplish red, interlaminated and interbedded with mudstone, dolomitic, grey-green, also occurring as irregular patches; tan streaks and patches of argillaceous silty dolomite within the grey-green mudstone; purplish mudstone is harder, more dolomitic than the red; green mudstone contains calcite crystals; zones of intraformational breccia up to several feet thick with matrix of dark red-brown mudstone; laminations and banding from 5 mm to 1 m wide, slightly undulating in places; vertical calcite-lined joints surrounded by grey-green mudstone; gypsum inclusions in bottom 14' of interval; lower contact irregular, undulating; photographs 1841', GSC cat. 149411-14	
	SASKATCHEWAN GROUP	
	Birdbear Formation	
	Anhydrite - carbonate unit	
1,822 - 1,885	Anhydrite: light grey with brownish cast, containing irregular partings of brownish tan dolomite; a few veinlets of white fibrous gypsum; photographs, GSC cat. 201887T, U, V, W	
1,885 - 1,925.6	Dolomite: medium grey with green cast, interbedded with brownish tan dolomitic limestone and brecciated anhydrite and gypsum; evenly, finely laminated to thick-bedded, slightly undulating; a few zones of minute vugs; zones of brown anhydrite crystals up to 5 mm in diameter; joints filled with gypsum and anhydrite; zones of brecciated anhydrite and gypsum in contorted beds of dolomite and limestone, some containing dark brown bituminous partings; brecciated anhydrite around anhydrite inclusions	
	Carbonate unit	
1,925.6 - 1,942	Limestone: dolomitic, light grey, faintly laminated; pyrite-lined vugs up to 4 mm in diameter, some filled with brown anhydrite toward top of interval; interbedded limestone, slightly dolomitic, pale to dark grey-brown, micritic, regularly laminated; joints filled with anhydrite and gypsum, gypsum occurring toward center of veinlets; dark brown bituminous partings; fossils collected from 1,939' to 1,948', algal? 'buns', small gastropod impressions, <i>Atrypa</i> sp.-med. costate, <i>Atrypa</i> cf. <i>Clarkei</i> Warren, <i>Grinewaldtia?</i> sp., <i>Styliolina</i> sp., ostracod, GSC loc. 70677	

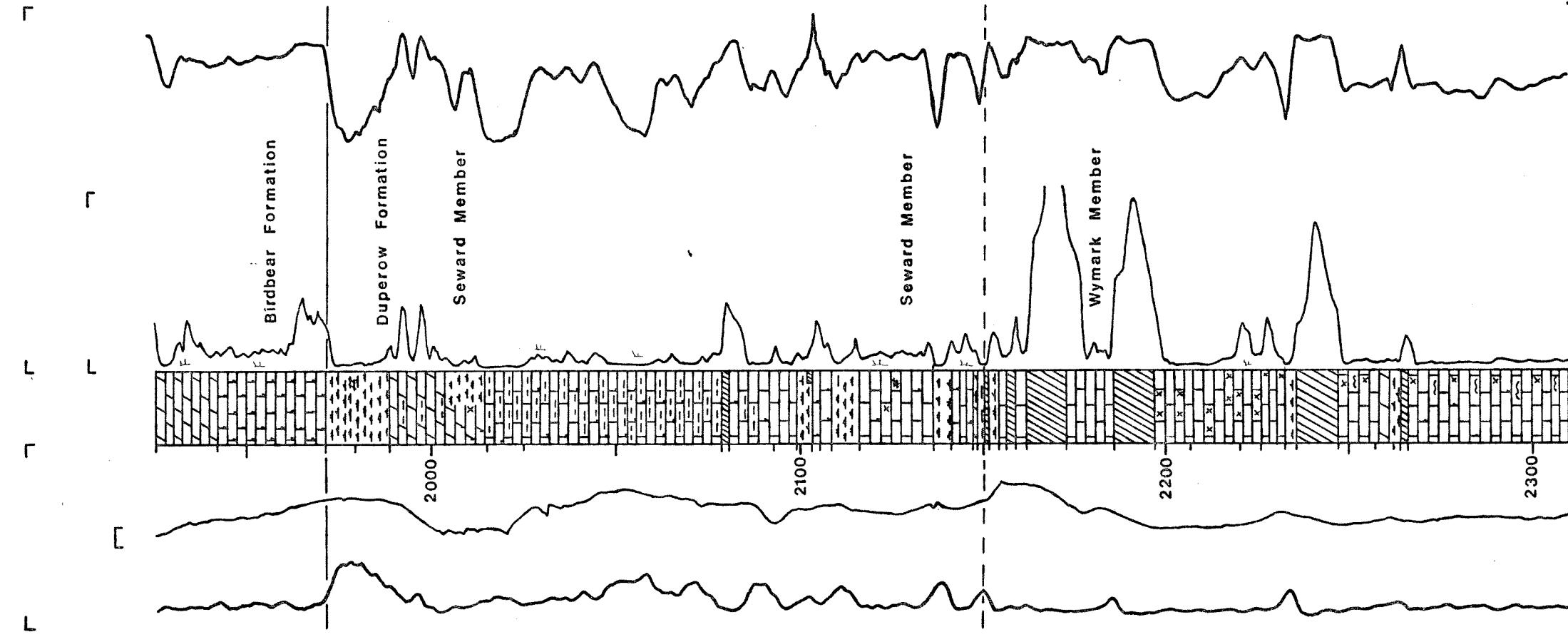
Depth ft	Lithology
1,942 - 1,971.6	Limestone: dolomitic, grey-brown, with pin-point porosity and faint coarse mottling; thin dark brown wavy carbonaceous laminae from a few inches to several feet apart appear regular on a large scale; gypsum and anhydrite in inclusions, isolated crystals and along joints and in brecciated zones of anhydrite and dolomite; slightly contorted bedding, distinctly brecciated in bottom few feet of interval; very sharp lower undulating contact has amplitude of 0.3 to 0.6 m in 4.5 m; zones of numerous small brachiopods, in places fragmented, some lines with calcite crystals, fossils collected from 1,948' to 1,966', calcareous algae? planispiral gastropod, <i>Atrypa</i> sp.-med. costate (to Index Collection), <i>Styliolina</i> sp., trilobite productellid, echinoderm ossicle with single axial canal, ostracod, GSC locs. 70685, 70372, 70676.
	Duperow Formation
	Seward Member
	Unit 4
1,971.6 - 1,979.3	Mudstone: dolomitic, grey with green cast, massive, blocky, finely disseminated pyrite; one anhydrite inclusion 25 cm in diameter 12 cm below upper contact
1,979.3 - 1,988.6	Mudstone: dolomitic, greenish grey to brown; gypsum and anhydrite in cracks and joints and as inclusions; red gypsum
1,988.6 - 2,015	Dolomite, light grey to tan, argillaceous in part, micro-crystalline to finely sugary with some porosity, finely laminated to thick-bedded; a few dolomitic mudstone interbeds; slightly wavy brown carbonaceous partings, some with stylolitic structures; zones or beds of anhydrite and gypsum fragments in the darker coarser grained dolomite; selenite inclusions; anhydrite inclusions with gypsum halos; some banding and laminae in carbonate curve around the gypsum and anhydrite inclusions; vugs up to 2.5 cm in diameter apparently after leached gypsum or anhydrite inclusions; calcareous dolomite and slightly dolomitic, red-brown massive mudstone in lower third of interval
2,015 - 2,079	Limestone: argillaceous, slightly dolomitic, dark grey, micritic, mottled in part, interbedded with rare 15 mm beds of tan, micrite, faintly banded, also mottled in part, with pin-point porosity; gypsum inclusions approximately 2.5 cm in diameter; dark brown carbonaceous (bituminous) laminae; dark brown bituminous lenses 1 mm wide and up to 25 mm long between 2,047 and 2,053'; fossils, 2,024' to 2,041', <i>Paracyclaspis</i> sp., <i>Atrypa</i> sp., <i>Paracyclaspis</i> sp., <i>Atrypa</i> sp. med. costate, <i>Atrypa</i> sp. J., <i>Cyrtospirifer</i> , sp. gastropod, GSC locs. 72973-72975 fossils 2,071', <i>Atrypa</i> cf. <i>A. ciliipes</i> Crickmay, <i>Atrypa</i> sp. L, <i>Atrypa</i> sp. M, <i>Atrypa</i> cf. <i>A. sp. M</i> , GSC locs. 72977, 72976, 72971

Depth ft	Lithology
2,079 - 2,081	Anhydrite: light grey with bluish cast; irregular brown partings
2,081 - 2,093	Limestone or mudstone: slightly dolomitic, slightly argillaceous, dark grey with green cast, micritic, interbedded with occasional 15 cm beds of tan, non-argillaceous, micritic-skeletal limestone with crinoid ossicles; dark brown bituminous partings; anhydrite inclusions
2,093 - 2,099.5	Limestone: dolomitic, tan to brown, micritic, finely banded; specks of dark carbonaceous matter; efflorescent on porous excavated fragments
2,099.5 - 2,103.5	Mudstone: calcareous, slightly dolomitic, dark grey with green cast, slightly argillaceous; anhydrite inclusions becoming more numerous downward
2,103.5 - 2,105.8	Limestone: dolomitic, light to dark brown with fine wavy banding, micritic; dark brown crystallotopic anhydrite and finely disseminated pyrite concentrated in bands
2,105.8 - 2,108.5	Limestone: dolomitic, tan with faint even banding, micritic, slightly porous
2,108.5 - 2,116	Mudstone or dolomite: argillaceous, dark grey with slight green cast, micritic zones with interstitial anhydrite
2,116 - 2,136.5	Limestone: very slightly dolomitic, tan, micritic; abundant irregular wavy dark brown bituminous partings, some stylolitic pyrite; dark crystallotopic anhydrite; inclusions of bluish white anhydrite up to 2.5 cm in diameter; joints filled with white gypsum; anhydrite decreases toward bottom of interval; upper contact sharp; zones of slightly fragmented brachiopods, prominent about 2,122'; fossils from 2,121' to 2,126'; <i>Atrypa</i> cf. <i>A. ciliipes</i> Crickmay, <i>Atrypa</i> cf. <i>A. sp.</i> J, GSC loc. 72967
Unit 3	
2,136.5 - 2,141	Mudstone: dolomitic or very argillaceous dolomite, dark grey with green cast, micritic massive to faintly laminated; upper contact gradational over 5 or 10 cm
2,141 - 2,141.2	Anhydrite, dark grey with red clast; sharp undulating contacts above and below
2,141.2 - 2,147	Limestone: very slightly dolomitic, pale brown, micritic; bands of dark brown crystallotopic anhydrite laths; inclusions of white to blue anhydrite, dark brown wavy bituminous partings; undulating lower contact; colony of corals 4 cm in diameter; fossils from 2140-2152; <i>Phillipsastrea</i> cf. <i>P. woodmansi</i> (white). <i>Atrypa</i> sp., <i>A.</i> cf. <i>J</i> , GSC loc. 72969

Depth ft	Lithology
2,147 - 2,148.3	Dolomite: calcareous, grey-brown, very slightly argillaceous, appears transitional between limestone above and mudstone below
2,148.3 - 2,150	Mudstone: dolomitic, dark grey with green cast; anhydrite
<u>Wymark Member</u>	
2,150 - 2,151	Anhydrite: dark grey with green cast
2,151 - 2,154	Mudstone: as in 2,148.3' to 2,150'
2,154 - 2,156.5	Limestone: as in 2,141.2' to 2,147
2,156.5 - 2,159	Anhydrite: grey with about 30% pink to pale brown dolomite
2,159 - 2,162	Limestone: pale to dark brown with abundant dark brown crystallotopic anhydrite crystals
2,162 - 2,173.2	Anhydrite: medium grey, massive, 10-30% pale brown dolomite; upper contact sharp
2,173.2 - 2,185	Limestone: pale brown with darker bands, very dolomitic in part; band of concentrated dark brown anhydrite crystals; "Atrypa" cf. "A." sp. J., GSC loc. 72968
2,185 - 2,197	Anhydrite: argillaceous, dark grey with green cast; anhydritic mudstone in upper half of interval; anhydrite containing up to 30% grey to tan dolomite in lower half of interval; lower contact gradational over 8 cm; <i>Atrypa</i> sp., GSC loc. 72972
2,197 - 2,200	Dolomite: brown-mottled, altered skeletal; interstices filled with anhydrite
2,200 - 2,207	Limestone: pale brown, finely banded, very dolomitic at top, micritic with skeletal zones, porous, relatively soft; a few blue-grey anhydrite inclusions; <i>Atrypa</i> sp., GSC loc. 72972
2,207 - 2,220.5	Limestone: pale brown, finely banded, micritic, with slightly dolomitic, skeletal zones, porous
2,220.5 - 2,226	Limestone: as above, but harder; porous, altered skeletal zones; many small anhydrite inclusions; stromatoporoid, colonial coral fragments, "Atrypa" cf. "A. ciliipes" Crickmay, GSC loc. 72964
2,226 - 2,232.8	Limestone: pale brown, finely banded, micritic-skeletal; anhydrite inclusions; band of interstitial anhydrite

IMC K SHAFT

1925-2310'



Depth ft	Lithology
Unit 2	
2,232.8 - 2,235.8	Mudstone: dolomitic, dark green-grey, massive
2,235.8 - 2,247	Anhydrite: dark grey; some tan dolomite
2,247 - 2,257	Limestone: pale brown very dolomitic micritic-skeletal, finely porous; dark bituminous partings; rare anhydrite and gypsum inclusions; sharp and slightly undulating upper contact
2,257 - 2,262	Dolomite: argillaceous or grey dolomitic mudstone, becoming shaly toward base, interlaminated in part with anhydrite
2,262 - 2,263.5	Mudstone: dolomitic grading downward to anhydritic mudstone, dark greenish grey, finely banded to massive; black (carbonaceous?) specks up to 10 cm in diameter; lower contact gradational over 8 or 10 cm
2,262 - 2,265.5	Anhydrite: brownish grey; sharp lower contact
2,265.5 - 2,311	Limestone: pale brown, fine to medium-bedded, micritic, with micritic-skeletal zones, dolomitic in part, zones of anhydrite inclusions and dolomitic limestone; brown bituminous laminae, stylolitic in places; limestone becoming very dense near base; lower contact gradational over 8 cm
2,311 - 2,312.5	Mudstone: anhydritic or argillaceous anhydrite, dolomitic, dark grey, massive
2,312.5 - 2,315	Mudstone: dolomitic, slightly anhydritic, dark grey-green; lenses of white gypsum; sharp and slightly irregular lower contact
2,315 - 2,317	Dolomite overlying anhydrite: dolomite, light brown, microsucrose, porous, altered skeletal (?), in irregular contact with anhydrite
2,317 - 2,327	Limestone: pale brown, dolomitic, micritic-skeletal; small colonial coral; gradational lower contact
2,327 - 2,329.5	Mudstone: dolomitic, anhydritic with anhydrite interbed, dark grey-green; gradational lower contact
2,329.5 - 2,333.5	Anhydrite: dark grey with brown cast; laminæ of dolomitic mudstone; sharp lower contact; vertical joint 6 m long striking N; stromatoporoid, coral fragments, GSC loc. 72970
2,333.5 - 2,335	Limestone: pale brown, dolomitic, micritic-skeletal
2,335 - 2,336	Anhydrite

Depth ft	Lithology
2,336 - 2,344	Limestone: dolomitic, pale brown, micritic-skeletal, with bituminous dark brown bands 5 to 10 cm apart, zones of anhydrite inclusions
2,344 - 2,344.7	Dolomite: calcareous, pale brown and blue-grey mottled
2,344.7 - 2,351.5	Limestone: very dolomitic, pale brown micritic-skeletal abundant carbonaceous (bituminous) laminae, wavy in top 12 cm of interval, becoming even-bedded downward with fewer carbonaceous laminae
2,351.5 - 2,353	Dolomite: argillaceous, grey and blue-grey mottled, soft; scattered vugs
2,353 - 2,357.5	Limestone: tan, pale brown, micritic-skeletal, dark brown bituminous laminae
2,357.5 - 2,358	Dolomite: dark brown-grey, microsucrose fine carbonaceous laminae, vugs and other porosity partly filled with earthy gypsum
2,358 - 2,364	Limestone: very dolomitic, pale brown, micritic-skeletal; a few dark brown bituminous laminae, anhydrite inclusions at top of interval
2,364 - 2,364.5	Dolomite: pale brown; abundant wavy dark brown bituminous laminae
2,364.5 - 2,369.5	Dolomite: calcareous, pale brown; abundant grey anhydrite inclusions
2,369.5 - 2,370.5	Anhydrite: grey; abundant tan dolomite
2,370.5 - 2,373.7	Dolomite: pale brown; anhydrite inclusions
2,373.7 - 2,374.5	Anhydrite: grey, dolomitic, up to 50% dolomite
2,374.5 - 2,376.2	Limestone: dolomitic, pale grey-brown, finely banded with dark brown bituminous laminae; small anhydrite inclusions
2,376.2 - 2,381.5	Limestone: dolomitic or calcareous dolomite, brownish grey, banded, micritic skeletal, silicified(?) in part; abundant dark brown bituminous partings; stromatoporoid, coral fragments, GSC loc. 72965
2,381.5 - 2,405	Limestone, dolomitic and calcareous dolomite: pale brown, micritic, skeletal in part, finely porous; coarse dolomite rhombs; faint banding, wavy on small scale, undulating on large scale; rare anhydrite inclusions; dark brown bituminous partings; brown organic specks; becomes less fossiliferous and more dolomitic downward; calcareous fossils, stromatoporoids, coral fragments
2,405 - 2,408	Dolomite: light brown microsucrose, altered skeletal in part; wavy brown laminations

Depth ft	Lithology
Unit 1	
2,408 - 2,409	Mudstone: dolomitic, blocky, green-grey; anhydrite lenses toward bottom of interval; upper contact gradational over 5 cm
2,409 - 2,409.3	Anhydrite: dark grey; green-grey mudstone partings; sharp and undulating contacts, above and below
2,409.3 - 2,433	Dolomite: slightly calcareous, brown; interbedded with dolomitic limestone pale brown, calcarenitic in part, finely porous; fine wavy banding in top 15 cm; dark brown with abundant dark brown bituminous partings and disseminated pyrite in top 5 cm below upper contact; anhydrite beds, with inclusions of wispy dolomite with particulate structure; anhydritic beds; gypsum-filled joint striking N; stromatoporoid, GSC loc. 72966
2,433 - 2,433.7	Dolomite and anhydrite: dolomite grey-brown, argillaceous; anhydrite, tan; 30% of rock; some dark grey mudstone
2,433.7 - 2,436.5	Limestone: dolomitic pale brown, micritic-skeletal
2,436.5 - 2,439.5	Dolomite: calcareous, pale brown, micritic
2,439.5 - 2,441	Mudstone: dolomitic, anhydritic in part, dark green-grey, sharp undulating lower contact
2,441 - 2,433	Limestone: tan, finely banded; a few fossils
2,433 - 2,447	Dolomite: tan, cryptocrystalline, anhydritic in part; anhydrite lenses up to 30% of interval
2,447 - 2,451.5	Limestone: dolomitic, micritic, banded; bituminous partings, some skeletal limestone
<u>Elstow Member</u>	
2,451.5 - 2,452.2	Mudstone: very dolomitic to slightly dolomitic, grey-mottled
2,452.2 - 2,456.5	Dolomite: argillaceous, dark grey-brown, micritic, banded; joints filled with gypsum
2,456.5 - 2,459.5	Limestone: argillaceous, dolomitic, dark grey-brown; rare inclusions of blue anhydrite; rare branching corals
2,459.5 - 2,468	Limestone: slightly argillaceous, grey-brown, calcarenitic in part, some with interstitial anhydrite; interbedded with dark grey dolomitic limestone containing dark brown carbonaceous (bituminous) partings, a few stylolites; abundant branching corals
2,468 - 2,471	Limestone: grey to dark grey mottled with brown; interbeds, skeletal; a little anhydrite

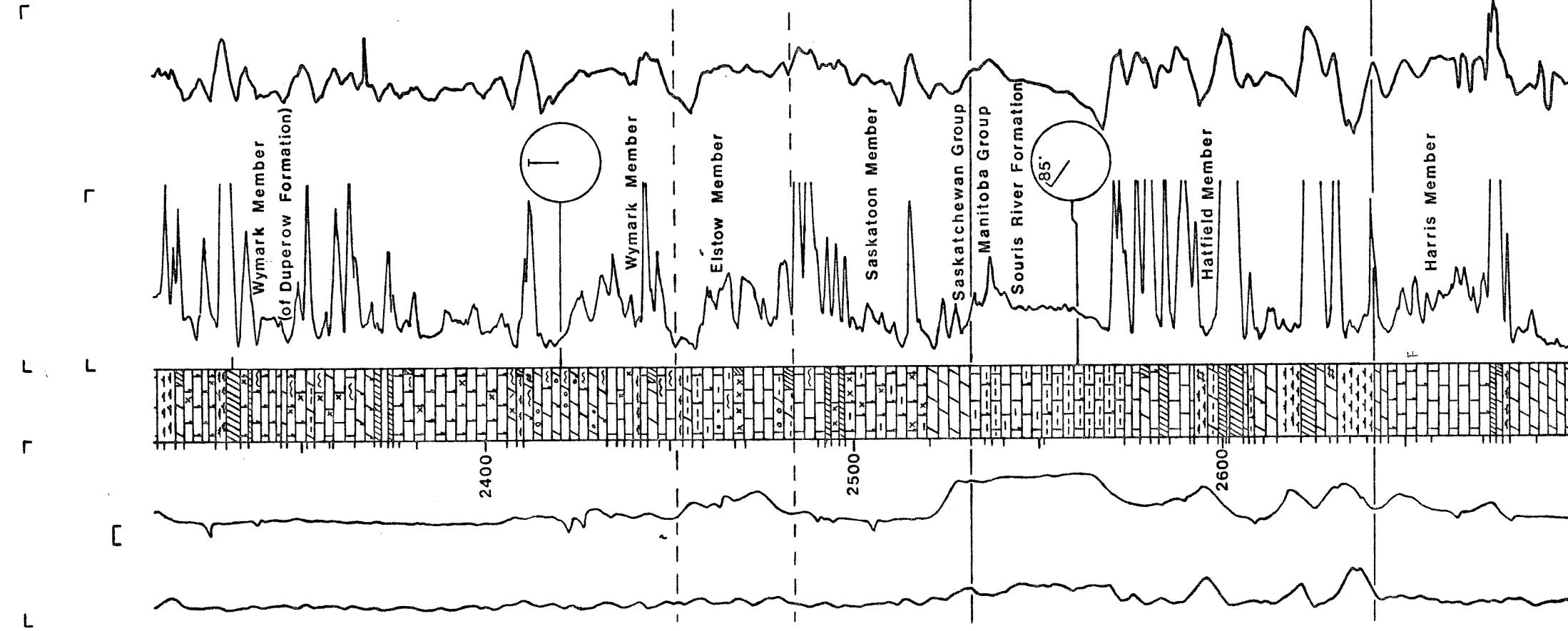
Depth ft	Lithology
2,471 - 2,480	Limestone: pale brown, skeletal, porous in part; brown bituminous laminae; calcarenitic bed with fragments of branching corals; stromatoporoids
2,480 - 2,485	Dolomite: grey, argillaceous; anhydrite
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	<u>Saskatoon Member</u>
2,485 - 2,493	Limestone: pale brown, massive, with wavy bituminous laminae; micritic
2,493 - 2,494	Anhydrite: grey with brown cast
2,494 - 2,496.5	Limestone: very dolomitic, pale brown, skeletal in part, massive; brown carbonaceous laminations
2,496.5 - 2,497.5	Anhydrite: grey with brown cast
2,497.5 - 2,502.5	Limestone: dolomitic, skeletal, as in 2,494'-2,496.5', grading downward to calcareous dolomite; some anhydrite with dolomite inclusions
2,502.5 - 2,521	Limestone: very dolomitic, slightly argillaceous, dark green-grey, micritic to finely skeletal; grades to calcareous microsucrosic dolomite
2,521 - 2,531	Dolomite: dark brown, microsucrose, finely banded; dark bituminous laminae; anhydritic(?) bands; very small gypsum- or anhydrite-filled joints
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	<u>Manitoba Group</u>
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	<u>Souris River Formation</u>
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	<u>Hatfield Member</u>
2,531 - 2,533	Limestone: pale brown-grey, slightly argillaceous
2,533 - 2,535.5	Limestone: dolomitic and argillaceous, dark green-grey; mottled after breccia, fragments 2.5 cm long; small anhydrite inclusions
2,535.5 - 2,540.5	Limestone: argillaceous, or calcareous mudstone, dark and light green-grey mottled; indefinite wavy banding and nodular structure
2,540.5 - 2,551	Limestone: dark green-grey, slightly argillaceous, slightly dolomitic, micritic

Depth ft	Lithology
2,551 - 2,573	Limestone: very argillaceous, grading to calcareous mudstone, slightly dolomitic, dark green-grey, banded, shaly; a few bedding planes covered with grey-brown carbonaceous(?) film; gypsum-filled joint dipping 85°NE
2,573 - 2,577	Limestone: pale brown, mottled in part, micritic; zones of crystallotopic dark brown anhydrite crystals(?); joints and porosity filled with gypsum
2,577 - 2,580	Dolomite: dark grey, with anhydrite inclusions, grading downward to anhydrite
2,580 - 2,583	Limestone: pale brown, banded with dark brown partings; becomes dolomitic downward, grading to sucrosic dolomite with chalky interstitial calcite; crystallotopic anhydrite; gypsum-filled jointing
2,583 - 2,585	Anhydrite: dark grey-brown, with much brown dolomite
2,585 - 2,591	Limestone: very dolomitic, pale brown, micritic, finely banded; micritic-skeletal in dark brown bituminous laminae; non-dolomitic limestone with crystallotopic anhydrite
2,591 - 2,592	Limestone: argillaceous, and calcareous mudstone, dark green-grey, banded
2,592 - 2,596	Mudstone: dolomitic dark green-grey, soft; finely disseminated pyrite
2,596 - 2,599.5	Dolomite: very argillaceous, becoming anhydritic downward, dark brownish grey, harder than the mudstone above
2,599.5 - 2,601	Anhydrite: dark brownish grey
2,601 - 2,602	Limestone: argillaceous, dolomitic, dark brown, micritic, banded
2,602 - 2,606	Anhydrite: dark brownish grey
2,606 - 2,607	Dolomite: pale brown microcrystalline; contorted bedding near top with light grey-tan dolomite inclusions (intraformational conglomerate?)
2,607 - 2,608.5	Limestone: very dolomitic, argillaceous, brown, finely banded, micritic
2,608.5 - 2,611	Dolomite: pale brown, banded calcareous in part, micritic, tri-star aggregates of gypsum(?) up to 15 mm in diameter
2,611 - 2,615.5	Dolomite: pale brown, with faint fine mottling, a few anhydrite inclusions and brown bituminous partings
2,615.5 - 2,621	Mudstone: very dolomitic or argillaceous dolomite, dark grey-green, massive; undulating lower contact

Depth ft	Lithology
2,621 - 2,625.5	Anhydrite: dark grey; inclusions of tan dolomite; sharp lower contact
2,625.5 - 2,629	Dolomite: pale brown, tan, faintly mottled and banded, microsucrose; bituminous laminae; zone 0.3 m thick in top 1 m of interval, of very pale brown, brittle dolomite with irregular upper contact and even, sharp lower contact
2,629 - 2,631	Dolomite: light brown, microsucrose, very dense; dark brown bituminous laminae, some with pyrite
2,631 - 2,635.5	Shale: dolomitic, green, fissile, very soft, sloughs easily; bituminous parting forms very sharp upper contact
2,635.5 - 2,639.5	Shale: dolomitic, green with large red patches, very soft, disintegrates in water more readily than shale above; contacts gradational over 5 to 10 cm above and below
2,639.5 - 2,641.4	Shale: dolomitic, green, soft; laminated, laminations dipping up to 25°
<u>Harris Member</u>	
2,641.4 - 2,642.2	Dolomite: pale grey-brown, very hard, dense; undulating laminae of grey anhydrite
2,642.2 - 2,645	Dolomite: brown, mottled, microsucrose; gypsum-filled jointing; rare bituminous partings
2,645 - 2,650.5	Limestone: dolomitic, light grey, micritic
2,650.5 - 2,653	Limestone: slightly dolomitic, dark grey to dark brownish grey, hard; abundant carbonaceous specks; "Atrypa" cf. "A. clarkei" Warren, <u>Allanaria allani</u> (Warren), <u>Eleuthero-komma</u> (?) sp., GSC Loc. 72978
2,653 - 2,657	Limestone: pale brown, slightly dolomitic, skeletal-micritic; dolomite rhombs; a few bituminous partings; abundant brachiopod fragments and crinoid stems; some gypsum-filled fossils; spherical concentric organic structures (stromatoporoids?) up to 23 cm in diameter
2,657 - 2,671.5	Limestone: pale brown, some with even dark banding, micritic-skeletal; small vugs, vertical joints up to 2.5 cm long filled with clear gypsum; zone or zones of light brown-mottled limestone with more abundant gypsum than above
2,671.5 - 2,673	Limestone: dolomitic, light brown, micritic, speckled with dolomite rhombs; irregularly wavy bituminous partings having an amplitude up to 10 mm; grades to medium grey limestone, argillaceous, dolomitic, micritic; sharp, even contacts above and below

IMC K2 SHAFT

2310-2695'



Depth ft	Lithology
2,673 - 2,674.5	Anhydrite: grey, becoming dolomitic downward
2,674.5 - 2,676	Dolomite: calcareous, largely anhydritic, brown, becoming light brown downward, microscrose, blue anhydrite inclusions; fine wavy banding with amplitude up to 10 cm, contorted in part; upper contact, gradational; lower contact, sharp and irregular
2,676 - 2,677.5	Mudstone: calcareous and dolomitic, dark green-grey, faint fine banding near top
2,677.5 - 2,678.5	Dolomite: pale brown
2,678.5 - 2,685	Dolomite: pale brown, microscrose, faintly banded; a few wavy bituminous partings
2,685 - 2,699	Dolomite: pale brown-grey, microscrose, faintly banded, very finely porous; a few brown bituminous partings near top; bituminous parting at bottom of interval
2,699 - 2,703	Dolomite: brown-grey, slightly calcareous, becoming tan to brown downward, microscrose; discontinuous, irregularly wavy, bituminous partings producing a mottled appearance; lower contact sharp, irregular at places
2,703 - 2,705.5	Mudstone: dolomitic or argillaceous dolomite: dark green, dense, with fine even banding.
2,705.5 - 2,706.5	Anhydrite: grey, with sharp, regular upper contact; lower contact, sharp, very uneven
2,706.5 - 2,707.5	Dolomite: pale brown, with undulating bands, microscrose; 5 mm undulating brown bituminous layer; thickness of bed varies from 15 to 30 cm
2,707.5 - 2,709.5	Dolomite: as above grading downward to brown dolomite; brown dolomite grades to dark green-grey argillaceous dolomite
2,709.5 - 2,713.5	Anhydrite: grey, alternating with pale brown dolomite beds; grades downward to anhydritic dolomite
2,713.5 - 2,714	Dolomite: pale brown, microscrose; lower contact marked by even brown bituminous layer
2,714 - 2,714.5	Dolomite: brown, microscrose; gypsum-filled jointing
2,714.5 - 2,716.5	Mudstone: dolomitic, dark green-grey
2,716.5 - 2,721.8	Anhydrite: largely interbedded with tan dolomite
2,721.8 - 2,723	Dolomite: pale brown, mottled in part with darker dolomite; very small inclusions of anhydrite
2,723 - 2,724	Dolomite: pale brown
2,724 - 2,724.5	Dolomite: brown; bituminous parting at top of interval

Depth ft	Lithology
2,724.5 - 2,725	Mudstone: dolomitic, dark grey-green
2,725 - 2,726	Anhydrite: dark brown becoming lighter-coloured downward
2,726 - 2,726.5	Dolomite: pale brown, with anhydrite blebs; wavy dark brown layer marks lower contact
2,726.5 - 2,727	Dolomite: pale brown; a few zones with rare anhydrite blebs
2,727 - 2,727.5	Dolomite: brown, pinching out at places
2,727.5 - 2,728	Mudstone: green-grey; varying in thickness; undulating with horizontal span of 0.6 to 1.3 m
2,728 - 2,729.5	Anhydrite: dark brown, grading to medium brown dolomitic anhydrite; little variation in thickness of bed
2,729.5 - 2,730	Dolomite: pale brown, mottled; very small anhydrite blebs; wavy bituminous layer marks lower contact, with undulations parallel to bedding above
2,730 - 2,731	Mudstone: grey-green; brown anhydrite inclusions toward bottom of interval; at places grades to brown dolomite as above; steep dip E
2,731 - 2,739.2	Anhydrite: dark brown, with green mudstone inclusions near top of interval
2,739.2 - 2,743	Dolomite: light tan, anhydritic in upper 15 cm; very fine bituminous(?) banding; upper contact sharp, slightly undulating
2,743 - 2,745.5	Mudstone: dolomitic, dark green-grey
2,745.5 - 2,750	Anhydrite: brown streaks of tan dolomite; pyritic laminae
2,750 - 2,758	Dolomite: tan to brown, light tan, finely banded at top; zones of brown anhydrite crystals
2,758 - 2,767	Mudstone: dolomitic, dark grey-green, medium hard; anhydritic(?) in part
<hr/> <b>Davidson Member</b> <hr/>	
2,767 - 2,773.7	Anhydrite: dark brown with 8 cm band of light grey-brown dolomite containing white anhydrite, 12 cm below upper contact
2,773.7 - 2,774.5	Dolomite: pale to medium brown, microscrose; bituminous partings; anhydrite inclusions
2,774.5 - 2,786	Anhydrite and anhydritic dolomite: interbedded, pale brown and grey, banded; argillaceous grey dolomite with (altered) calcarenitic granularity; brown bituminous laminations; cherty(?) layers; photograph, GSC cat. 201888-H

Depth ft	Lithology
2,786 - 2,789.8	Dolomite: anhydrite, light brown-grey, with regular brown partings; a few porous laminae
2,789.8 - 2,792.3	Dolomite: pale to light brown, with dark brown algal mat(?) laminae; a few anhydritic laminae; vertical veinlets or fractures with gypsum, 0.5 mm wide
2,792.3 - 2,795.2	Dolomite: brown, sugary, porous (rhombs 0.08 mm); anhydrite inclusions; gypsum partly filling porosity
2,795.2 - 2,795.8	Limestone and dolomite: limestone, dolomitic, brown, with dolomite rhombs and relict calcarenitic(?) texture, very hard, non-porous; band of dark brown dolomite 2.5 cm thick at top of interval, containing bituminous specks
2,795.8 - 2,798.2	Dolomite: brown, sugary, brown laminated, slightly porous, with poor permeability
2,798.2 - 2,800	Anhydrite: dolomitic, brown-grey, banded in part, pelleted or dolarenitic dolomitic bands
2,800 - 2,802.9	Dolomite: brown, sugary, porous in part; coarse rhombs; brown shaly zone
2,802.9 - 2,806.9	Anhydrite and dolomite: interlaminated; anhydrite predominates in upper part, dolomicrite predominates at base
2,806.9 - 2,811.8	Anhydrite and anhydritic mudstone: pale grey, dolomitic in part; light brown dolomite with relict calcarenitic texture and discontinuous brown organic laminae
2,811.8 - 2,822	Dolomite: or dolomicrite, grey-brown, banded; zones with dark bituminous specks; undulating and slightly distorted dark brown layers, some bituminous and shaly; two beds of dolomitic anhydrite, 2 feet (0.6 m) thick in basal 7 feet of interval
2,822 - 2,828	Dolomite: or dolarenite, grey with relict calcarenitic or pelleted texture; brown organic laminae resembling algal mat layers; zone of coarse vugs
	The following data are compiled in part from examination of samples from the shaft wall and from a log of the pilot hole core made prior to construction of this section of the shaft.
2,828 - 2,836	Dolomite: light brown, sugary, banded, with zones of vuggy porosity, poor permeability; inclusions of white anhydrite near base
2,836 - 2,867	Dolomite: brown, sugary, firm; vuggy porosity; anhydrite-filled vugs, after fossils in part, up to 5 cm long; vug after a charophyte

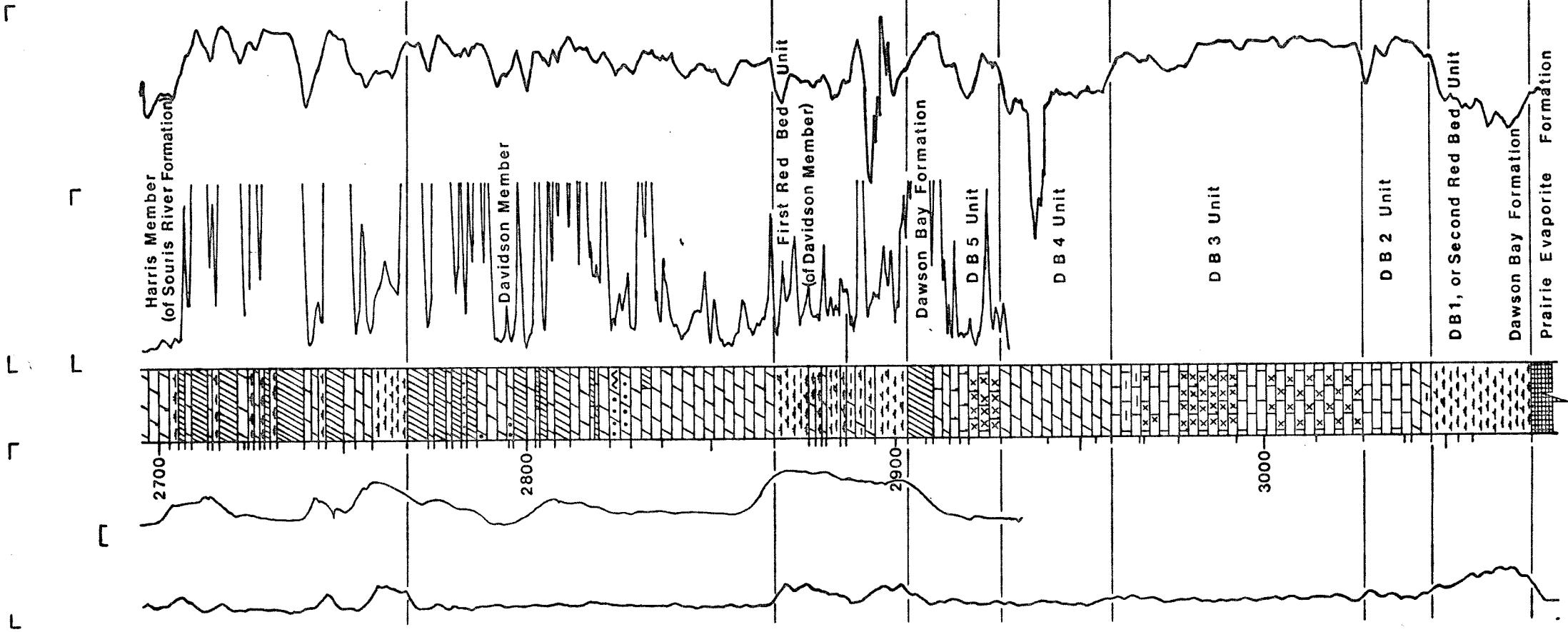
Depth ft	Lithology
<u>First Red Bed unit</u>	
2,867 - 2,876.5	Mudstone: dolomitic and anhydritic, light to medium grey, some with green cast, faintly laminated in part
2,876.5 - 2,878	Dolomite: medium grey dolomicrite; a little pyrite; mudstone interbedded
2,878 - 2,879.5	Mudstone: medium grey, in part with green cast
2,879.5 - 2,881	Dolomite: argillaceous, brown-grey; fracture filling and inclusions of clear anhydrite or gypsum
2,881 - 2,885	Mudstone: anhydritic, dolomitic, light grey, massive; more dolomitic interbeds have a brown cast; a few discontinuous lenses of pale grey anhydrite
2,885 - 2,886.5	Mudstone: light grey to pale brown, dolomitic and(?) calcareous; carbonaceous bed 1 cm thick at base of interval
2,886.5 - 2,849.5	Dolomite and mudstone: intergrading and interbedded, argillaceous dolomite and dolomitic mudstone, light brown-grey, with shaly interbeds up to 0.3 m thick; inclusion of blue-grey anhydrite 5 mm across; undulating laminated zones; carbonaceous bed reported at base of interval
2,894.5 - 2,900	Mudstone: dolomitic, anhydritic, light grey; shaly intervals undulating and laminated, up to 10 cm thick
2,900 - 2,903.5	Mudstone: dolomitic, anhydritic in part, massive
Dawson Bay Formation	
DB5 member	
2,903.5 - 2,908	Anhydrite: dolomitic, argillaceous
2,908 - 2,910	Anhydrite and anhydritic dolomite: interlaminated and interfingering
2,910 - 2,913	Dolomite: pale brown dolomicrite, very finely porous; anhydritic lenses in top 0.5 feet of interval; band of dolomitic limestone 1.5 feet below top, 15 cm thick, more porous than adjacent dolomite, containing sparry calcite (after fossils?)
2,913 - 2,914.3	Dolomite: pale to medium brown dolomicrite, finely porous in part; wavy brown bituminous partings; anhydrite lens at top
2,914.3 - 2,917	Limestone: very dolomitic, pale to light brown, micritic, altered calcarenous in part, largely with fine porosity; zones of gypsum filling vugs; thin dolomite bed 0.5 feet from base of interval

Depth ft	Lithology
2,917 - 2,919.5	Limestone: very dolomitic, light brown, intergrading with calcareous dolomite; non-dolomititic corals, spines and other fossil fragments; interstitial sugary dolomite with light porosity; band of brown shaly laminae
2,919.5 - 2,928.5	Limestone: dolomitic, brown, finely skeletal, micritic; abundant brown bituminous specks and dark brown shaly partings increasing toward base; zone with pore spaces filled by sparry gypsum or calcite
	DB4 member
2,928.5 - 2,941	Dolomite: brown, sugary; high interstitial porosity
2,941 - 2,954	Dolomite: light to medium brown, sugary, porous; vugs in lower part of interval after coral and other fossils
2,954 - 2,958.5	Dolomite: light to pale brown, microsucrose, very finely porous to tight
	DB3 member
2,958.5 - 2,966	Limestone: pale brown, micritic; slightly argillaceous below 2,959.5'; abundant crinoid fragments at top
2,966 - 2,967.5	Limestone: skeletal; large vugs and some interstitial chalky calcite; permeability generally poor, greater along irregular bedding planes
2,967.5 - 2,970	Limestone: dolomitic, pale brown, micritic-skeletal, very slightly argillaceous
2,970 - 2,976.5	Limestone: dolomitic, pale brown, micritic, mottled with non-dolomitic smooth-textured limestone; zones of abundant fossil fragments; scattered large vugs (after fossils?)
2,976.5 - 2,993.5	Limestone: dolomitic in part, pale brown, altered skeletal-micritic
2,993.5 - 3,000	Limestone: pale brown, micritic; scattered brachiopod fragments; indefinite carbonaceous(?) specks; dark-speckled areas (of gypsum or halite saturation?)
3,000 - 3,014	Limestone: pale grey-brown, micritic-skeletal; numerous vugs after fossils; little permeability; regular bedding planes 1 foot (0.3 m) apart
3,014 - 3,027	Limestone: pale grey-brown, micritic-skeletal, bedded, as above; vug filled with chalky calcite

IMC K2 SHAFT

2695-3073

- 81 -



Depth ft	Lithology
	DB2 member
3,027 - 3,030.5	Limestone: pale grey-brown, micritic, speckled with darker (gypsiferous?) areas
3,030.5 - 3,038	Limestone: pale brown, grey-mottled, micritic, compact, nearly lithographic, smooth-textured; zones with vugs, filled in part with brown anhydrite and chalky dolomite
3,038 - 3,040	Limestone: pale brown, grey-mottled, micritic; few vugs
3,040 - 3,045.5	Dolomite: dark brown, grey mottled, micritic, compact, translucent, nearly lithographic; may be slightly argillaceous at base
	DB1, or Second Red Bed member
3,045.5 - 3,048.5	Mudstone: dolomitic and anhydritic
3,048.5 - 3,053	Mudstone: slightly dolomitic, pale pinkish brown
3,053 - 3,057.3	Mudstone: very dolomitic, light grey to light brown, blocky to massive; irregular fissility with salt coating
3,057.3 - 3,060	Mudstone: dolomitic, red-brown, green-mottled
3,060 - 3,066	Mudstone: dolomitic, red-brown, green mottled in part; irregular fissility
3,066 - 3,073	Mudstone: red-brown, some irregular green banding; abundant crystals of halite

Prairie Evaporite Formation

3,073 Halite: not examined

APPENDIX II  
SYLVITE NO. 2  
Geological Log

SYLVITE OF CANADA LTD. NO. 2 SHAFT, ROCANVILLE

Lsd. 12, Sec. 22, Tp. 17, Rge. 30W1

Elevation of shaft collar (Datum): 1,570'

Observations of shaft wall, C.E. Wright; lithology, L.L. Price

Depth ft	Lithology
CENOZOIC	
<u>Quaternary deposits</u>	
0	- 19 Limited information: gravel cobbles and boulders
19	- 22 Till, calcareous: clay, fine sand to cobbles, unindurated; ferruginous stains; no apparent direction of force
22	- 27 Till, calcareous: very finely sandy clay, light grey with buff cast, igneous cobbles, unindurated
27	- 34 Till, calcareous: very finely sandy clay, medium light grey, unindurated; scattered cobbles and pebbles
34	- 35 Till, calcareous: medium light grey, more indurated than above; some gravel and pebbles
35	- 38 Till, calcareous: light grey clay, medium sand to cobbles (igneous and sedimentary); gently undulating contact at 36', marked by gravels; photo GSC cat. 149490
38	- 40 No information
40	- 43 Till, calcareous: light grey clay; medium sand to pebbles, igneous and sedimentary; gravel
43	- 45 Till, calcareous: light grey clay; medium sand with igneous and sedimentary pebbles
45	- 46 No information
46	- 48 Till calcareous: light grey clay; coarse sand to cobbles; very finely sandy zones; microscopic ferruginous(?) stains
48	- 50 Till, calcareous: light grey clay; coarse sand to cobbles; white chalky weathered fragments of calcareous white-speckled shale; photo GSC cat. 149494, 5
50	- 52 Till, calcareous: light grey clay; coarse sand to cobbles; chalky fragments of calcareous white-speckled shale

Depth ft		Lithology
52	-	53 No information
53	-	55 Till, calcareous: light grey clay, medium sand to pebbles; scattered chalky fragments of calcareous blocky white-speckled shale
55	-	57 Till, calcareous: light grey clay; medium sand to cobbles; scattered ferruginous(?) and calcareous fragments
57	-	59 Till, calcareous: light grey clay; fine sand to pebbles; scattered ferruginous(?) fragments
59	-	61 Till, calcareous: light grey clay, coarse sand to cobbles; scattered ferruginous(?) and calcareous chalky fragments; scattered small pockets of very fine sand
61	-	62 No information
62	-	64 Till, calcareous: light grey clay; coarse sand to pebbles; scattered white chalky fragments of calcareous rock
64	-	66 Till, calcareous: light grey clay; very fine sand to pebbles; sand pockets
66	-	68 Till, calcareous: light grey clay; fine sand to pebbles; scattered sand pockets, scattered ferruginous(?) stains
68	-	70 Till, calcareous: light grey clay; fine sand to cobbles; pockets of fine sand
70	-	71 Till, calcareous: light grey clay; fine sand to cobbles; isolated sand pockets; no apparent direction of force
71	-	73 Till, calcareous: light grey clay; fine sand to cobbles; isolated sand pockets
73	-	75 Till, calcareous: light grey clay; fine sand to cobbles; scattered chalky white calcareous fragments; fragment of wood 2 cm long
75	-	76 No information
76	-	79 Till, calcareous: light grey clay; fine sand to boulders; lens of fine sand with irregular basal contact
79	-	83 Till, calcareous: fine to sand to cobbles; poorly unindurated
83	-	86 Till, calcareous: light grey clay; coarse sand to cobbles; scattered ferruginous stains
86	-	89 Till, calcareous: light grey clay; medium sand to cobbles; ferruginous stains; pyritized tooth; calcareous white chalky fragments
89	-	93 No information

Depth ft	Lithology
MESOZOIC (Cretaceous)	
Riding Mountain Formation	
99 - 99	Till, calcareous: light grey clay; very fine sand to cobbles; white chalky fragments of calcareous white-speckled shale and argillaceous limestone
99 - 106	Shale: medium grey, blocky, non-calcareous, finely silty, very soft, with irregular fissility; brown ferruginous zone, very soft, possibly concretionary, altered by deep weathering; tarnished aggregates of minute pyrite spheres (after trace fossils); section fractured in several directions, slumped, slickensided
106 - 113	Shale: medium grey blocky, silty; streaks and mottling of finely divided pyrite, tarnished and oxidized, after trace fossils and fecal pellets (oval, 0.25 mm); dry shale from 106'-113' has appearance of dampness, possibly through saturation of a soluble iron salt; bedding disturbed as above; calcareous worm (?) tube 0.4 mm across, pelecypods; (from shaft #1) - indeterminate baculitid? fragments, GSC loc. 83485
113 - 118	Shale: light grey, slightly silty, blocky; finely divided pyrite, tarnished, after trace fossils; specks of carbonized organic matter; bedding more firm than above but faulted, contaminated with drilling mud from pilot hole; (from shaft #1) - <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Photadomya cf. mcleani</i> Landes, pelecypods, genus and species indet., gastropods, genus and species indet., <i>Dentalium</i> (s. lato) sp. indet., GSC locs. 83489, 83513
118 - 121	Shale: medium brown-grey, finely silty, blocky; rare trace fossils; set of fractures dipping 45° to 60°, direction unknown (from core of pilot hole)
121 - 127	Shale: medium light grey, very slightly and finely silty; pyritized trace fossils abundant; much oxidation; ferruginous concretion (soft, weathered?) scattered biotite(?), specks of carbon and rare foraminifera
127 - 131	Shale: light grey, smooth-textured, non-silty, blocky; pyritized areas after tracks, burrows(?), conical tubes (nearly vertical, 0.8 mm across, 0.8 mm long); larger tubes; (from shaft #1) - <i>Scaphites (Hoploscaphites) n. sp.</i> ex aff. <i>gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm s. lato, <i>Photadomya mcleani</i> Landes, GSC loc. 83487

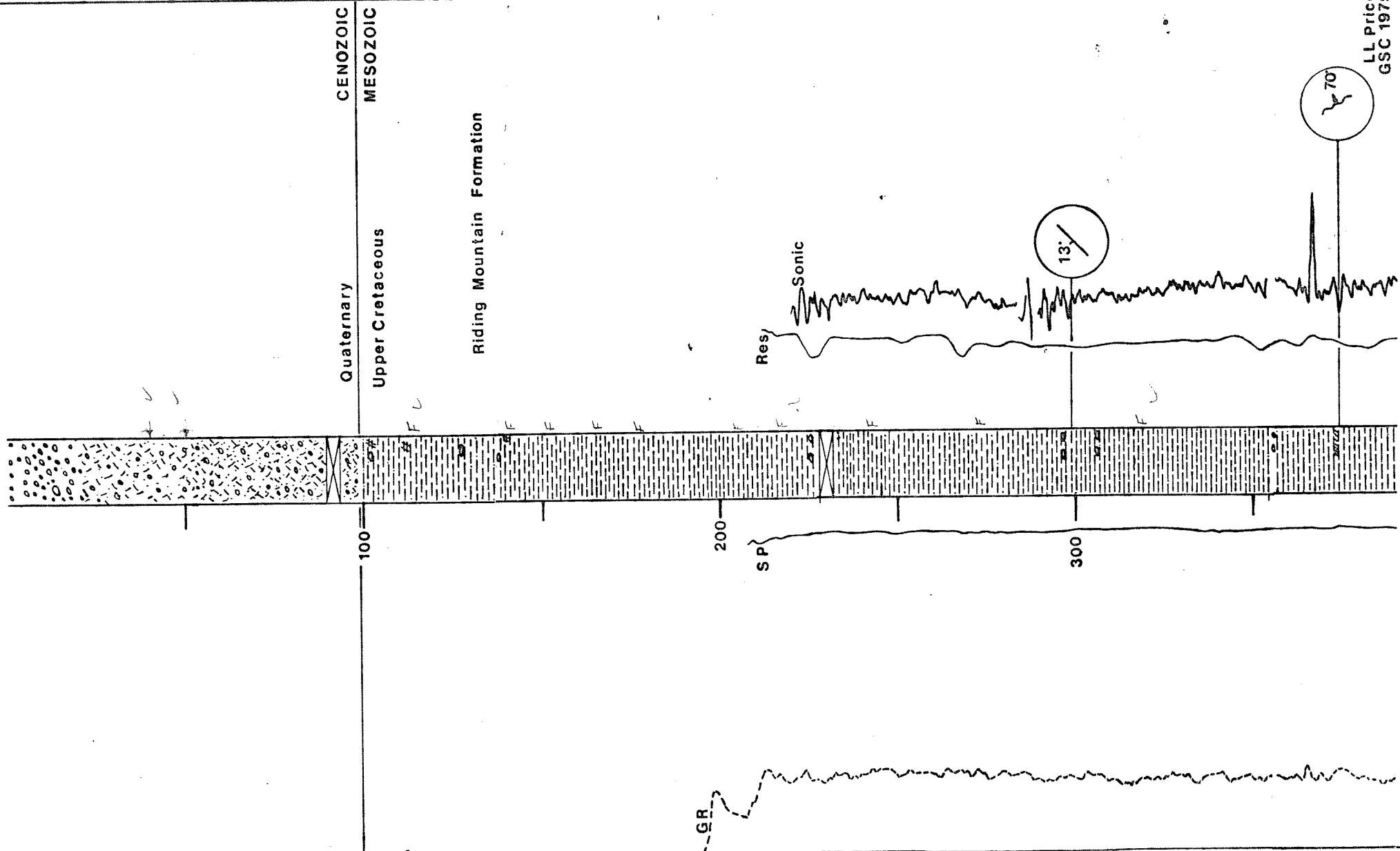
Depth ft	Lithology
131 - 138	Shale: medium light grey, finely silty, blocky; ironstone nodules; disseminated pyrite fine specks of carbon; minute slickensides 1 to 33 mm long; siliceous worm (?) tubes up to 0.5 mm across; pyritized trace fossils; pelecypods; (from shaft #1) - <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites)</i> n. sp. ex aff. <i>gilli</i> Cobban and Jeletzky, <i>Inoceramus</i> cf. <i>Inoceramus balticus</i> Böhm s. lat, GSC loc. 83492
138 - 153	Shale: medium brown-grey, blocky, faintly silty; disseminated pyrite at top; specks of carbon; pyritized trace fossils, worm (?) tubes; foraminifera; <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm s. lato, <i>Inoceramus</i> sp. indet., gastropods, genus and species indet., <i>Dentalium</i> (s. lato) sp. indet., GSC loc. 83496
153 - 157	Shale: medium light grey, blocky; specks of carbon; pyritized trace fossils; siliceous worm tubes; (from shaft #1) - <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Scaphites (Hoploscaphites)</i> n. sp. ex aff. <i>gilli</i> Cobban and Jeletzky, GSC loc. 83484
157 - 170	Shale: medium brown-grey, blocky, faintly silty; limestone on north and west wall; pyritized trace-fossils, fragments of gastropods; (from shaft #1) - <i>Scaphites (Hoploscaphites) cf. gilli</i> Cobban and Jeletzky, <i>Goniomya</i> sp. indet. (a new species?), GSC loc. 83486
From core of pilot hole for No. 2 shaft	
170 - 174	Shale: medium light grey, blocky, much harder than shale above; indefinite silty lense, specks of carbon; pyritized trace fossils; siliceous worm (?) tubes, 0.25 mm in diameter
174 - 184	Shale: medium light grey with brown cast as above; blocky with irregular fissility, faintly silty in part; rare brown ferruginous zones; minute specks of carbon; siliceous worm (?) tubes; pyritized trace fossils; small pelecypods; <i>Inoceramus</i> ; minute coiled ammonite; ctenoid fish scales; (from shaft #1) - <i>Scaphites (Hoploscaphites) cf. gilli</i> Cobban and Jeletzky, <i>Baculites</i> sp. indet., <i>Inoceramus balticus</i> Böhm s. lato, <i>Inoceramus</i> ex aff. <i>mclearni</i> Douglas, <i>Dentalium</i> (s. lato) sp. indet., gastropod, genus and species indet., GSC loc. 83491
184 - 200	Shale: medium brown-grey, much harder than above, slightly ferruginous(?), with less carbon; trace-fossils rare; ornate gastropods

Depth ft	Lithology
200 - 220	Shale: medium brown-grey, blocky, slightly ferruginous in part; scattered pyritized and oxidized burrows; fragments of siliceous or arenaceous agglutinated worm (?) tubes; (from shaft #1) - <i>Scaphites (Hoploscaphites) gilli</i> Cobban and Jeletzky, <i>Inoceramus balticus</i> Böhm s. lato including <i>I. balticus</i> var. <i>saskatchewanensis</i> Warren, <i>Inoceramus</i> ex aff. <i>mclearni</i> Douglas, pelecypods, genus and species indet., gastropods, genus and species indet., <i>Dentalium</i> (s. lato) sp. indet., <i>Baculites ovatus</i> Say, GSC locs. 83482, 83493 and 83480
220 - 228	Shale: medium light grey, blocky, hard, ferruginous to moderately fissile, ironstone concretions; minute specks of carbon; rare trace fossils
228 - 232	No information
232 - 266	Shale: medium grey with brown cast, blocky; minute specks of carbon and of biotite; siliceous worm (?) tubes; pyritized trace fossils, widely scattered, indefinite; 255-266, 'Baculites' sp. indet., <i>Inoceramus</i> cf. <i>balticus</i> Böhm s. lato, pelecypods, genus and species indet., ? <i>Dentalium</i> (s. lato) sp. indet., fish scales, GSC loc. 85726
The following data are taken from wall and excavated material of No. 2 shaft except when indicated	
226 - 277	Shale: medium light grey, blocky; zones of fine dark silt mixed with coarse medium grey silt (quartz from less than .0039 to 0.3 mm); pyritic streaks after trace fossils, gastropods and other shell fragments, siliceous worm tubes; <i>Inoceramus</i> cf. <i>balticus</i> Böhm s. lat, <i>Inoceramus</i> sp. indet., GSC loc. 83506
277 - 288	Shale: medium light grey with faint green cast, blocky; tarnished pyrite after trace fossils (lithology from core hole)
288 - 298	Shale: medium light grey, blocky, silty to .03 mm, silt partings; ironstone concretions and halos; fish scales, siliceous worm tube, coprolites (?), streaks of finely divided tarnished pyrite after trace fossils
298 - 304	Shale: medium light grey, blocky, silty to .025 mm, silt partings; ironstone concretions and halos; fish scales, gastropods, siliceous tubes and pyritized horizontal worm burrows or trace fossils; bedding dips 13° NW
304 - 307	Shale: medium light grey, slight brown cast, blocky, silty to .02 mm; pyrite grains (?), siliceous tubes, pyritic streaks after trace fossils

SYLVITE SHAFT NO. 2, ROCANVILLE SASKATCHEWAN

0-390'

0- 390



Depth ft		Lithology
307 -	319	Shale: medium light grey, very fine sand to silt; silt partings; traces of ironstone and concretions, siliceous tubes and pyritized trace fossils, fossil fragments (gastropoda)
319 -	336	Shale: medium light grey, silty with very fine sand zones; pyritized trace fossils, scattered fish remains near top; <i>Inoceramus cf. balticus</i> Bohm s. lat., GSC locs. 83510, 83514
336 -	349	Shale: medium light grey, silty; ironstone concretions, calcareous, buff with brown centres, pyritic (?) in part; silt partings; fish remains; siliceous tubes and pyritized horizontal burrows or tracks
349 -	355	Shale: medium light grey, blocky, slightly silty in part; microfossils, pyritized trace fossils (from core of pilot hole)
355 -	364	Shale: medium light grey, blocky; ironstone concretions; pyritized plant remains, wood(?) fragment, fish remains, mollusca, polychaeta(?); fossils collected from 335 to 364; small generically indeterminate minable ammonites, Baculites sp. indet., pectinid? pelecypod, genus and species indet., GSC loc. 83515
364 -	367	Shale: medium light grey, blocky; microfossils (from core of pilot hole)
367 -	370	Shale: medium light grey, blocky, silty, scattered siliceous worm tubes
370 -	380	Shale: medium light grey, blocky, very finely and slightly sandy to silty; fractures on NNW and SSE walls; 3 feet long, dipping 64° ENE; bedding dips 10° SW on west side of fracture and 70° SE on east side; dip of fracture deviates to 770 SW, bedding levels at 378' or 11" (28 cm) below apex; SSE wall-fracture dips 63° ENE, bedding dips 280° ENE on east side and 120° SW on west side; ironstone bed 15 cm thick, 370' to 370.5', bentonite bed, light grey, biotitic, 5 mm thick; scattered siliceous tubes, streaks of tarnished pyrite after trace fossils, scattered pelecypods
380 -	384	Shale: medium light grey, blocky, very finely sandy to silty; pyritic streaks
384 -	400	Shale: medium light grey, blocky, slightly silty; carbonaceous specks, scattered siliceous tubes, pyritic streaks or trace fossils containing minute spheres of pyrite, shell fragments
400 -	410	Shale: medium light grey blocky, slightly silty; carbonaceous specks, fossil fragments, fish remains, scattered siliceous tubes, light grey worm burrows, pyritic in part, foraminifera (lithology from core log in part)
410 -	415	Shale: medium light grey, blocky, very finely and slightly sandy to silty; zones of minute slickensides; fish remains, coprolites (?), tarnished pyrite streaks numerous in some zones

Depth ft	Lithology
415 - 420	Shale: medium, light grey, very slightly calcareous (?), a little very fine sand to silt; scattered limonitic halos; ironstone band at 419' dips 6° S.W.; major slickensides in SW wall (convex) dip 78° SW - minor slickensides dip 44° SE; fish remains, siliceous tubes and pyritized trace fossils or worm tracks; photographs GSC cat. 149491, 3
420 - 427	Shale: medium light grey, blocky; faintly silty to very finely sandy; scattered limonitic halos, pyritized worm (?) tracks and coprolites (?)
427 - 433	Shale: medium light grey, blocky, faintly silty; numerous small slickensided fragments, ironstone bed 427' to 427.8' sloping 430' on opposite SW wall; pyritized worm (?) tracks; photographs GSC cat. 149496, 7
433 - 448	Shale: medium light grey, clayey, less massive than above; white siliceous tubes, pyritized tracks, other fossils (from core of pilot hole)
448 - 454	Shale: medium light grey, blocky, silty; ironstone lenses and limonitic halos, some with siderite(?) crystals; carbonaceous specks; scattered siliceous tubes and pyritized worm tracks; slickensided zone on NE wall
454 - 468	Shale: medium light grey, clayey, smooth-textured; band of earthy ironstone 2 to 3 cm thick; siliceous worm tubes; minute pyritic streaks (from core of pilot hole)
468 - 474	Shale: medium light grey blocky, faintly silty; zones of ironstone concretions at 469.5', to 474'; scattered worm burrows, part pyritized and filled with medium grey silt: poorly preserved carbonized fossil in ironstone concretion; siliceous worm (?) tubes
474 - 481	Shale: medium light grey, blocky, very slightly silty; ironstone concretion band 474' to 475'; scattered partially pyritized worm burrows
481 - 482	No information
482 - 492	Shale: medium light grey, blocky, faintly silty; scattered small ferruginous concretions and halos; bentonite, light grey, biotitic at 487' to 487.2'; minutely slickensided zones; scattered trace fossils, partly pyritized, plant(?) remains, carbonaceous specks; (from log of pilot hole core in part)
492 - 498	Shale: medium light grey, blocky, very slightly silty, glauconitic layer at 492.5'; scattered small ironstone concretions, some containing poorly preserved fossils; scattered worm(?) tracks, partly pyritized; plant(?) remains; photographs GSC cat. 149498, 9

Depth ft	Lithology
498 - 505	Shale: medium light grey, blocky, very slightly silty; bentonite, 10 mm thick, light to medium grey, mottled, biotitic; scattered glauconite; scattered partially pyritized worm tracks
505 - 509	Shale: medium light grey, blocky to slightly fissile, faintly silty; ironstone concretions; bentonite, light grey, mottled; fish remains; silt-filled and partly pyritized sparse plant(?) remains, GSC plant loc. 8465; <i>Granulopticus</i> sp. indet. (an ammonite operulum GSC loc. C-16900
	Vermilion River Formation
	<u>Pembina Member</u>
509 - 515	Shale: dark grey; bentonite, light grey, mottled, biotitic, at 510.5'; fish scales
515 - 521	Shale: medium to dark grey, blocky; lenses of bentonite, light grey, with yellow efflorescence; ironstone in small concretions and limonite halos; fish bones and scales; <i>Inoceramus</i> sp. indet., GSC loc. 83507
521 - 529	Shale: dark grey, fissile; bentonite beds at 524.6', 524.9', 525.9', 528.7'; abundant fish bones
529 - 535	Shale: dark grey, fissile to smoothly conchoidal-fracturing; bentonite beds light grey to medium light grey and brown at 529.0' to 529.2' (light grey), 529.7' to 530.0' (0.6 cm light grey, 5 cm tan), 530.2' to 530.6' (light to medium grey), 531.2 to 531.5' (light grey), 531.7' to 531.9' (light grey), 532' to 532.3' (light grey), 532.4' to 532.8' (light grey); fish remains; crossbedding at 530.6' to 531.2'
535 - 541	Shale: medium light grey, blocky with some fissility; light buff ironstone concretions; heavily pyritized "clay balls"; trace fossils and plant remains
541 - 547	Shale: medium grey, mottled in part, blocky; bentonite beds at 542 to 542.2' (3 cm light green, 3 cm light grey), 542.7' to 542.8 (medium grey), 543.2' to 543.3' (grey and light green); scattered ironstone concretions and lenses; pyritized trace fossils
547 - 551	Shale: medium grey, blocky; ironstone concretions and slickensides (548'); finely divided pyrite on bentonite contacts; horizontal veinlet of colourless white mineral; fish remains
551 - 556	Shale: medium grey, predominantly blocky, bentonite, biotitic 552'; increasing number of non-calcareous white-speckled zones; fish remains

Depth ft	Lithology
(Fossils from the following section between 556' and 876' were collected from the No. 1 shaft where indicated)	
556 - 577	Shale: medium dark grey, bentonitic in part, (15 bentonite bands were seen in the pilot hole core of No. 1 shaft in this interval, from 1 to 7.5 cm thick, some with gradational contacts); carbonaceous specks, minute non-calcareous white specks (indeterminate microfossils); colourless efflorescence on shale samples; slightly calcareous zone with fish bones near base; <i>Scaphites (Hoploscaphites) hippocrepis</i> De Kay, form III of Cobban (1969, USGS Prof. paper 619, p. 21-24) cf. <i>Haresiceras natronense</i> Reeside, (poor imprint). <i>Baculites</i> sp. indet., GSC loc. 83501, in No. 1 shaft
577 - 581	Shale: calcareous, light grey at top, heavily speckled with flattened chalky calcite bodies; medium grey below calcareous, and white-speckled in part; <i>Baculites</i> sp. indet., <i>Inoceramus</i> (?) sp. indet., GSC loc. 83502, in No. 1 shaft
581 - 587	Shale: medium grey, non-calcareous; biotite, fishbone fragments, minute thin-shelled pelecypods
587 - 607	Shale: medium grey, calcareous; white-speckled zones increasing downward; zones with finely divided pyrite; expanding crystals of an efflorescent salt; fine flakes of biotite; zones of fishbone fragments; much non-speckled or sparsely speckled shale; <i>Baculites</i> sp., (a large smooth form such as are restricted to the later part of the Santonian stage or younger beds. <i>Lingula</i> sp., indet., <i>Inoceramus</i> sp. indet., <i>Ostrea</i> sp. indet., (juvenile shells), indeterminate pelecypods, GSC loc. 84785, 84787 GSC loc. 83481 in No. 1 shaft
607 - 615	Shale: calcareous, medium grey, banded with heavily white-speckled zones, shale expands with efflorescence of colourless mineral; indeterminate juvenile pelecypods, GSC loc. 83481 in No. 1 shaft
615 - 619	Shale: calcareous, white-speckled, with little organic matter; fissile layer with adjacent yellow jarosite, 10 mm thick; <i>Ostrea Congesta</i> Conrad, <i>Inoceramus</i> sp. indet., (resembles <i>I. deformis</i> Meeks. lato more than any other species known to the writer but not identifiable definitively specifically), GSC loc. 84783
619 - 626	Shale: medium grey, non-calcareous, fissile; minute specks of carbon; nodules 0.5 mm across of iron sulphate (?), partly recrystallized to acicular crystals; <i>Inoceramus</i> , sp. indet. (resembles <i>I. deformis</i> Meeks. lato more than any other species the writer is familiar with but cannot be determined specifically), <i>Ostrea</i> cf. <i>congesta</i> Conrad, GSC loc. 83500 in No. 1 shaft

Depth ft		Lithology
626	- 631	Shale: medium grey, fissile, calcareous and white-speckled in part; large septarian concretions; <i>Ostrea congesta</i> , Conrad, <i>Inoceramus</i> sp. indet., GSC loc. 84784
637	- 643	Shale: bentonitic, and calcareous; waxy-textured bentonite; biotite; large septarian concretions; <i>Inoceramus</i> sp. indet., resembles giant forms of <i>I. deformis</i> Meek more than any other <i>Inoceramus</i> species the writer is familiar with, but cannot be determined specifically, <i>Ostrea</i> cf. <i>congesta</i> Conrad, GSC loc. 83508
637	- 643	Shale: bentonitic, and calcareous; waxy-textured bentonite; biotite; large septarian concretions
643	- 649	Shale: medium to light grey, calcareous, blocky, smooth textured, marl-like; streaks of finely divided pyrite
649	- 653	Shale: calcareous medium light grey; scattered fine fragments of <i>Inoceramus</i> ; zone of calcite-healed fractures at 652'
653	- 658	Shale: calcareous, medium light grey; scattered pyritized plant (?) remains; zone of scattered white specks; <i>Inoceramus</i> cf. <i>deformis</i> Meek, <i>Baculites</i> sp. indet., <i>Ostrea</i> cf. <i>congesta</i> Conrad, pelecypods, genus and species indet., GSC loc. 83505
658	- 664	Shale: calcareous, medium light grey, fissile; scattered minute pyrite spheres and pyritized organic remains; scattered fish remains and white specks
664	- 670	Shale: calcareous and non-calcareous, medium light grey, fissile; scattered calcite-healed fractures; heavily white-speckled in some zones, <i>Ostrea</i> (s. lato) sp. indet., GSC loc. 83499, in No. 1 shaft
670	- 675	Shale: calcareous and non-calcareous, medium light grey; carbonaceous fragments; zones of abundant white specks; calcite-healed fractures at 672.5', cut across bedding; <i>Inoceramus</i> cf. <i>halli</i> White, (= <i>I. fragilis</i> var. <i>prairiensis</i> McLearn), <i>Inoceramus</i> ex. gr. <i>Lamarecki Parkinssoni</i> s. lato, <i>Baculites</i> sp. indet., GSC loc. 83504, <i>Inoceramus</i> sp. indet., GSC loc. 83512, in No. 1 shaft
675	- 685	Shale: non-calcareous, medium light grey; silt partings with biotite; fish fragments, fragments of large lamellibranch
685	- 691	Shale: predominantly calcareous, medium light grey; calcite-healed fractures in limestone concretions; fish bone fragments, <i>Baculites</i> sp. indet., <i>Scaphites?</i> sp. indet., <i>Inoceramus</i> sp. indet., GSC loc. 83503
691	- 695	Shale: predominantly calcareous, medium light grey; calcite-healed fractures in ironstone concretions; two large lamellibranchs observed in wall go to 105 cm in length, shell 5 cm thick; pyritized organic fragments

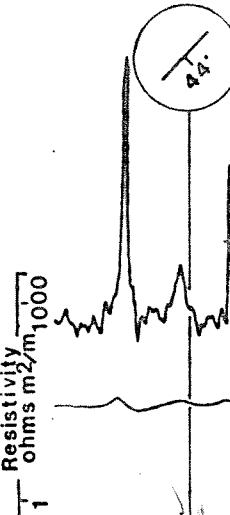
Depth ft		Lithology
695 - 700		Shale: variably calcareous, medium light grey; calcite-healed fractures in ironstone concretions at 696'; lamellibranch fragments scattered throughout; small fragments of blue-grey bentonite, not observed in place, possible contamination
700 - 706		Shale: calcareous to non-calcareous, medium light grey; calcite-healed fractures in concretions; zones of heavily white-speckled shale, very fine fragments of lamellibranches <i>Inoceramus Lamarecki</i> Parkinson s. str. (a giat form), <i>Inoceramus</i> cf. <i>I. Lamarecki</i> Parkinson var. <i>cuvieri</i> Sowerby, GSC loc. 83509
706 - 713		Shale: calcareous, medium grey; small nodules of tan ironstone; large fragments of thin lamellibranch shells at 711'; zones of heavily white-speckled shale; (from shaft No. 2) - <i>Inoceramus</i> sp. indet., GSC loc. 83488; (from shaft No. 1, 702-719', <i>Inoceramus</i> cf. <i>Lamarecki</i> Parkinson var. <i>cuvieri</i> Sowerby, <i>Inoceramus</i> cf. <i>Lamarecki</i> Parkinson s. stricto, GSC loc. 83498
713 - 718		Shale: predominantly non-calcareous, medium grey; calcite-healed fractures in concretions at 718'; pyrite (or marcasite?)
		<u>Morden Member</u>
718 - 721		Shale: non-calcareous, medium to medium light grey; small lenses of pyrite; light blue-grey bentonite, pyritic at 721', calcite-healed fractures in concretions
721 - 730		Shale: non-calcareous, medium grey; bentonite bed, 10 mm thick, light blue-grey, biotitic; sparsely white-speckled zones
730 - 739		Shale: non-calcareous, medium grey; scattered pyrite crystals; scattered fish remains
739 - 745		Shale: non-calcareous, medium grey, bed of bentonite, light blue-grey, 5 mm thick, biotitic
745 - 751		Shale: non-calcareous, medium grey, bentonite bed, light blue-grey, 20 mm thick, biotitic
751 - 754		Shale: non-calcareous, medium grey, fissile, bentonite bed, light blue-grey, 5 mm thick biotitic
754 - 760		Shale: non-calcareous, medium grey, fissile, bentonite bed 757' to 757.1', light blue grey to medium light blue-grey, with mottled basal contact; scattered white specks
760 - 765		Shale: non-calcareous, medium grey, fissile, silty; pyrite, disseminated and in small lenses; some white-speckled zones
		<u>Favel Formation</u>
765 - 768		Shale: calcareous, medium dark grey, blocky, white-speckled in part; calcareous zone with veinlets of amber calcite; lamellibranch fragments; pyritized spines(?) about 3 mm long
768 - 772		Shale: calcareous, medium grey, blocky, white speckled; calcite veinlets; lamellibranch fragments, fish fragments

SYLVITE SHAFT NO. 2, ROCANVILLE, SASKATCHEWAN

390'-781'

Sonic Interval Transit Time  
70 microseconds per foot

Resistivity  
70 ohms m<sup>2</sup>/m<sup>1000</sup>



Riding Mountain Formation

Vermilion River Formation

Pembina Member

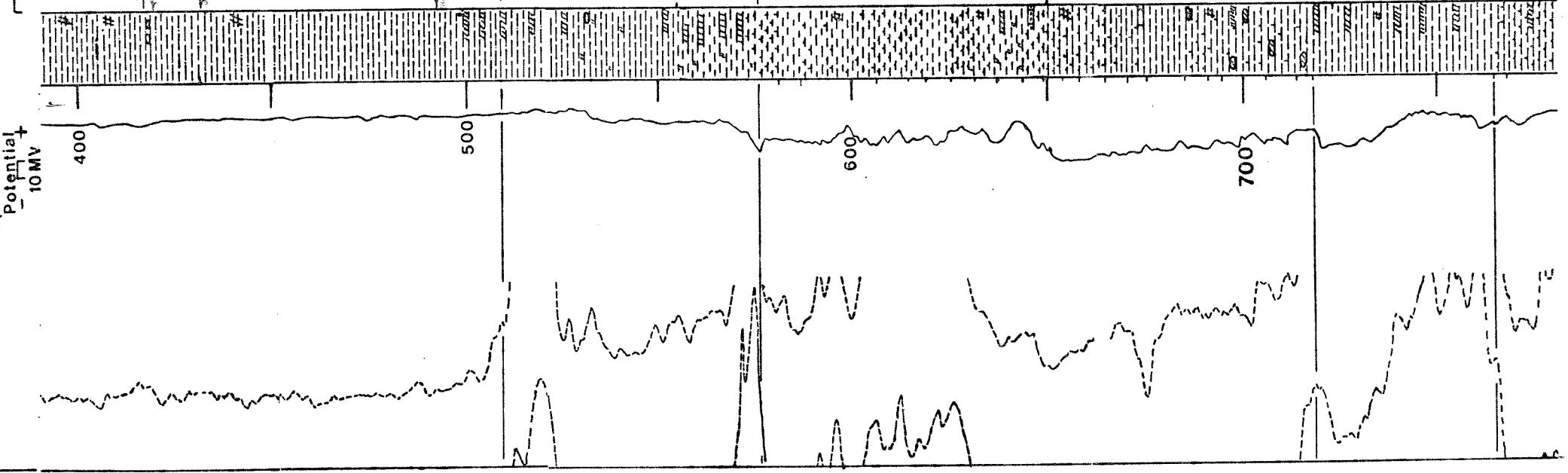
Boyne Member

Morden Member

Favel Formation LL Price GSC 1975

Gamma Ray API Units 150

Spontaneous Potential - 10 MV

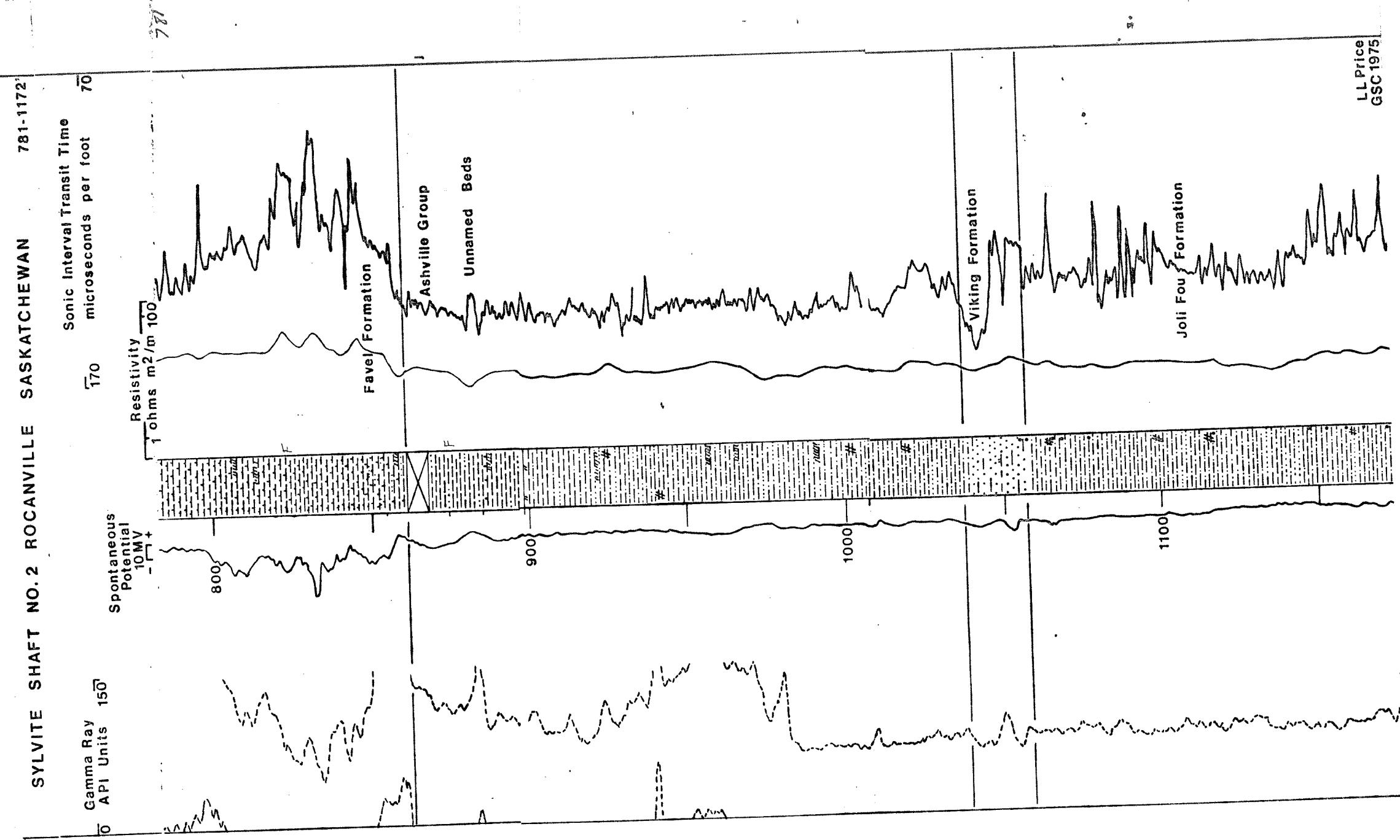


Depth ft	Lithology
772 - 774	Shale: calcareous, medium grey, blocky, white-speckled; bentonite, light blue-grey, biotitic; lamellibranch fragments
774 - 778	Shale: calcareous, medium grey, blocky, white-speckled; calcite veinlets in concretionary beds decreasing; lamellibranch fragments
778 - 788	Shale: calcareous, medium grey, blocky, bentonite bed, light blue-grey, biotitic, 5 mm thick; lamellibranch fragments; peculiar cast markings - spines(?)
788 - 795	Shale: calcareous, medium grey, blocky, white-speckled, with petrolierous odour; lenses of colourless bioclastic limestone; bentonite, light blue-grey, biotitic, grading to shale; lamellibranch fragments, fish remains
795 - 800	Shale: calcareous, medium grey, blocky, white-speckled, with petrolierous odour; small ironstone concretions; bentonite, light blue-grey, biotitic, two layers 10 mm thick, 15 cm apart; lamellibranch fragments
800 - 805	Shale: calcareous, medium grey, blocky, heavily white-speckled, with petrolierous odour, fish remains
805 - 813	Shale: calcareous, medium grey, blocky, heavily white-speckled, with petrolierous odour, bentonite, biotitic medium blue-grey, 10 mm thick; fish bone fragments
813 - 822	Shale: calcareous, medium grey, blocky, white-speckled, with petrolierous odour; bentonite, biotitic light blue-grey, 5 cm thick; matted fish bone fragments, lamellibranch
822 - 827	Shale: calcareous, medium grey, blocky, with petrolierous odour; bentonite, light blue-grey, sparsely biotitic; ironstone, light brown, calcareous, chalky, fish fragments, <i>Inoceramus labiatus</i> Schlotheim s. str., GSC loc. 83495
827 - 831	Shale: calcareous, medium grey, white-speckled, blocky; bentonite, light blue-grey, 5 mm thick; matted lenses of lamellibranch fragments, 5 mm thick at 827.2', 15 cm thick at 828.5', 5 mm thick at 831'; <i>Inoceramus labiatus</i> Schlotheim s. str., GSC loc. 83497
831 - 839	Shale: calcareous, medium grey, with petrolierous odour, blocky; white-speckled zones, bentonite, light blue-grey, mottled
839 - 849	Shale: calcareous, medium grey, blocky, with petrolierous odour, silty to very finely sandy; bentonite, light and medium grey, mottled, 841.5'-841.9'; white-speckled zone; fish bone fragments
849 - 854	Shale: calcareous, medium grey, white-speckled, blocky; bentonite bed, light blue-grey, 8 mm thick, slightly biotitic; fish bone fragments, pelecypods

	Depth ft	Lithology
854	- 859	Shale: calcareous to slightly calcareous, medium grey; silty; bentonite, light grey, biotitic, 5 mm thick at 855'; fish remains, zones of white specks; (from shaft #1)
859	- 861	Shale: slightly calcareous to non-calcareous, medium grey; occasional very fine sand partings; bentonite, light blue-grey, biotitic, 5-10 mm thick; sparse fossil fragments, fish remains
		ASHVILLE GROUP
		Unnamed Beds
861	- 868	No information
868	- 874	Shale: non-calcareous, medium grey, predominantly fissile; zones with light grey silt partings; fish remains, <i>Inoceramus</i> sp. indet., <i>Ostrea</i> (s. lato) sp. indet., GSC Loc. 83511
874	- 885	Shale: non-calcareous, medium grey, predominantly fissile, with light grey silt partings; fish remains; (from shaft #1) - <i>Prionocyclus</i> cf. <i>hyatti</i> Stanton, <i>Inoceramus</i> cf. <i>lamarekii</i> Parkinson var. <i>cuvieri</i> Sowerby, GSC Loc. 83490, in No. 1 shaft
885	- 886	Shale: calcareous to non-calcareous, medium grey, fissile; bentonite, light blue-grey, non-biotitic, 10 mm thick; one white-speckled zone, fish remains, pelecypods
886	- 894	Shale: medium grey, smooth-texture, bentonitic in part; scattered pelecypod fragments, fish scale (from core)
894	- 898	Shale: non-calcareous, medium grey, predominantly fissile, silty; pelecypods, some pyritized; small slickensides
898	- 903	Shale: non-calcareous, medium grey, fissile, silty; pelecypods numerous small slickensides
903	- 909	Shale: medium light grey; thinly interbedded bentonitic shale
909	- 913	Shale: medium grey, fissile, silty; scattered pelecypod fragments; fewer small slickensided surfaces
913	- 918	Shale: medium grey, fissile, silty; carbonaceous black specks; pyritized specks; scattered pelecypod fragments
918	- 924	Shale: medium grey, fissile, silty with light grey silt partings; pyrite specks, gypsum(?) healed fractures; fish(?) fragments
924	- 931	Shale: medium grey, fissile, silty with scattered light grey silt partings; bentonite, light blue-grey, mottled, biotitic, approximately 20 mm thick; carbonaceous black specks, pyrite specks; fish fragments

Depth ft	Lithology
931 - 937	Shale: medium grey, fissile, silty, with rare light grey silt partings; carbonaceous black specks; fish fragments
937 - 941	Shale: medium grey, fissile, silty, with rare light grey silt partings, carbonaceous black specks, gypsum-healed(?) fracture; fish bone fragments (tooth and part of mandible)
941 - 945	Shale: medium grey, fissile, silty; carbonaceous black specks; pyritized crinoid segments(?), fish bones in breccia
945 - 949	Shale: medium grey, fissile, silty; carbonaceous black specks; bentonite, light grey, 5 mm thick, biotitic; fish fragments; small slickensided fragments
949 - 956	Shale: medium grey, fissile, silty with light grey silt partings; carbonaceous black specks; fish fragments
956 - 962	Shale: medium grey, fissile, silty; carbonaceous black specks; light blue-grey bentonite, 5 mm thick; partially pyritized fish fragments
962 - 968	Shale: medium grey, fissile, silty; carbonaceous black specks; fish remains
968 - 976	Shale: medium grey, fissile, silty; bentonite, light grey and medium grey, biotitic; comminuted fish remains
976 - 990	Shale: medium light grey, fissile, silty; gypsum-healed fractures, scattered pyrite after plant(?) remains
990 - 1,001	Shale: medium light grey, predominantly fissile, silty; scattered fish fragments
1,001 - 1,007	Shale: medium light grey, predominantly fissile, silty, sparse light grey silt partings; pyrite after plant(?) remains
1,007 - 1,014	Shale: medium light grey, predominantly fissile, silty with sparse light grey silt partings; comminuted fish remains
1,014 - 1,024	Shale: medium light grey, fissile, silty; scattered pyrite after trace fossils
1,024 - 1,030	Shale: medium light grey, fissile, silty; disseminated pyrite
1,030 - 1,037	Shale: medium light grey, fissile, silty; pyrite; scattered fish fragments
1,037 - 1,046	Shale: medium light grey and medium grey, fissile, silty; pyrite after plant(?) remains; siliceous worm burrows, scattered fish fragments

Depth ft	Lithology
Viking Formation	
1,046 - 1,049	Shale, shaly sandstone and bentonite: shale, medium light grey, fissile, silty; scattered zones of yellow-green glauconite; shaly very fine grained; scattered fish fragments; bentonite, light grey, biotitic, 10 mm thick
1,049 - 1,057	Shale and shaly sandstone: shale, medium light grey, fissile silty; scattered zones of yellow-green glauconite; shaly sandstone, light grey to medium light grey, blocky, very fine quartz and subangular chert grains; areas of pyritization; scattered fish fragments
Joli Fou Formation	
1,057 - 1,065	Shale: medium light grey, fissile, silty with light grey silt partings; ironstone concretions, light tan; scattered pyrite after trace fossils; scattered fish fragments
1,065 - 1,070	Shale: medium light grey, fissile, silty with light grey silt partings; pyrite after marine plants or animal traces; patches of glauconite; small ironstone concretions; siliceous worm burrows
1,070 - 1,076	Shale: medium light grey, fissile, silty, with discontinuous partings or patches of light grey silt; traces of ironstone (after coprolites?)
1,076 - 1,080	Shale: medium light grey, fissile, silty, with discontinuous partings of light grey silt and light grey, glauconitic, very fine grained sand; small grey ironstone concretions; pelecypod fragments, fish remains
1,080 - 1,117	Shale: medium light grey, moderately fissile, partings of silt and fine grained sand; fish remains (from core of shaft No. 1)
1,117 - 1,122	Shale: medium light grey, fissile, silty in part, with light grey, pyritic silt partings; bed of coarse sand with concretionary lenses, containing black and grey chert clasts from coarse sand to pebble size, some flattened (5 mm - 2.5 cm); glauconite at 1,119'; scattered fish remains
1,122 - 1,128	Shale: medium light grey, fissile, silty with light grey silt partings and very fine grained sand; scattered pyrite
1,128 - 1,134	Shale: medium light grey, fissile, silty; heavily pyritized areas
1,134 - 1,141	Shale: medium light grey, fissile, silty; scattered pyrite
1,141 - 1,147	Shale: medium light grey, fissile, silty; scattered partings of very fine, light grey sand



Depth ft		Lithology
1,147	- 1,154	Shale: medium light grey, moderately fissile; discontinuous partings and lenses of silt; very fine grained sandstone with disseminated pyrite; glauconite in sandstone lenses; slickensides dipping from $10^{\circ}$ - $45^{\circ}$ (from core of shaft No. 1)
1,154	- 1,158	Shale: medium light grey, fissile, silty, numerous partings of light grey, very fine grained sand; glauconite
1,158	- 1,162	Shale: medium light grey, fissile, silty; partings of light grey, very fine grained sand; glauconite in some partings
1,162	- 1,167	Shale: medium light grey, fissile to blocky, silty; partings of light grey, very fine grained sand; glauconite in some partings; chert granules; fish remains
1,167	- 1,168	Shale: medium light grey, blocky, silty; partings of light grey, very fine grained sand; scattered glauconite grains
1,168	- 1,174	Shale: medium light grey, blocky; partings of light grey very fine grained sand; scattered glauconite grains; fish remains
1,174	- 1,178	Shale: medium light grey, blocky, silty; fewer partings than above, of light grey, very fine grained sand; scattered glauconite grains; fish remains
1,178	- 1,183	Shale: medium grey, silty to sand; disseminated glauconite decreasing downward; chlorite; fragments of this shelled pelecypod; fish remains, specks of carbonized plant(?) remains
1,183	- 1,185	Shale: medium light grey, blocky, silty; few very fine grained sand partings; scattered glauconite grains; scattered pyrite after plant(?) remains; fish remains
1,185	- 1,188	Shale: medium grey; fine grained sand lenses containing chlorite; disseminated glauconite decreasing downward; pyrite streaks; minute pelecypods, (from core of shaft No. 1)
1,188	- 1,191	Shale: medium light grey, blocky, silty; scattered pyrite grains; fish remains
1,191	- 1,194	Shale: medium to medium dark grey, moderately fissile with zones of silt partings and disseminated pyrite (from core of shaft No. 1)
1,194	- 1,198	Shale: medium light grey, blocky, silty; sandstone, medium light grey, blocky; chert pebbles; zones of abundant glauconite; fish remains
1,198	- 1,203	Shale: medium light grey with light grey silty region, moderately fissile; silty areas contain marcasite(?) and scattered grains of glauconite

Depth ft	Lithology
1,203 - 1,207	Shale: medium light grey, with light grey silt lenses, moderately fissile, silt lenses contain marcasite(?) and increased amount of glauconite
	MANVILLE GROUP
	Pense Formation
1,207 - 1,212	Shale: medium light grey, with lenses of light grey, very fine grained sand, silty, moderately fissile; sand lenses contain marcasite and glauconite, glauconite zone at 1,209', ironstone and glauconite band at 1,210'
1,212 - 1,215	Sand, shale and sandstone: shale medium light grey, moderately fissile, silty; sand, light grey, fine grained but coarser than the above lenses; sandstone, medium light grey, very fine grained, mottled, dense, scattered marcasite crystals throughout; brachiopods at 1,213'
1,215 - 1,216	Sandstone: medium light grey, hard, very fine grained
1,216 - 1,217	Sandstone and shale: medium light grey sandstone, very fine grained, hard; shale, silty to sandy, top about 1,216.5', blocky
1,217 - 1,219	Shale and sand: shale, medium light grey, predominantly fissile; sand, light grey, very fine grained; worm burrows
1,219 - 1,221	Sand: light grey, very fine grained; contains medium light grey silty laminae
1,221 - 1,228	Sandstone: very fine grained, quartzose, poorly indurated, porous, shaly, with irregular "lenses" and interbeds of medium to dark grey shale; much bioturbation; carbonized wood
1,228 - 1,235	Sand: light grey, shaly material in fine bedding planes; small brachiopods, evidence of burrowing organisms
1,235 - 1,237	Siltstone: calcareous, indurated with siderite, clay and pyrite
1,237 - 1,243	Sandstone: very fine grained, porous, poorly indurated, argillaceous; irregular current laminae; mica, specks of carbon; worm burrows with coarser sand; non-porous, shaly interbeds increasing toward base
1,243 - 1,256	Shale and siltstone, interlaminated and interbedded: siltstone, light grey, argillaceous, porous, finely laminated and crossbedded; shale, medium to dark grey, silty to sandy in part, laminated

Depth ft	Lithology
1,256 - 1,264	Sand: light grey, very fine grained, with medium light grey shaly interbeds; carbonized wood fragments, burrows filled with fine sand
1,264 - 1,266	Sand and shale: sand, light grey, very fine grained, with brown shaly interbeds; shale, medium light grey, fissile, with fine silt partings

#### CANTUAR FORMATION

1,266 - 1,268	Clay: light to medium brown grey, silty, with yellow specks of ferruginous clay (incipient siderite spherules); pyritic carbonaceous inclusions (after plant fragments?)
1,268 - 1,276	Shale: (from 1,268'-1,269'), medium light grey, silty, predominantly fissile; interbedded light grey silt lenses; 1,269'-1,276' - Clay; medium light brown to pinkish brown, small light speckled areas (forams?), pyritic worm burrows in shale and mostly in area of contact but present throughout, microslickensides abundant
1,276 - 1,283	Clay: light brown grey, highly silty, grading to clayey sandstone, very fine to fine grained sand, carbon specks; 8 mm, 25 mm, and 50 mm bands of sandstone around 1,278.5', poorly indurated, irregular lenses of quartzose pyritic sand, carbonized vegetable matter
1,283 - 1,303	Sandstone: medium to light grey, carbonized wood fragments, some light grey silty areas, microslickensides present
1,303 - 1,306	Sandstone: medium light grey to light grey, silty to very fine grained sand, blocky; carbonized wood fragments in fractures, sometimes pyritized; fractures strike about N-S, dip 35-45° SW; slickensides, small unconnected stringers of coal
1,306 - 1,330	Sandstone: as above; some siltstone included at 1,316-1,323'
1,330 - 1,342	Clay: silty, dark brown grey, carbonized vegetable remains, slickensides

#### JURASSIC

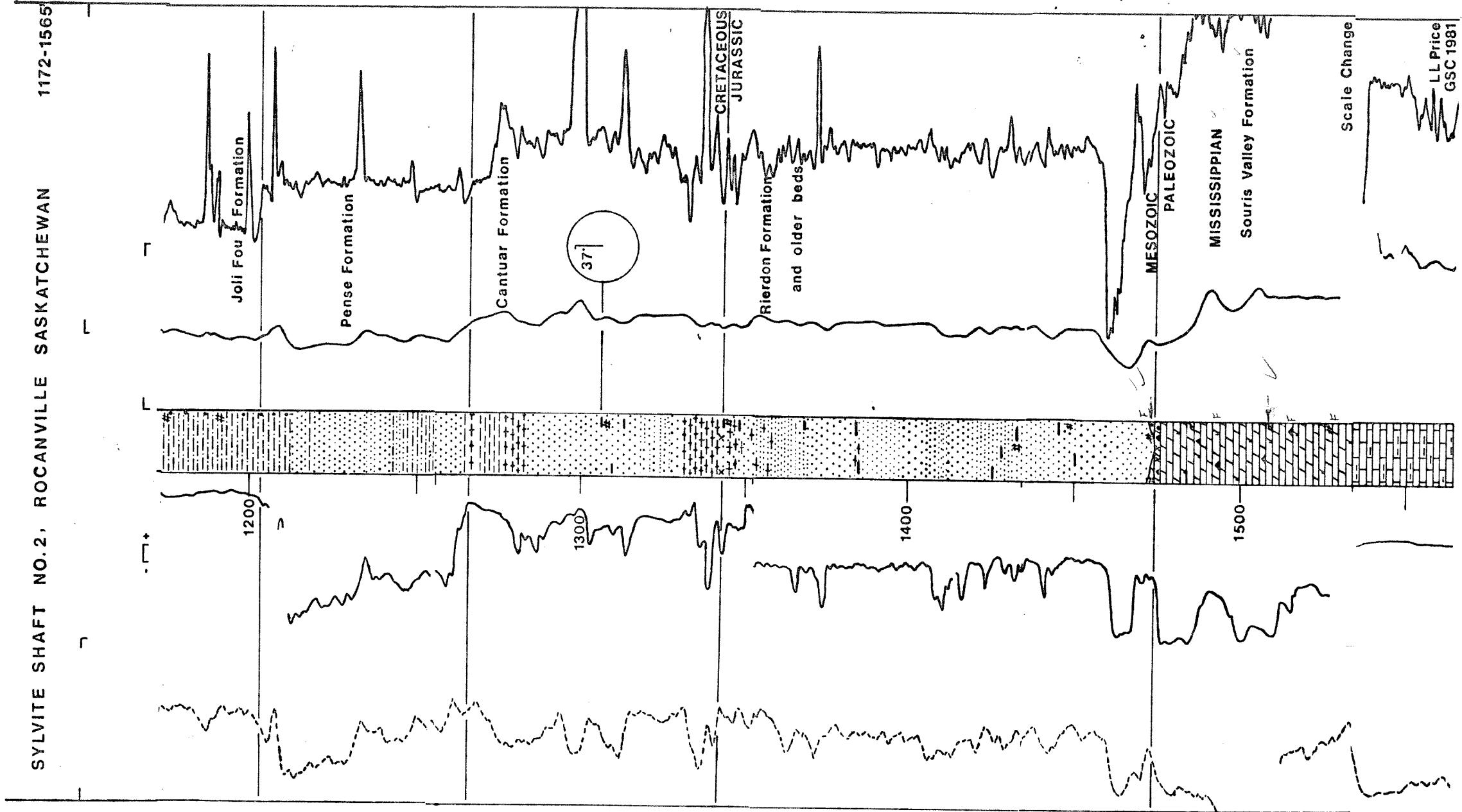
	Rierdon Formation and older beds
1,342 - 1,343	Sandstone and breccia: medium light grey to medium light brown, blocky; breccia matrix, calcareous sand with rounded grains, fragments of pale brown clay; carbonized wood fragments with pyrite, clay content increases toward 1,343' with slickensides appearing
1,343 - 1,348	Clay: silty, light grey becoming less silty and finely laminated downward; upper part contains rare lenses of fine grained quartzose sand and scattered isolated quartz grains, gradational and darker with silt lenses toward base
1,348 - 1,350	Sandstone: medium grey brown, clayey, poorly sorted fine to medium grained; tight, grading to sandy clay, abundant carbonized wood specks, becoming coarser toward base

Depth ft	Lithology
1,350 - 1,353	Siltstone: clayey, intergrading with silty clay, light brown grey with irregular laminations; fine specks of carbon
1,353 - 1,360	Siltstone and clay: medium to light grey and light brown; shaly, siltstone, light grey with medium grey interbeds from 1,355'-1,360'; undulating red brown clay 1,354'-1,355'; shaly black clay 1,353'-1,354'; shaly black clay contains ironstone haloes
1,360 - 1,365	Siltstone: medium light grey, blocky, silty; ironstone haloes and pyrite inclusions; small fragments of carbonized plant matter
1,365 - 1,370	Siltstone and sandstone: siltstone from 1,365'-1,368.5', sandstone graded from 1,368.5'-1,370'; medium light grey, blocky, silty to very fine grained sand, small ironstone haloes; small fragments of carbonized wood
1,370 - 1,377	Sandstone: light grey, blocky, very fine grained sand, ironstone concretions larger than above, some containing pyrite; argillaceous band near top, with silt-filled burrows
1,377 - 1,378	Siltstone: clayey, pale to light grey brown, finely laminated in part tight to finely porous
1,378 - 1,380	Sandstone: calcareous in part, light, blocky, very fine grained but coarser than above; ironstone concretions, ferruginous stains
1,380 - 1,383	Sandstone and clay: light grey and medium light grey respectively, blocky; silty to very fine grained sand, poorly indurated
1,383 - 1,398	Siltstone: pale grey brown, finely laminated, finely porous in part; large fragments of carbonized wood near top in clay band, 6 mm from top, second large wood fragments 6 mm from base; becomes slightly coarser and more friable, less argillaceous in basal 1.2 metres
1,398 - 1,412	Sandstone to siltstone: light grey, blocky, silty to very fine grained sand; carbonized wood fragments, disrupted current bedding, pyrite inclusions, chalky specks on bedding planes;
1,412 - 1,418	Sandstone: pale to light grey brown, argillaceous, very fine grained, laminated; porous in part, poorly indurated, friable; argillaceous bands, carbonized wood fragments, specks of carbon
1,418 - 1,420	Siltstone: light grey with medium grey interbeds, blocky, silty; carbonaceous black specks, blue grey ferruginous(?) stains
1,420 - 1,423	Siltstone: medium light grey with light grey sandy beds, predominantly fissile, silty; carbonized plant remains

Depth ft	Lithology
1,423 - 1,425	Siltstone: clayey or very fine grained sandstone; light grey brown, firm, tight, massive, highly silty clay, abundant carbon specks
1,425 - 1,434	Siltstone with sandstone: medium light grey, silty to very fine grained sand, blocky; partially pyritic carbonized wood fragments
1,434 - 1,445	Siltstone: medium light grey, blocky silty to very fine grained sand(?); carbonized plant remains
1,445 - 1,451	Siltstone and sandstone: medium light grey to light grey, blocky, silty to very fine grained sand; carbonized wood fragments, marcasite crystals, microslickensides
1,451 - 1,465	Sand: pale brown, loose, fine grained quartzose, moderately well sorted
1,465 - 1,467	Sand and sandstone: light grey to medium light grey; very fine grained sand; fossils from 1465-1475, <i>Spirifer</i> cf. <i>rawleyi</i> Weller, GSC Loc. 67550, from 1454-1620' <i>Spirifer</i> sp. cf. <i>rawleyi</i> Weller.? Ovattia sp. as in GSC Loc. 67556, productid brachiopod indet., GSC Loc. 70679
1,467 - 1,476	Sand: medium brown with dark brown carbonaceous streaks, fine to very fine grained sand, subangular; chert, medium grey to dark grey, fragmental, angular to subangular, in glauconitic dolomitic matrix; dolomicrite, medium light grey, soft, fragmental, some fragments 30 cm - 60 cm in length; pyrite scattered throughout interval; Souris Valley Fm. contact undulating between 1,471'-1,475' with a sharp line between the upper brown carbonaceous sand and lower chert, dolomicrite breccia; photographs GSC cat. 201882, 201936, 201936-A, -B, -C, -F
MISSISSIPPIAN	
Souris Valley Formation	
1,476 - 1,487	Dolomite: calcareous, light grey brown, microcrystalline (altered bioclastic?); non-calcareous intervals; limestone band 7.5 cm thick, with brachiopods and dark pyrite 90 cm from top; scattered bugs and vertical fracture 22 cm from base of interval; fossils from 1460-1620; <i>spirifer</i> cf. <i>rawleyi</i> Weller.? <i>Imbrixia forbesi</i> Norwood and Protten,? <i>Oleithyridina</i> , other in determinate brachiopods, <i>Ganinia</i> sp. GSC Loc. 70680
1,487 - 1,490	Dolomite: calcareous, light grey, 50-60% sparry calcite grains, subangular, 1/16-1/8 mm; chert nodules, medium light grey; pyrite
1,490 - 1,493	Dolomite: calcareous, light grey to light brown, slightly argillaceous, 40% sparry calcite cement; glauconite grains on some bedding planes, small chert pebbles, and nodules to 10 cm, medium light grey; pyrite in small clusters and grains; <i>Spirifer</i> sp. cf. <i>S. rawleyi</i> Weller, fenestrate bryozoan, GSC Loc. 67551

SYLVITE SHAFT NO. 2, ROCANVILLE SASKATCHEWAN

1172-1565



Depth ft	Lithology
1,493 - 1,506	Dolomite; calcareous, light grey with orange brown cast, slightly argillaceous, silty; pyrite grains, carbonaceous mud partings; conulate and costate brachiopods, bryozoans, organ pipe(?) corals; echinoderms columnals, <i>Spirifer</i> , sp. cf. <i>Srowleyi</i> Weller, other indeterminate brachiopods, fenestrate bryozoa, conularid indet., GSC locs. 67552 and 67553
1,506 - 1,510	Dolomite: calcareous, light buff, silty; tripolitic chert nodules at 1,508', bedding level, 15 cm thick; photographs GSC cat. 201936-D, -E
1,510 - 1,534	Dolomite: medium light brown to light buff, silty, pyrite in small concretions 2.5 to 5 cm across; small fractures; tripolite chert at 1,513', bedding 5 to 15 cm thick. Minute crinoid ossicles replaced by red brown gypsum; fenestrate bryozoan indet., <i>Spirifer</i> sp. cf. <i>Srowleyi</i> Weller, <i>fenestratibryozoa</i> , <i>Unispirifer mirnewankensis</i> Shimer, ? <i>Ovatisia</i> sp., GSC locs. 67554, 67555, 67556
1,534 - 1,550	Limestone: medium light brown to buff, medium brown interbeds, micrite, silty (<1/16 mm), argillaceous; irregular inclusions of pyrite, pyrite healed fractures(?), calcite healed fracture, heavily mineralized fracture zone; small and large brachiopod (5 cm across); spiriferid brachiopod, GSC loc. 67557
1,550 - 1,565	Limestone: light brown to buff, micritic, argillaceous, silty; sparry calcite in vugs
1,565 - 1,569	Limestone: maroon with brown cast, micritic argillaceous, silty; numerous well preserved plant remains
1,569 - 1,579	Limestone: medium light brown, micritic argillaceous, silty; trace fossils (worm burrows?); pyrite inclusions; brachiopod indet., GSC loc. 67559
1,579 - 1,590	Limestone: medium light brown to grey brown, dolomitic, micritic, argillaceous, silty; pyrite-healed microfractures, pyrite inclusions; greenish mudstone bands generally 5 cm thick at 1,584.5', 1,585.5', 1,586.5', 1,587.5', 1,588.5', 1,589.5', 1,589.75'
1,590 - 1,597	Dolomite: tan to light brown, microcrystalline, calcareous in part; inclusions of microcrystalline pyrite up to 2.5 cm long in upper 30 cm of interval, rare inclusions of tripolitic chert
1,597 - 1,605	Limestone: medium light brown to maroon, micritic, slightly argillaceous, silty; calcite healed microfractures; finely bedded, light green haloes and microfractures, white calciferous laminations; brachiopod indet., GSC loc. 67560
1,605 - 1,610	Limestone: medium light brown to medium brown and maroon, micritic, argillaceous, silty; small lenses of triplitic chert(?); crinoid ossicles, some "ghost" crossbedding, microfractures healed with calcite and bounded with haloes

Depth ft	Lithology
1,610 - 1,622	Limestone: maroon, rusty brown to light olive green, micritic, argillaceous, silty; tripolitic chert in small pockets at 1,621.5', pyrite at 1,615' dark hematitic spots; crossbedding and worm burrows at 1,619'-1,620'
1,622 - 1,626	No information
1,626 - 1,662	Limestone: maroon, rusty brown to medium light brown, micritic argillaceous, silty; hematitic dark spots, pyrite inclusions, calcite blebs, glauconite grains, sparry calcite filled microfractures and vugs; tripolitic chert lenses, chlorite rich ooze, clay concentration at abundantly glauconitized zone 1655-1660, (see text), GSC loc. C-6548!
1,662 - 1,671	Limestone: maroon to 1,665', 1,665'-1,671' light grey brown, micritic, argillaceous, silty; pyrite inclusions, glauconite grains from 1,665'-1,671', tripolitic chert; crude oil oozing at 1,669'; crinoid and brachiopod fragments, diatoms in tripolitic chert; boudinage structure
1,671 - 1,677	Limestone: medium light brown, some locally dolomitized areas; pyrite crystals, white calciferous material filling vugs, oil ooze; crinoid ossicles
1,677 - 1,685	Limestone: pale brown, with wavy brown shaly banding and boudinage structures; limestone lenses, dolomitic; coarsely to finely crystalline, crinoidal, bioclastic, rare nodule of tripolitic chert, continued band of tube-like cavities 6 mm-10 mm diameter, 5 cm from base of interval containing pyrite and brown organic matter, voids resembling animal borings, some pyrite replacing crinoid stems; fossils from 1683-1703 <i>Unispirifer minnewankensis</i> Shimer, articulated crinoid stem in chert nodule; productellid brachiopod, horn coral indet., GSC loc. 70675, 70681
Bakken Formation	
Upper Shale Member	
1,685 - 1,695	Shale: brown-black, red-brown streak, carbonaceous or bituminous, red hematitic specks, light grey microscopic clay lenses; upper contact sharp, undulating, dip 2.5° SW. with argillaceous mudstone band 6 mm-12 mm thick between shale and the above carbonate, lower contact gradational, base of shale well defined; fossils from 1689-1695, productoid brachiopod indet., GSC loc. 70673,
1,695 - 1,698	Limestone: micritic grading to dolomite, medium grey to medium light grey; argillaceous, ferruginous silt filled fractures in top 15 cm; ferruginous worm burrows; ? <i>Schizophoria</i> sp., <i>Composita</i> sp., spiriferid and chonetid brachiopods, indet., caninid corals indet., nautiloid indet., GSC locs. 70674, 70675, 70681

Depth ft	Lithology
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Middle Sand Member

1,698 - 1,707 Sandstone: medium light grey to medium brown, maroon and yellow, variegated; very fine grained sand to silt, dolomitic; pyrite grains with yellow oxidation haloes, minute lenses of black shale in top 7.5 cm of interval; brown limonitic or hematitic surface in core, represents a vuggy band 30 cm from base (unconformity?); lower shale member missing

Upper Devonian

Qu'Appelle Group

Torquay Formation

1,707 - 1,721 Sandstone: medium light grey, maroon, rusty yellow, medium light brown laminations, very fine grained sand to silt; oil patches and water in loose sand zone 1,717.5'-1,718.5'

1,721 - 1,732 Limestone: medium light brown, medium light olive green matrix, intraclasts slightly calcareous? pyrite in upper part of interval, matrix dolomitic toward 1,732', silty

1,732 - 1,751 Siltstone: maroon, light olive green intraclasts(?); slightly calcareous, dolomite rhombs, silt to very fine grained sand, thinly bedded toward base; fish plate indet., GSC loc. 70682

1,751 - 1,801 Siltstone and mudstone: pale grey brown to green and red brown, interbedded and interlaminated in some zones, intraformational breccias, slump structure, vuggy zones 25 mm-15 cm thick

1,801 - 1,833 Siltstone and mudstone: pale green, pink to red brown and maroon, dolomitic, interlaminated with much contorted bedding, slump structures and intraformational breccias; inclusions of coarsely crystalline pink gypsum up to 75 mm long throughout interval

Saskatchewan Group

Birdbear Formation

1,853 - 1,869 Anhydrite: white with medium brown stringers, microcrystalline; cryptocrystalline limestone and microcrystalline dolomite interbedded towards base, some organic matter, dolomite slightly argillaceous; limestone, altered calcarenitic(?), 4.5 m from top has faint laminae resembling algal mats

1,869 - 1,875 Limestone: medium light brown to medium light grey, dolomitic, argillaceous, finely laminated, vug fillings of white anhydrite 5 cm long, connected by enlarged, healed fractures; no voids, specks of brown organic matter, large spores at base

SYLVITE SHAFT NO. 2, ROCANVILLE SASKATCHEWAN 1565-1950'

GAMMA RAY API Units

0 120 240

SONIC microseconds per foot

140 40

RESISTIVITY ohms  $\text{m}^2/\text{m}$

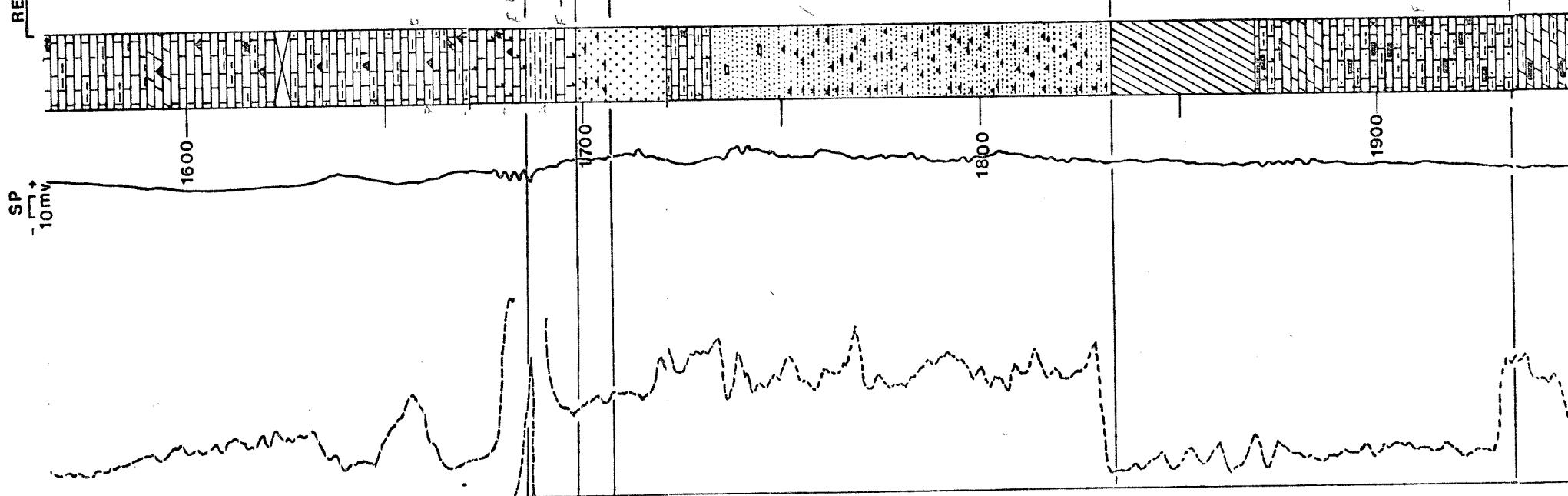
100 1000

Upper Member Bakken Formation  
Middle Member  
UPPER DEVONIAN

Torquay Formation

Birdbear Formation

Duperow Formation  
Seward Member



Depth ft	Lithology
1,875 - 1,885	Dolomite: pale brown, microcrystalline to sugary, and finely porous in part, finely laminated to massive, altered calcarenite; minute anhydrite inclusions, dark brown and bituminous at base
1,885 - 1,927	Limestone: pale brown, dolomitic, micritic matrix with abundant imbedded fossils fragments and dolomite rhombs; wavy brown shaly banding and nodular structures increasing downward, scattered nodular inclusions of anhydrite up to 25 mm long, zones with fragmented or calcarenitic appearance, resembling intraformational breccia; limestone fragments imbedded in brown shaly matter, specks of brown organic matter, scattered brachiopods, abundant brown (algal?) laminations; thin interval appearing to be transitional between quiet water "boudinage", muddy limestone and micritic or intertidal calcarenite; 1909-1916, <i>Spinatrypa</i> sp. indet., <i>Cyrtospirifer</i> sp. indet., gastropod moulds indet., GSC Loc. C-6549
1,927 - 1,933	Limestone: medium to light brown, slightly dolomitic, argillaceous, silty, calcarenitic and altered bioclastic, microcrystalline; anhydrite filled vugs, lenses of non-dolomitic lithographic limestone; dwarf boudinage structure

#### Duperow Formation

##### Seward Member

1,933 - 1,947	Dolomite: pale grey brown to medium grey, cryptocrystalline irregular and lenticular argillaceous banding; pyrite inclusions and anhydrite filled fractures and vugs
1,947 - 1,965	Dolomite and anhydrite: dolomite, light grey brown to pale brown, cryptocrystalline, banded; interbedded with crystalline anhydrite (>30% of interval)
1,965 - 1,994	Dolomite: pale grey brown to light brown, microscuscose, moderately compact, slightly argillaceous, irregular brown shaly partings, faintly banded; inclusions of anhydrite up to 25 mm in diameter; mottling suggesting a boudinage structure of argillaceous limestones
1,994 - 2,007	Limestone: light grey to light grey brown, cryptocrystalline, increasingly argillaceous downward; boudinage lense and wavy shale band structure, brown organic specks; 75 mm inclusion of blue grey anhydrite 120 cm above base
2,007 - 2,008	Dolomite: light grey, cryptocrystalline, highly argillaceous; brown organic specks
2,008 - 2,039	Limestone: light brown to dark grey brown, dolomitic, highly argillaceous in part, cryptocrystalline; altered bioclastic, mottled, with anastomosing algal(?) banding, scattered brachiopods, <i>Lingula</i> sp. indet. " <i>Atrypa</i> " ex. gr. "A" <i>multicostellata</i> kottlowski, " <i>A</i> " sp. indet., <i>Cyrtospirifer</i> ex. gr. " <i>C. thalattodama</i> " Crickmay, <i>Cyrtospirifer</i> sp. indet., <i>Charactophylloidium</i> sp. indet., fishplate fragment, GSC locs. C-6550, C-6514, C-6551
2039 - 2,040	Anhydrite: finely calcarenitic, irregular inclusions of cryptocrystalline limestone

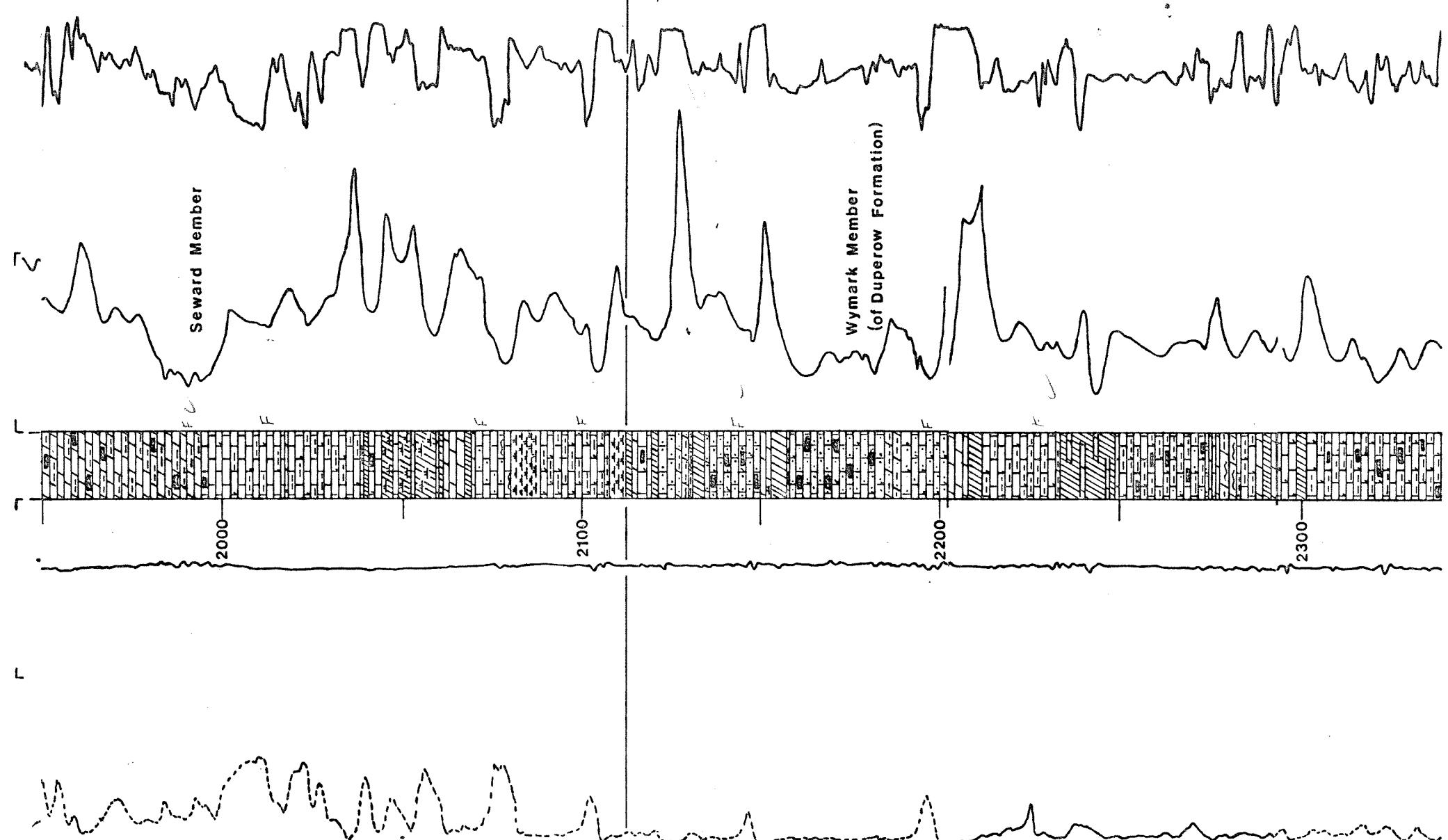
Depth ft	Lithology
2,040 - 2,043.5	Limestone: pale brown, cryptocrystalline, grey brown laminations; inclusions of anhydrite
2,043.5 - 2,061	Anhydrite, mudstone and dolomite: anhydrite, pale grey brown, cryptocrystalline, fine banded to "blebby", about 80% of interval; light grey argillaceous dolomite or dolomitic mudstone, cryptocrystalline, several beds and inclusions from 10 cm to 30 cm thick of pale brown, cryptocryalline, bedded dolomite
2,961 - 2,062	Dolomite: medium to light brown, micro- to cryptocryalline, undulating dark banding
2,062 - 2,067	Dolomite: medium to light grey, argillaceous; small inclusions or lenses of clear anhydrite, fine lenticular structure
2,067 - 2,069	Anhydrite: finely crystalline, lustre mottling; wispy inclusions of buff dolomite, irregular laminations of brown limestone in basal 5 cm
2,069 - 2,070	Dolomite: pale brown, microcryalline, altered biothermal pyramidal stromatoporoids in growth position
2,070 - 2,080	Limestone: tan to light brown, bioclastic in part, cryptocryalline micritic matrix, partly calcarenitic; wavy banding and nodular appearance, algal mat type bands at base, argillaceous in basal 30 cm; abundant fossil fragments and whole brachiopods, stromatoporoid, not studied, <i>Cladopora</i> , sp. undet., " <i>Schucterellza</i> " sp. indet., <i>Atrypa</i> sp. ex. qr. " <i>A</i> " <i>multicostellata</i> kottlowski, GSC loc. C-6552
2,080 - 2,086.5	Mudstone: dolomitic, or highly argillaceous dolomite, light grey argillaceous content decreasing downward; wispy mottling and banding dolomite zoning
2,086.5 - 2,092	Limestone: light brown, dolomitic altered bioclastic, with vug fillings and blebs of anhydrite; band of pyrite inclusions at 2,090'; scattered brachiopods, stromatopora, not studied, <i>Cladopora</i> sp. undet., <i>Dysphyllum</i> sp. indet., <i>Pachiphyllum</i> sp. indet., <i>Phacellophyllum</i> (?) sp. indet., " <i>Atrypa</i> " ex. qr. " <i>A</i> " <i>multicostellata</i> kottlowski, GSC loc. C-6553
2,092 - 2,100	Limestone: pale to light brown, dolomitic bioclastic, near-reef facies with numerous horn corals in reclining position
2,100 - 2,101.5	Limestone: medium to light brown with brown shaly lamination, bioclastic, earthy to finely crystalline, much carbonized organic matter; corals branching in basal 7.5 cm
2,101.5 - 2,107	Limestone: pale to light brown, earthy texture with irregular brown shaly banding; scattered inclusions of white anhydrite up to 19 mm long
2,107 - 2,111	Mudstone: light grey, dolomitic, highly argillaceous, massive; 15 cm interval of wispy dolomitic mettling
2,111 - 2,113.5	Anhydrite: dark brown to light grey, mottled

Depth ft	Lithology
2,113.5 - 2,115.25	Dolomite: light brown, cryptocrystalline with coarse porosity filled by anhydrite: irregular brown banding and concentric structures suggesting algal heads, 10 cm in diameter
2,115.25 - 2,120	Limestone: pale brown, coarsely crystalline, contorted banding and laminations; calcarenous zones, slightly altered, numerous voids and vertical fractures filled with white and brown anhydrite; concentric structures suggesting algal heads or stromatoporoids <i>Desquamaria</i> sp. undet., C-6554
2,120 - 2,121.75	Anhydrite: pale brownish grey with inclusions of earthy textured (altered calcarenitic?) dolomite; increasing downward to dolomite with contorted brown banding and no anhydrite in basal 15 cm
2,121.75 - 2,124	Limestone: tan to brownish white, micritic, mottled cryptocrystalline to microcrystalline, altered fine calcarenite; faint irregular banding, GSC Loc. C-6554
2,124 - 2,125.75	Limestone: pale brown, altered bioclastic, cryptocrystalline, scattered anhydrite filled vugs
2,125.75 - 2,131	Dolomite: tan to light brown, microscuscose, earthy texture, slightly argillaceous, altered calcarenite; anastomosing algal mats in basal 30 cm; faint mottling suggesting boudinage
2,131 - 2,134.25	Anhydrite: light grey; wispy inclusions of dolomite
2,134.75 - 2,136	Dolomite: light brown to tan, finely crystalline to earthy, altered calcarenite(?); voids filled with anhydrite, concentric structures resembling stromatoporoids or algal heads
2,136 - 2,150	Limestone: pale grey brown, cryptocrystalline, earthy texture, largely calcarenitic; dolomite rhombs, specks of organic matter, faint boudinage structure; 30 cm zone of brown anhydrite inclusions 60 cm from top of interval; large brown nodule of lithographic limestone 130 cm from top of interval; stromatoporoids, not studied, <i>Pachyphyllum</i> sp. undet., <i>Smithiphyllum</i> sp. indet., atrypid fragments, indet., GSC Loc. C-6555
2,150 - 2,153	Dolomite: light brown to grey, microcrystalline; with veriform, irregular and distorted laminations of dolomitic and anhydritic mud becoming less distinct downward
2,153 - 2,158	Anhydrite: blue grey at top becoming brownish grey; increasing banding toward base
2,158 - 2,158.25	Dolomite: pale brown with brown algal(?) laminations

Depth ft	Lithology
2,158.25 - 2,181	Limestone: light to pale brown, altered calcarenitic, bioclastic, microcrystalline to earthy texture; vugs filled with clear to brown anhydrite, vertical fractures with white gypsum; black organic specks; stromatoporoids, not studied, atrypid fragment, GSC locs. C-6556 and C-6557
2,181 - 2,186	Limestone: pale brown, cryptocrystalline to earthy texture, altered calcarenitic; large irregular vertical fractures, 20 mm separation filled with pale grey anhydrite, concentric structure resembling stromatoporoid in growth position 30 cm from top of interval
2,186 - 2,189	Dolomite: light grey to brown, microcrystalline, argillaceous, altered calcarenitic(?), fractures with anhydrite filling
2,189 - 2,201	Limestone: light brown, microcrystalline to earthy texture, altered bioclastic, finely porous; some pores infilled by anhydrite and bands of brown anhydrite inclusions (2,195'-2,201'); stromatolitic structures 60 cm from top of interval, a few brachiopods below stromatolites, abundant branching type corals and stromatoporoids stromatoporoids, not studied, <i>Phacellophyllum</i> sp. indet., <i>Smithiphyllum</i> sp. undet., GSC loc. C-6558
2,201 - 2,202	Limestone: pale to light brown, highly dolomitic, altered calcarenite, micritic matrix; brown anhydrite after gypsum laths
2,202 - 2,207.25	Dolomite: light grey, finely mottled
2,207.25 - 2,211.75	Anhydrite: pale brown grey, coarsely mottled
2,211.75 - 2,231	Limestone: light to medium brown, microcrystalline, dolomitic; stromatolites, (consisting of concentric laminated growths up to 4 cm diameter) in growth position; wavy brown argillaceous laminations, finely porous, abundant efflorescence
2,231 - 2,232.75	Limestone: tan, dolomitic, bioclastic; earthy texture in part, stromatoporoid, not studied, rugose coral indet., C-6559
2,232.75 - 2,233.25	Dolomite: light grey, argillaceous
2,233.25 - 2,248.5	Anhydrite and dolomite: light brown or brownish white, largely laminated, earthy texture, finely porous; interbedded and included anhydrite, grey crystalline for 20% of interval, basal 45 cm grey brown in colour
2,248.5 - 2,270.5	Limestone: grey brown grading to tan, dolomitic, argillaceous banding, cryptocrystalline, earthy texture with zones of dolomite rhombs, finely porous; bands of brown anhydrite crystals, scattered inclusions of white anhydrite up to 75 mm, shale partings

SYLVITE SHAFT NO. 2, ROCANVILLE SASKATCHEWAN

1950-2340'



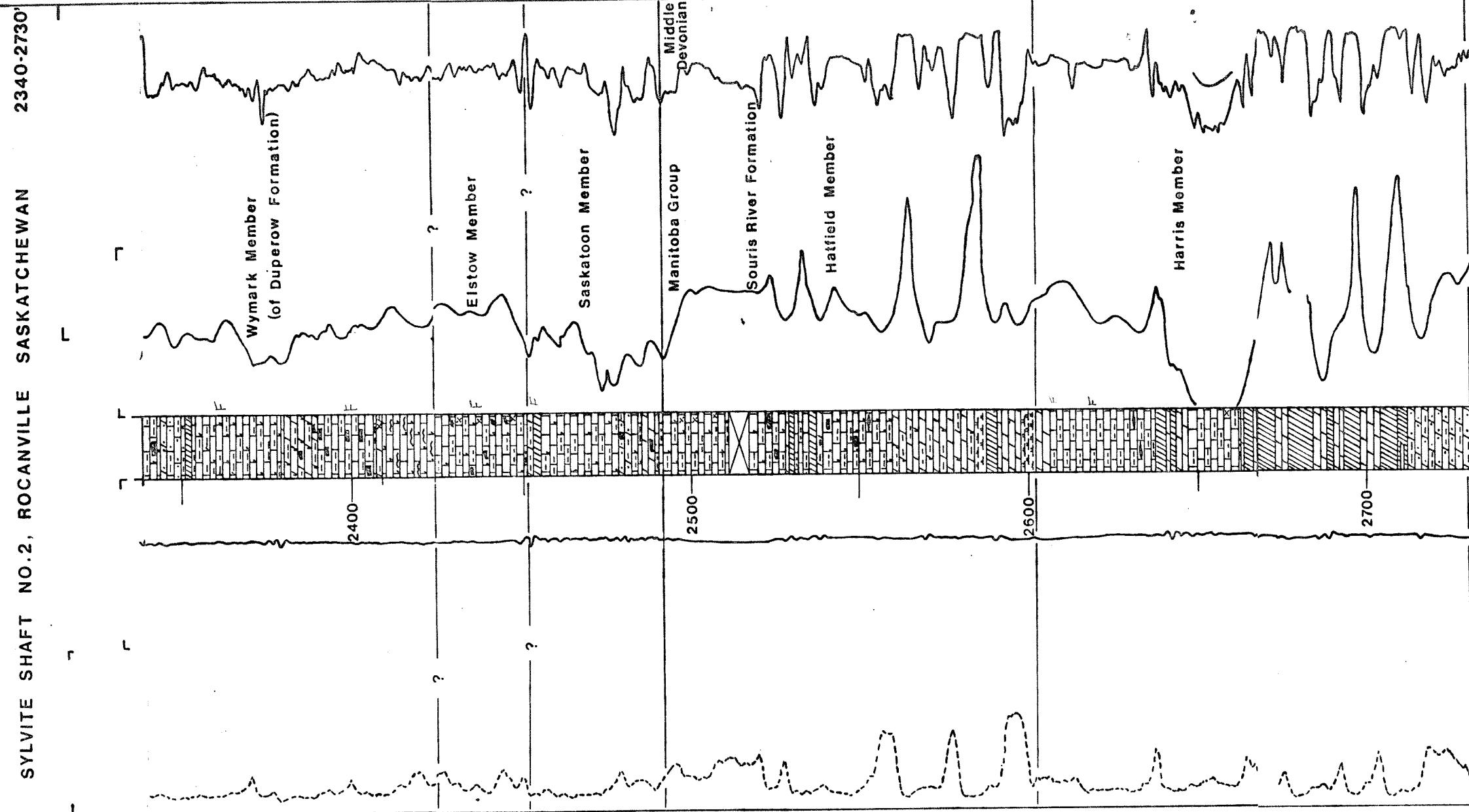
Depth ft	Lithology
2,270.5 - 2,275.7	Limestone: medium to light brown, altered calcarenite(?), heavily dolomitized; shell fragments, numerous stromatoporoids in growth position, brown organic laminations draped over stromatoporoid heads; becomes slightly argillaceous grading to dolomite toward base, specks of organic matter
2,275.7 - 2,276	Dolomite: light grey brown, finely sugary, brown organic specks and inclusions of grey anhydrite
2,276 - 2,277.25	Limestone: brownish white, laminated, earthy texture, finely porous
2,277.25 - 2,282.5	Dolomite: medium to light grey to light brown, argillaceous; abundant anastomosing algal mat type laminations, anhydrite in upper part of interval
2,282.5 - 2,288.25	Limestone: light brown, chalky texture, finely porous, argillaceous wavy banding; brown anhydrite crystals after gypsum and minute blebs of white anhydrite
2,288.25 - 2,290	Dolomite; buff, finely sugary, tight, scattered brown organic specks
2,290 - 2,292.5	Anhydrite: light grey, faint banding
2,292.5 - 2,293	Dolomite: pale light brown, microscrose
2,293 - 2,298	Limestone: pale light brown, earthy texture, dolomitic, finely porous; heavily speckled with dolomite
2,298 - 2,301	Anhydrite: with brown dolomite laminations, contorted toward base
2,301 - 2,343	Limestone: medium grey to medium light brown, argillaceous dolomitic; gypsum laths and anhydrite inclusions, with anhydrite healed microfractures; irregular stromatolites in growth position, brachiopod fragments; stromatoporoid, not studied; rugose coral, indet., GSC loc. C-6559
2,343 - 2,345	Dolomite: light to pale light brown, earthy texture, laminated in part; interbedded calcareous fossil zone, with brachiopods at top; altered coarse calcarenite in part with interstitial anhydrite (from core of No. 1 shaft)
2,345 - 2,351	Limestone: pale light brown, calcarenitic in part with sparry matrix; anastomosing brown irregular laminations concentrated toward base
2,351 - 2,353	Anhydrite: with wispy brown dolomite
2,353 - 2,379	Limestone: medium to light brown, dolomitic, argillaceous, lithographic; occasional carbonaceous banding, anhydrite healed fractures; stromatoporoid fragments; stromatoporoids, not studied, <i>Alveolites</i> sp. indet.; phaceliphyllid coral, indet.; <i>Smithiphylloid</i> sp. indet.; stromatoporoids, not studied; gastropod, indet.; GSC locs. C-6560, C-6561

Depth ft	Lithology
2,379 - 2,390	Dolomite: medium light brown with a grey cast, calcareous; minute anhydrite inclusions, some interlaminated limestone
2,390 - 2,407.25	Limestone: medium light brown with a grey cast, dolomitic, argillaceous, microsucrose in part; brown carbonaceous specks, small anhydrite inclusions; brachiopod fragments, scattered corals; stromatoporoids, not studied, <i>Alveiolites</i> sp. indet.; <i>Neocolumnaria?</i> sp. nov., <i>Macgeea</i> sp., <i>Tabulophyllum</i> sp. indet., <i>Spinatrypa</i> sp. indet., <i>Allanaria</i> sp. indet., GSC loc C-6562
2,407.25 - 2,409.5	Dolomite: light brown grey, mottled, slightly argillaceous microcrystalline; upper 15 cm of interval shows veriform anhydrite(?) mottling, highly porous zones after solution of chalky anhydrite or dolomite; a few breccia fragments near top
2,409.5 - 2,424	Limestone: medium light brown with grey cast, dolomitic, microsucrose; minute calcite healed vugs, dark brown algal laminae, black carbonaceous specks; stromatoporoids, not studied, <i>Alveiolites</i> sp. indet., GSC loc. C-6563
2,424 - 2,451	Limestone: light grey brown, highly dolomitic, altered bioclastic, slightly porous, argillaceous, with argillaceous banding and calcareous nodules ranging from boudinage structure to zones of apparent penecontemporaneous brecciation; anhydritic(?) infillings, gypsum laths, pyrite grains and brown organic specks; stromatoporoid zone 15 cm thick, some nucleated by coral amphipora(?), probably not in growth position, (from core of No. 1 shaft); stromatoporoids, not studied, <i>Thamnopora</i> sp. indet., stropheodontid, indet., <i>Spinatrypa</i> sp. indet., <i>Allanaria</i> sp. ex. gr. <i>A. minutilla</i> , Crickmay, GSC loc. C-6564
2,451 - 2,453	Dolomite: light grey brown, argillaceous, microcrystalline, compact; disseminated pyrite and clear anhydrite crystals, suggestion of verminiform mottling
2,453 - 2,455.25	Anhydrite: pale grey brown, banded; irregular dolomitic bands dipping 20° in basal 7.5 cm; stromatoporoids, not studied, " <i>Atrypa</i> " sp. indet. GSC loc. C-6565
2,455.25 - 2,474	Limestone: pale brown, dolomitic, bioclastic, finely porous in part; zone of faint boudinage and argillaceous banding alternating with zones of abundant whole brachiopods in micritic matrix, large stromatoporoids near top decreasing in size and number downwards
2,474 - 2,478.5	Limestone: medium to medium light brown, cryptocrystalline, dolomitic; brown shaly zone with angular limestone fragments, zones with brachiopod fragments

Depth ft	Lithology
2,478.5 - 2,482	Dolomite: light grey brown, finely porous, microscrose, specks of organic matter; basal 45 cm irregularly banded, finely crystalline, compact, with altered calcarenitic and brown shaly bands; anhydritic in part
2,482 - 2,485.25	Limestone: light grey brown, dolomitic, cryptocrystalline; specks of organic matter
2,485.25 - 2,488.5	Dolomite: brown, microcrystalline, banded, compact, very slightly porous; becomes light brown with scattered anhydrite laminae in basal 30 cm
2,488.5 - 2,491	Limestone: medium light brown, dolomitic, argillaceous, cryptocrystalline; speckled with anhydrite(?) translucent zones in lower part
Souris River Formation	
2,491 - 2,511	Limestone: light grey brown, argillaceous, cryptocrystalline; boudinage structure present in upper part of interval, zones of shaly banding with sub-angular breccia fragments of carbonate; 15 cm bioclastic zone near top with 25 mm "pebbles" of dark argillaceous limestone (from core of No. 1 shaft)
2,511 - 2,517	No information
2,517 - 2,528	Limestone: light brown grey, argillaceous banding, dolomitic, bioclastic; "boudinage" structure, band of brown anhydrite inclusions
2,528 - 2,529	Dolomite: light brown grey, argillaceous, cryptocrystalline, banded
2,529 - 2,530.3	Anhydrite: pale grey, with indefinite brown dolomite banding
2,530.3 - 2,531	Dolomite: pale brown, microcrystalline, banded
2,531 - 2,535	Limestone: light brown, dolomitic, cryptocrystalline becoming argillaceous downward, faint, small scale "boudinage" type nodules and wavy banding; zones of brown anhydrite inclusions
2,535 - 2,537	Anhydrite: light grey brown, crystalline, inclusions of tan coloured dolomite in basal 15 cm
2,537 - 2,539	Dolomite: pale brown, cryptocrystalline, earthy texture, very finely porous; healed fractures and minute anhydrite blebs, brown argillaceous partings curved and undulating, dipping at about 20°.
2,539 - 2,555	Limestone: light grey brown, argillaceous, cryptocrystalline, highly dolomitic, decreasing downwards, earthy texture; irregular brown shaly bands and zones of anhydrite aggregates

Depth ft	Lithology
2,555 - 2,560	Limestone: medium light grey, medium light brown, micro-sucrose, argillaceous, oolitic; anhydrite filled vugs, gypsum laths
2,560 - 2,573	Dolomite: medium light grey to medium light brown, slightly calcareous, microsucrose, shaly laminations; anhydrite at 2,561'-2,563' and 2,568'-2,571', medium brown to translucent mottled, coarsely crystalline
	The remaining 465' of section were not observed in No. 2 shaft; the following interval is described from the core of No. 1 shaft 514' north and 87' east of No. 2
2,573 - 2,584	Dolomite: pale brown grey, slightly argillaceous, micro-sucrose, tight; pebble like anhydrite in basal 25 cm, a few irregular brown shaly laminations
2,584 - 2,587.5	Mudstone: light grey, dolomitic and argillaceous dolomite; contorted or irregular banding
2,587.5 - 2,590.5	Anhydrite: light brown, wispy inclusions of tan dolomite
2,590.5 - 2,597.5	Dolomite: light brown, microcrystalline, argillaceous; scattered wavy brown inclusions, zones of anhydrite inclusions up to 25 mm long, grey argillaceous inclusions near base
2,597.5 - 2,601	Mudstone: red brown, dolomitic
2,601 - 2,602	Mudstone: light green grey, dolomitic or argillaceous dolomite
2,602 - 2,606	Dolomite: light brown, argillaceous, anhydrite inter-laminated, grading to calcareous, microsucrose, tight; faint colour laminations gradational to limestone below;
2,606 - 2,627	Limestone: light grey brown, argillaceous banding, bioclastic in part, micritic matrix with boudinage structure; stromatolites below 2,619' increasing in size downward; bioclastic zones in lower part of interval; "Atrypa" sp. cf. "A" oneidensis Beus <i>Allanaria allzani</i> (Warren), <i>Allanaria</i> sp. indet., gastropod mould, indet., GSC locs. C-6566, C-6567
2,627 - 2,637.5	Limestone: pale grey brown cryptoocrystalline, earthy texture, undulating brown shaly bands; pelletoid or oolitic massive zone 30 cm thick near base, finely porous zones
2,637.5 - 2,640.5	Anhydrite: light brown grey, tan dolomitic laminations
2,640.5 - 2,642	Dolomite: light grey, shaly, with irregular banding; zone of intraformational breccia near base with eroded dolomitic fragments in shale
2,642 - 2,642.5	Anhydrite: light grey with brown dolomite banding

Depth ft	Lithology
2,642.5 - 2,647	Dolomite: light grey brown, cryptocrystalline, altered calcarenitic to bioclastic, microcrystalline dolomite rhombs, calcareous; argillaceous banding, vertical anhydrite filled fractures 5 mm wide
2,647 - 2,663	Limestone: pale brown, dolomitic, cryptocrystalline, earthy texture, argillaceous grey brown banding; zones with white anhydrite or gypsum rosettes intergrading with calcareous dolomite; grades to dolomite in basal 30 cm
2,663 - 2,664	Dolomite: light grey brown, argillaceous, fine penecon-temporaneous brecciation
2,664 - 2,666.5	Anhydrite: dark brown grey with tan dolomitic laminations near top; dolomitized stromatoporoid inclusion in growth position 10 cm+ in diameter, resting on brown shaly base of interval
2,666.5 - 2,667.5	Dolomite: light grey brown, argillaceous; minute healed penecontemporaneous fractures
2,667.5 - 2,672.5	Anhydrite: brown grey, faintly banded by dolomite zones
2,672.5 - 2,676.75	Dolomite: pale to light brown to light grey, microcrystalline, finely porous in part; irregular brown laminations in upper 37 cm, abundant anhydrite blebs in upper 25 cm; top zone resembles altered calcarenite
2,672.75 - 2,684	Anhydrite: light brown grey, faintly banded and mottled; 25 mm brown shaly zone at base
2,684 - 2,687	Dolomite: medium to light brown, finely sugary and porous, massive
2,687 - 2,688	Dolomite: light grey brown, sugary; fairly compact with slightly porous zones
2,688 - 2,690	Anhydrite: dark brown grey; tan anhydrite laminations
2,690 - 2,693	Dolomite: pale to light brown to brown grey, microscrose to earthy texture; interlaminated blebby anhydrite in top 12.5 cm, brown shaly laminations in upper part, becoming massive and increasingly argillaceous downward
2,692 - 2,698	Anhydrite: medium grey to light brown grey, slightly dolomitic, microcrystalline; irregular wispy dolomite laminations
2,698 - 2,702	Dolomite: pale brown, earthy texture, porous; interlaminated and blebby anhydrite in upper 30 cm, 75 mm inclusion and small anhydrite blebs 37 cm from base
2,702 - 2,703.5	Dolomite: light grey brown, microcrystalline, altered calcarenitic, bioclastic; specks of brown organic matter, laminated in top 75 mm and at base, remainder massive with small anhydrite inclusions

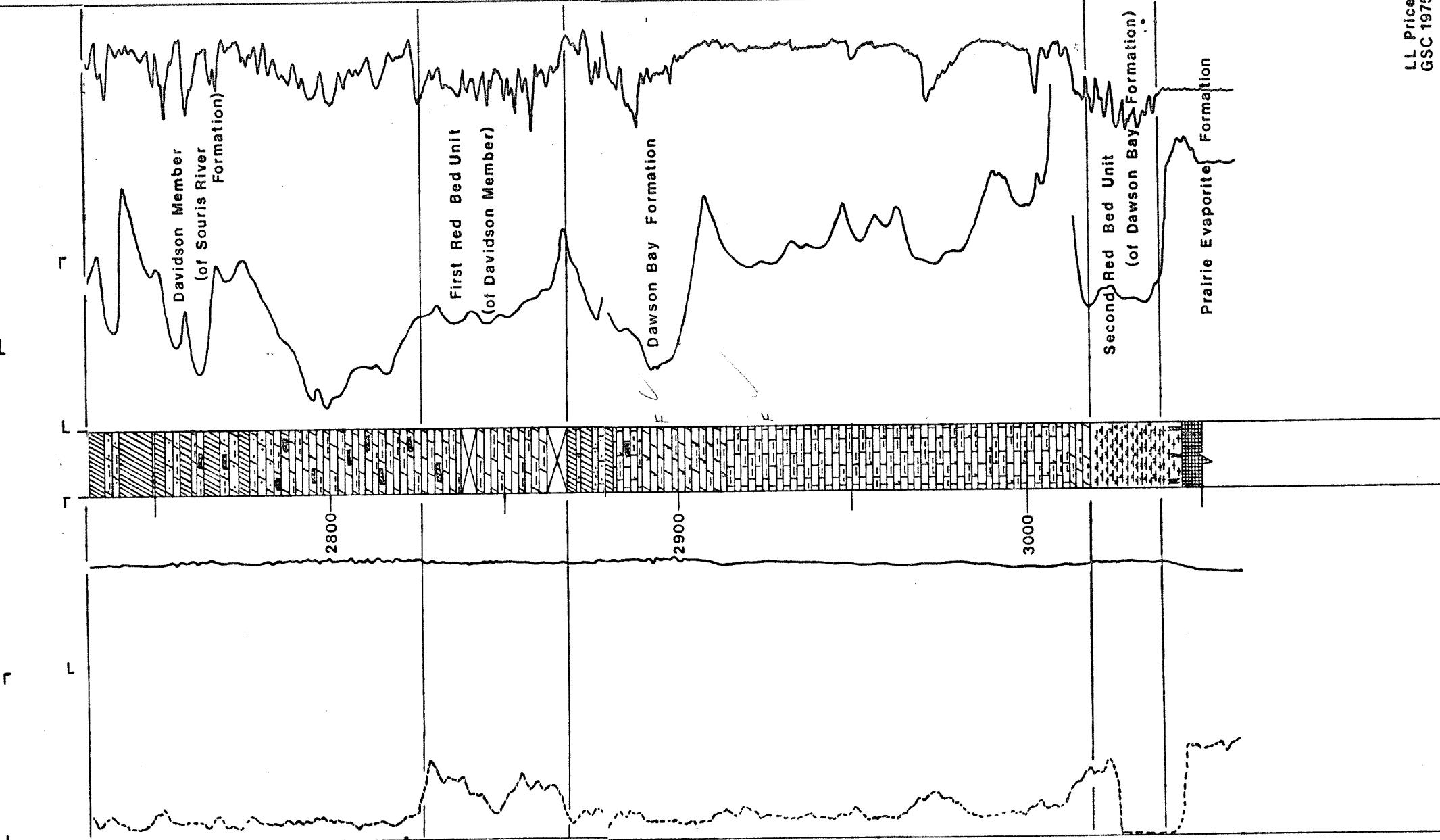


Depth ft	Lithology
2,703.5 - 2,704	Dolomite: medium grey, argillaceous, cryptocrystalline; irregular laminations and argillaceous mottling
2,704 - 2,709	Anhydrite: medium grey to medium brown grey, dolomitic, argillaceous; argillaceous mottling and faint brownish dolomitic banding
2,709 - 2,712	Anhydrite and dolomite: anhydrite, brown grey, interbeds 2.5 cm to 20 cm thick of pale brown dolomite, dark microcrystalline brown laminae
2,712 - 2,730.5	Dolomite: pale to light brown, cryptocrystalline, argillaceous, altered calcarenitic(?); abundant brown anhydrite crystals, dolomite becomes finely crystalline, compact, and massive downward
2,730.5 - 2,735.3	Anhydrite: brown grey, indefinite brown dolomite banding; 20 cm interbed of laminate pale brown dolomite 60 cm from base of interval
2,735.3 - 2,739.5	Dolomite: pale to light brown to light grey, microcrystalline with faint granularity suggesting altered calcarenitic origin, argillaceous; inclusions and discontinuous lenses of light grey anhydrite
2,739.5 - 2,748.75	Anhydrite: brown grey with indefinite dolomitic laminations and lenses, interlaminated and interbedded tan anhydrite in basal 45 cm
2,748.75 - 2,749.75	Dolomite: light brown, microcrystalline, compact; laminated in part due to alternations in crystal size or relict granularity
2,749.75 - 2,753	Anhydrite: medium light grey, with faint dolomitic banding
2,753 - 2,757.75	Dolomite: grey brown to pale brown, microcrystalline, porous, earthy texture, calcarenous, calcarenitic to bioclastic in part; abundant brown organic matter, inclusions of white anhydrite, laminated at base; brachiopods, stromatolites
2,757.75 - 2,760.5	Anhydrite: light brown grey with indefinite brownish dolomitic banding becoming pale brown, finely crystalline and dolomitic in basal half of interval
2,760.5 - 2,764	Dolomite: medium brown to light grey brown, finely crystalline to vuggy in part, porous; some vug fillings and inclusions of selenite and anhydrite
2,764 - 2,768.75	Anhydrite: grey to light brown grey; irregular shaly banding
2,768.75 - 2,771.5	Anhydrite and dolomite: anhydrite, light grey brown and pale brown laminated; dolomite, microsucrose (altered calcarenitic), interbedded and interlaminated

Depth ft	Lithology
2,771.5 - 2,774	Dolomite: light brown to brown, microcrystalline (altered calcarenitic?) to microsucrose; abundant brown organic matter, stromatoporoids apparently in growth position
2,774 - 2,777	Anhydrite: light brown grey, irregular brown dolomite banding grading downward to tan dolomite with bands of anhydrite blebs
2,777 - 2,782	Dolomite: pale to dark brown, microcrystalline, earthy, slightly porous to compact, altered calcarenitic or bioclastic; irregular brown shaly partings and lenses or bands of anhydrite blebs
2,782 - 2,785	Dolomite: medium to light brown, microcrystalline to micro-sucrose, finely porous in part; unlaminated with abundant brown organic specks, scattered large anhydrite inclusions
2,785 - 2,796	Dolomite: medium to light brown, coarsely crystalline, vuggy in part, unlaminated; scattered lustre mottling following minute fractures, discontinuous brown partings; undulating brown shaly bands up to 6 mm thick, a few anhydrite inclusions in upper half of interval
2,796 - 2,826.5	Dolomite: light to medium brown, microcrystalline, finely vuggy, porous, faintly argillaceous; inclusions of selenite up to 25 mm long, inclusions of brown and grey anhydrite; grey and argillaceous at base
2,826.5	First Red Bed Unit
2,826.5 - 2,837	Dolomite: light grey, argillaceous, cryptocrystalline, structureless
2,837 - 2,842	No information
2,842 - 2,848	Dolomite: light brown grey to light brown, cryptocrystalline, argillaceous; brown shaly partings and banding, undulating to flat, interlaminated anhydrite in two 5 cm to 10 cm bands in lower half of interval
2,848 - 2,862	Dolomite: argillaceous or dolomitic mudstone; light grey anhydritic in part, zones of anhydrite inclusions up to 25 mm, anhydrite band at top of interval
2,862 - 2,868	No information
Dawson Bay Formation	
2,868 - 2,870.7	Anhydrite: light grey to light amber, dolomitic in upper 25 mm, slightly undulating basal contact
2,870.7 - 2,871.5	Dolomite: pale to light brown grey, argillaceous; irregular banding anhydrite blebs in lower half of interval
2,871.5 - 2,872	Limestone: light brown, microcrystalline, calcarenitic

Depth ft	Lithology
2,872 - 2,875	Anhydrite: light brown grey, wispy inclusions of dolomite becoming more prominent toward base and grading to laminated light brown dolomite, altered calcarenitic or bioclastic, microsucrose in basal 10 cm
2,875 - 2,877	Limestone: light to medium brown, dolomitic, altered calcarenitic, microcrystalline; irregular dark brown bituminous laminations becoming prominent in basal 22.5 cm
2,877 - 2,878.25	Limestone: light grey brown, cryptocrystalline, calcarenitic in top 7.5 cm; prominent discontinuous dark brown shaly laminations, bands of anhydrite or selenite inclusions
2,878.25 - 2,880.7	Anhydrite: light brown grey, irregular bands and laminations of buff dolomite, grading downward to dolomite with anhydrite laminations
2,880.7 - 2,889	Limestone: light to dark brown, calcarenitic, porous; irregular brown black shaly partings, interstitial clear anhydrite and anhydrite inclusions of anhydrite at 85 cm from top; numerous stromatoporoids 12 cm+ long, some in growth position
2,889 - 2,902	Dolomite: light to dark brown, calcareous in part, dark brown shaly banding, porous, altered bioclastic; numerous stromatoporoids nucleated by corals (e.g. <i>Thamnopora</i> type), usually up to 13 mm, single specimen reaches 10 cm; <i>Actinostroma</i> sp. undet., <i>Thamnopora</i> sp. undet., <i>Neocolumaria</i> sp. nov., form c, <i>Disphyllum</i> sp. indet., <i>Spinatrypa</i> sp. indet., "Schuchertella" sp. indet., <i>Stringocephalus</i> sp. indet., <i>Disphyllum?</i> sp. indet., GSC locs. C-6508, C-6509 and C-6513
2,902 - 2,907	Dolomite: medium brown, compact, microcrystalline, structureless; stromatoporoid, indet., GSC loc. C-6513
2,907 - 2,914	Dolomite: grey brown, microcrystalline, tight, lustre mottling from gypsum
2,914 - 2,921.3	Limestone: pale grey brown, slightly dolomitic, slightly argillaceous, cryptocrystalline; wavy banding and boudinage type structure, basal contact irregular with apparent solution or erosion; crinoid ossicles, <i>Thamnopora</i> (?)
2,921.3 - 2,927	Limestone: light grey brown, mottled, argillaceous; wavy banding and boudinage structure; <i>Thamnopora</i> sp. indet., <i>Disphyllum</i> sp. indet., <i>Spinatrypa</i> sp. indet., <i>Emmenella</i> sp. indet., GSC loc. C-6546
2,927 - 2,937	Limestone: pale grey brown, cryptocrystalline, argillaceous; crinoid ossicles, stromatoporoids up to 75 mm long; zones of salt filled pores
2,937 - 2,987	Limestone: light grey brown to light brown, cryptocrystalline, slightly argillaceous, zones of dolomite rhombs, minute fractures and vugs filled with halite, porous zones filled with halite

SYLVITE SHAFT NO. 2, ROCANVILLE SASKATCHEWAN 2730 - 3050'



Depth ft	Lithology
2,987 - 3,014.75	Limestone: grey brown to dark brown, cryptocrystalline, slightly argillaceous vugs and porous zones filled with halite; becoming dolomitic toward base
3,014.75 - 3,018	Dolomite: dark to light grey, argillaceous, salty(?), cryptocrystalline
Second Red Beds	
3,018 - 3,026.7	Mudstone: light brown grey, dolomitic; vertical fractures infilled with orange halite with transverse crystallization
3,026.7 - 3,038	Mudstone: red brown, dolomitic, veinlets of red halite; slickensides in upper 1 m, green mottling 1.3 m from base of interval
Prairie Evaporite	
3,038 - 3,044	Clay: red brown, abundant small inclusions of halite, discontinuous vertical veinlets of orange red halite
3,044	Halite: no description

Appendix III  
List of photographs

Appendix III(a)

List of Photographs Showing Stratigraphic Detail of Shaft Wall, IMC K2 Shaft

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-5-19	149415	Cone-in-cone structure, Riding Mountain Formation.	474 ft.		
64-2-3	113279-M	Sulphur sublimation from burning in excavated shale in surface dump, Vermilion River Formation.			
64-2-9	113279-M	Spontaneous combustion in white-speckled shale excavated from Vermilion River and Favel Formations.			
64-3-13	113279-B	Part of skeleton of a fish, Ashville Group, upper part; a unique specimen representing the only articulated fish remains observed anywhere, during the project.	964 ft.		
65-5-20	149416	Irregular bedding, "Fish Scale Sand", excavated fragment.	1005 ft.		Figure 6
64-2-12	113277-C	Section of upper and lower jaws of Ichthyosaur, Ashville Group, 35 feet below "Fish Scale Sand" equivalent.	1046 ft.		
64-1-1	113275-E	Shale, upper part of Joli Fou Formation.	1157 ft.		
64-1-2	113275-I	Shale, upper part of Joli Fou Formation.	1157 ft.		
64-1-3	113276-B	Parting in frozen shale, Joli Fou Formation.	1241 ft.		

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
64-2-14	113279-C	Concretions, Joli Fou Formation	1246 ft.		
64-2-15	113277-G	Fault, in shale, Joli Fou Formation, view 1, stereo R.	1246 ft.	W	
64-2-16	113273-M	Fault, in shale, Joli Fou Formation, view 1, stereo L.		W	
64-2-17	113277-D	Slippensided fault plane in shale, Joli Fou Formation, view 2, stereo L.	1246 ft.	W	
64-2-18	113277-A	Slippensided fault plane in shale, Joli Fou Formation, view 2, stereo R.		W	
64-2-19	113279-D	Fault in shale, Joli Fou Formation, view 1, stereo R.	1255 ft.		
64-2-20	113279-E	Fault in shale, Joli Fou Formation, view 1, stereo L.	1255 ft.		
64-2-22	113277-F	Fault in shale, Joli Fou Formation, view 2.	1255 ft.	NW	
64-3-3	113278-E	Joli Fou dark shale on Pense silt; contact is marked by the double layer of chert - and quartz - grain sandstone. Symmetrical large ripples of similar sandstone are 23 cm above the interface.	1275 ft.	ESE	Figure 7
64-3-4	113278-F	Joli Fou shale or Pense silt.	1275 ft.	SSE	Figure 8
64-3-12	113280-F	Laminated silt and shale, much - burrowed, Pense Formation, excavated fragment.	1277 ft.		

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
64-3-14	113278-J	Wavy and lenticular bedding, Pense Formation, view 1.	1285 ft.	NE	
64-3-15	113278-A	Wavy and lenticular bedding, Pense Formation, view 2.	1285 ft.	E	
64-3-16	113277-L	Wavy and lenticular bedding, Pense Formation, view 3.	1285 ft.	N	Figure 9
	113280-C	Wavy bedding, Pense Formation, excavated fragment.	1286 ft.		
65-1-19	113273-G	Wavy-bedded Pense (silty shale) on massive Cantuar (clay) excavated fragment showing scoured interface.	1313 ft.		Figure 10
65-1-1	113273-H	Carbonized wood in silty clay, showing nearly horizontal orientation.	1355 ft.		
		Cantuari Formation; large fragment is 0.3 m long.			
65-1-2	113273-A	Carbon wood fragments in silty clay, closeup, Cantuar Formation.	1355 ft.		
65-1-3	113274-L	Discontinuous ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, general view.	1359 ft.	NE	
65-1-7	113273-D	Ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, detail, view 2.	1359 ft.	NE	

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-1-8	113273-L	Ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, detail, view 3.	1359 ft.	SE	
65-1-9	113274-J	Ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, detail, view 4.	1359 ft.	E	
65-1-10	113273-K	Ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, detail, view 4.	1359 ft.	W	
65-1-11	113273-J	Ironstone layer between carbonaceous and non-carbonaceous clays, Cantuar Formation, detail, view 5.	1359 ft.	E	
65-1-12	113273-I	Ironstone layer between carbonaceous and non-carbonaceous clay, Cantuar Formation, detail, view 6.	1359 ft.	N	
65-2-2	113257-G	Carbonized wood, top of Jurassic siltstone, excavated fragment.	1397 ft.		
65-2-3	113257-I	Conglomerate on top of Jurassic-Cretaceous unconformity, excavated fragment.	1396		Figure 11
65-2-4	149363	Coal seam, Jurassic.	1399 ft.	S	
65-2-6	113257-J	Sand-silt contact below coal seam showing steepening dip, view 1.	1399 ft.	N	
65-2-5	113257-F	Irregular sand-silt contact below coal seam, view 2.	1400 ft.	N	

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-2-7	149364	Sand-silt contact, closeup.	1400 ft.		
65-2-8	113257-D	Sand-silt contact, view 3.	1400 ft.	SE	
65-2-9	149365	Irregular bedding in clay laminated silt.	1452 ft.	S	
65-2-11	149366	Inclined contact, variegated clay with grey-green silt below.	1461.5 ft.		
65-2-13	113257-A	Mississippian-Jurassic contact, view 1, stereo L.	1464 ft.	E	
65-2-14	113257-B	Mississippian-Jurassic contact, view 1, stereo R.	1464 ft.		Figure 12
65-2-15	149367	Mississippian-Jurassic contact, closeup.	1464 ft.	E	
65-2-16	113257-C	Mississippian-Jurassic contact, showing inclined bedding above, view 3.	1464 ft.	SSE	
65-2-17	113257-H	Mississippian-Jurassic contact, showing limestone fragments in Jurassic, view 4.	1464 ft.	NE	
65-2-18	149368	Mississippian-Jurassic contact, view 5, closeup, poor photo quality.	1464 ft.	NE	
65-2-19	113257-E	Mississippian-Jurassic contact, view 6, poor quality photo.	1464 ft.	SW	
65-3-1	149370	Mississippian-Jurassic contact, variegated clay, silt of limestone, poor photo quality	1457 ft.	NE	

GSC Field No.	Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-3-3	149371	Mississippian-Jurassic contact; clay follows weathering along joint and bedding planes in carbonate,	1460 ft.	NE	
65-3-4	149372	Mississippian-Jurassic contact; clay follows weathering along joint and bedding planes in carbonate.	1454-1460 ft.	NE	
65-3-5	149373	Mississippian-Jurassic contact, Jurassic laminated silt and clay on limestone with clay in weathered jointing planes.	1454-1460 ft.	NE	
65-3-6	149374	Deeply weathered Mississippian carbonate; chert and limestone fragments in clay matrix with siderite (?) sphericles, excavated fragment.	1480 ft.		
65-3-7	149375	Deeply weathered Mississippian carbonate; much-altered limestone fragments in clay matrix	1485-1490 ft.	E	
65-3-8	149376	Deep-weathered Mississippian carbonate; non-altered limestone fragments in clay matrix	1485-1490 ft.	N	
65-3-9	149377	Irregular bedding of limestone and clay.	1485-1490 ft.	E	

GSC Field No.	Catalogue No.	Subject	Depth	Sector of Shaft wall	Reference if figured in report
65-3-10	149378	Irregular bedding, closeup.	1485-1490 ft.		
65-3-11	113276-G	Solution breccia (right) adjoining bedded Mississippian limestone below the sub-Jurassic unconformity. Souris River Formation.	1490-1495 ft. SW		
65-3-14	149394	Solution breccia (right) adjoining bedded Mississippian limestone below the sub-Jurassic unconformity. Souris River Formation, stereo view L.	1490-1495 ft.		
65-4-16	149395	Contact, Middle Member. Bakken, (silt) with Lower Member (dark shale).	1741 ft.	N	
65-4-17	149396	Contact, Middle Member. Bakken, (silt) with Lower Member (dark shale).	1741 ft.	N	
65-4-18	149397	Contact, Middle Member. Bakken, (silt) with Lower Member (dark shale).	1741 ft.	N	
65-4-20	149398	Contact, Middle Member. Bakken, (silt) with Lower Member (dark shale), light marks are water splashes; note colour boundary between red above and green below does not coincide with silt-shale interface.	1741 ft.		

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-5-1	149399	Breccia, fragments up to 45 cm across, top of Torquay Formation, (approx.) Bedded limestone, Souris Valley Formation.	1765 ft.		
65-3-14	149382	Bedded limestone, green-grey and red-brown, Souris Valley Formation.	1495 ft.	NE	
65-3-15	149383	Bedded limestone, green-grey and red-brown, Souris Valley Formation.	1537 ft.	NE	
65-3-15	149384	Bedded limestone, green-grey, red-brown, intergrading, Souris Valley Formation.	1537 ft.	NE	
65-4-2	149389	Basal contact, Souris River Formation, (limestone) on Bakken Formation, Upper Member (dark shale), view 1.	1716.8 ft.	E	
65-4-3	149390	Basal contact, Souris River Formation (limestone) on Bakken, Upper Member, (dark shale), closeup, view 2.	1716.8 ft.	W	
65-4-5	149391	Basal contact. Souris River Formation (nodular and massive limestone) on Bakken Formation, Upper Member, (dark shale).	1716.8 ft.	E	
65-4-12	149392	Laminated siltstone, Middle Member, Bakken Formation.	1733 ft.		
65-4-13	149393	Channel, upper surface of Lower Member, Bakken Formation, stereo view R.	1738.5 ft.	NE (?)	Figure 13

Field No.	CSC Catalogue No.	Subject	Depth	Sector of Reference if No.
65-4-14	149394	Channel, upper surface, Lower Member Bakken Formation, stereo view L.	1738.5 ft.	
65-5-3	149401	Breccia near top of Torquay Formation, view 1.	1765 ft.	Figure 14
65-5-4	149402	Breccia near top of Torquay Formation, view 2.	1765 ft.	
65-5-5	149403	Breccia near top of Torquay Formation, view 3.	1765 ft.	
65-5-6	149404	Breccia near top of Torquay Formation, view 4.	1765 ft.	
65-5-7	149405	Contact between light coloured siltstone, top of Torquay Formation, and underlying mudstone breccia, view 1.	1763.2 ft.	
65-5-8	149406	Contact between light coloured siltstone, top of Torquay Formation, and underlying mudstone breccia, view 2.	1763.2 ft.	
65-5-11	149407	Contact between light coloured siltstone, top of Torquay Formation, and underlying mudstone breccia, view 2, closeup.	1763.2 ft.	
65-5-12	149408	Interbedded silty dolomite in mudstone, Torquay Formation.	1801 ft.	Figure 15
65-5-13	149409	Interbedded silty dolomite in mudstone, Torquay Formation, closeup.		

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
65-5-15	149411	Undulating bedding. Typical of Torquay Formation, view 1.	1841 ft.		
65-5-16	149412	Undulating colour-banding, mottling, in brecciated silty and dolomitic mudstone, Torquay Formation, view 2.	1841 ft.		
65-5-17	149413	Bedding in banded and mottled mudstone. Torquay Formation, view 3.	1841 ft.		
65-5-18	149414	Silty, dolomitic bedding, breccia, in mottled and banded mudstone, Torquay Formation, view 4.	1841 ft.		
65-6-9	201887-T	Basal contact, Torquay (mottled mudstone) on irregular surface of Birdbear (pale anhydrite and dolomite), view 1.	1882 ft.		
65-6-10	201887-U	Basal contact, Torquay (mudstone) on irregular Birdbear anhydrite and dolomite, view 2.	1882 ft.		
65-6-11	201887-V	Basal contact, Torquay (mudstone) on irregular Birdbear anhydrite and dolomite, view 3.	1882 ft.		
65-6-14	201887-W	Basal contact, Torquay (mudstone) on irregular Birdbear anhydrite and dolomite, view 4.	1882 ft.		
66-2-4	20188-H	Bedding near top of Davidson Member, banded anhydrite and dolomite, Souris River Formation	2775 ft.	S	

Appendix III (b)  
List of photographs showing stratigraphic dated on shaft wall,  
Sylvite Shafts

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
68-4-6	149490	Glacial till, No. 1 Shaft.	37-40 ft.	NW	
68-4-14	149494	Glacial till, No. 1 Shaft, view 1.	50 ft.		
68-4-15	149495	Glacial till, No. 1 Shaft, view 2.	50 ft.		
68-4-9	149491	Ironstone lense in Upper Cretaceous shale, Riding Mountain Formation, No. 2 Shaft; scale shown by hose diameter of $2\frac{1}{2}$ inches (5.1 mm)	419 ft.	E	
68-4-13	149493	Slickenside zone, Upper Cretaceous shale, Riding Mountain Formation, No. 2 Shaft.	419-421 ft.	SSW	
68-4-17	149496	Slickensided zone, Upper Cretaceous shale, Riding Mountain Formation, No. 2 Shaft, view 1.	432 ft.	ENE	
68-4-18	149497	Slickensided zone, Upper Cretaceous shale, Riding Mountain Formation, No. 2 Shaft, view 2.	432 ft.	ENE	
68-4-19	149498	Glauconitic sandy zone, Upper Cretaceous shale, Riding Mountain Formation, No. 2 Shaft.	493 ft.	N	

Field No.	GSC Catalogue No.	Subject	Depth	Sector of Shaft Wall	Reference if figured in report
68-4-20	149499	Concretionary Zone, Upper Cretaceous shale, Riding Mountain, No. 2 Shaft.	495.5 ft.	N	
69-3-6	201888-Z	Contact, Jurassic sand on Mississippian Souris River carbonate; carbonate fragments elongate, inclined.	1473 ft.		
69-3-9	201936	Contact, Jurassic on Mississippian Souris Valley; inclined bedding in carbonate.	1473 ft.		
69-3-12	201936-F	Contact, Jurassic on Mississippian carbonate; inclined bedding with "weathered" coating in carbonate, closeup view.	1473 ft.		
69-3-13	201936-A	Contact, Jurassic on Mississippian carbonate; inclined bedding with "weathered" coating in carbonate, distant view.	1473 ft.		
69-3-14	201936-B	Contact, Jurassic sand/clay on Mississippian; distorted bedding in sand.	1473 ft.		
69-3-15	201936-C	Contact, Jurassic sand on Mississippian carbonate, on inclined surface.	1473 ft.		
69-3-16	201936-D	Chert nodules in Mississippian carbonate, Souris Valley Formation.	1508 ft.		
69-3-17	201936-E	Chert nodules in Mississippian carbonate, closeup.	1508 ft.		

Report on 11 conodont samples from the Souris Valley Formation,  
International Minerals and Chemical K2 Shaft,

by A.C. Higgins and B.J. Dougherty

Stratigraphy

Souris Valley  
Fm. 1495 -  
1500 ft. from  
top of shaft.  
Wt. of sample  
485 g.

Souris Valley  
Fm. 1500 -  
1505 ft. from  
top. Wt. 449 g.

Souris Valley  
Fm. 1515 -  
1520 ft. from  
top. Wt. 503 g.

Souris Valley  
Fm. 1520 -  
1525 ft. from  
top. Wt. 355 g.

Locality, Conodonts & Age

16 km due east of town of Esterhazy,  
SE Saskatchewan; NTS 62L9,  
1sd. 7, sec. 27. tp. 19, rge. 32, west 1

*Siphonodella isosticha* (Cooper)

Age: *Siphonodella isosticha* - Upper  
*S. crenulata* Zone, middle  
Tournaisian (Tn2a-c).

Remarks: CAI 1 - 1.5

*Siphonodella isosticha* (Cooper)

Age: *Siphonodella isosticha* - Upper  
*S. crenulata* Zone, middle  
Tournaisian (Tn2a-c).

Remarks: CAI 1.5

*Gnathodus delicatus* Branson & Mehl  
*Siphonodella isosticha* (Cooper)

Age: *Siphonodella isosticha* - Upper  
*crenulata* Zone, middle  
Tournaisian (Tn2a-c)

Remarks: CAI 1.5

*Siphonodella isosticha* (Cooper)  
*Siphonodella* cf. *isosticha* (Cooper)  
*Gnathodus delicatus* Branson & Mehl  
*Bispathodus aculeatus* (Branson & Mehl)  
*Polygnathus communis* *communis* Branson & Mehl  
*Hindeodella ibergensis* Bischoff  
*Lonchodina* sp.

GSC Loc. No.

C-108378

<u>Stratigraphy</u>	<u>Locality, Conodonts &amp; Age</u>	<u>GSC Loc. No.</u>
	Age: <i>Siphonodella isosticha</i> - Upper <i>crenulata</i> Zone, middle Tournaisian (Tn2a-c).	
	Remarks: CAI 1-1.5	
Souris Valley Fm. 1525 - 1530 ft. from top. Wt. 257 g.	<i>Spathognathodus</i> sp.	
	Age: indeterminate.	
Souris Valley Fm. 1530 - 1535 ft. from top. Wt. 344 g.	<i>Bispaphodus aculeatus</i> (Branson & Mehl) <i>Gnathodus punctatus?</i> (Cooper)	
	Age: upper <i>Sandbergi</i> - L. <i>crenulata</i> Zones, middle Tournaisian (Tn2a, b)	
	Remarks: CAI 1.5	
Souris Valley Fm. 1535 - 1540 ft. from top. Wt. 483 g.	<i>Bispaphodus aculeatus</i> (Branson & Mehl) <i>Siphonodella obsoleta</i> Hass	
	Age: <i>Sandbergi</i> - L. <i>crenulata</i> Zones middle Tournaisian (Tn2a,b)	
	Remarks: CAI 1.-1.5	
Souris Valley Fm. 1540 - 1545 ft. from top. Wt. 480 g.	<i>Siphonodella cooperi</i> Hass morphotype 2 <i>Siphonodella obsoleta</i> Hass <i>Siphonodella cf. isosticha</i> (Cooper) sensu Klapper 1971 <i>Polygnathus communis communis</i> (Branson & Mehl) <i>Falcodus leptus</i> Cooper <i>Ligonodina</i> sp.	
	Age: upper <i>Sandbergi</i> - L. <i>crenulata</i> Zones middle Tournaisian (Tn2a, b)	
	Remarks: 1.5	
Souris Valley Fm. 1545 - 1550 ft. from top. Wt. 474 g.	<i>Elictognathus laceratus</i> (Branson & Mehl) <i>Angulodus walrathi</i> (Hibbard) <i>Dinodus leptus</i> Cooper <i>Falcodus angulus</i> Huddle	
	Age: <i>Sandbergi</i> - L. <i>crenulata</i> Zones middle Tournaisian (Tn2a, b)	
	Remarks: CAI 1	

<u>Stratigraphy</u>	<u>Locality, Conodonts &amp; Age</u>	<u>GSC Loc. No.</u>
Souris Valley Fm. 1555 - 1560 ft. from top. Wt. 410 g.	<i>Falcodus angulus</i> Huddle <i>Siphonodella obsoleta</i> Hass Age: <i>Sandbergi</i> - <i>L. crenulata</i> Zones middle Tournaisian (Tn2a, b)	
	Remarks: CAI 1	
Souris Valley Fm. 1567 - 1578 ft. from top. Wt. 489 g.	<i>Siphonodella obsoleta</i> Hass <i>Polygnathus communis</i> <i>communis</i> Branson & Mehl Age: <i>Sandbergi</i> - <i>L. crenulata</i> Zones middle Tournaisian (Tn2a, b)	
	Remarks: CAI 1 - 1.5	

Comments on the Age of the upper part of the Souris Valley Formation.

The conodont faunas of Early Carboniferous age have been studied in great detail by Sandberg and Gutschick in Utah and by Klapper (1966) in Montana, Wyoming and South Dakota, and a detailed zonation, based mainly on the species of the genus *Siphonodella* has been proposed by Sandberg et al (1978). In the Esterhazy Shaft, because the samples were small, not all of these zones can be recognized, but the following summary indicates that at least three zones should be present.

Souris Valley Formation, Esterhazy, Shaft

1495 - 1525 feet *Siphonodella isosticha* - Upper *crenulata* Zone.

1525 - 1578 feet *Siphonodella sandbergi* - Lower *crenulata* Zones

The lower two zones should be separable when more samples have been processed.

Thermal Maturity of the upper part  
of the Souris Valley Formation

The conodont faunas have been examined by J. Dougherty who has assessed their maturity in terms of the Epstein et al (1977) scale. This scale and its relationship to both the palynomorph and vitrinite reflectance scales are given below.

Conodonts		Palynomorphs		Vitrinite	
CAI	Temperature °C	Translucency Index (Amoco)	Weight percent Carbon in Kerogen	Reflectance	Percent Fixed Carbon
1	<50-80	1-5	<82	<0.8	<60
1/2	50-90	5-up.5	81-84	0.7-0.85	60-65
2	60-140	5-6	81-87	0.85-1.3	65-73
3	110-200	up. 5-6	83-89	1.4-1.95	74-84
4	190-300	6	84-90	1.95-3.6	84-95
5	300-400	up. 6-7	+90	+3.6	+95

The Souris Valley conodont faunas fall between CAI (conodont alteration index) 1 and 1.5 which indicates that the rocks are mature enough for oil generation and would fall within the oil window. To a certain extent surface preservation and size of the specimens have influenced the CAI readings. Higher CAI readings were obtained from larger specimens and/or specimens with poor surface preservation. The best estimate which can be given, indicates that the specimens average out at the higher end of CAI 1. This would still indicate mature rocks.

References

- Epstein, S.G., Epstein, J.B., & Harris, L.D., 1977. Conodont Color Alteration - an index to Organic Metamorphism. U.S.G.S. Prof. Paper 995, 27 pp.
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- Sandberg, C.A., Gutschick, R.C., 1979. Guide to Conodont biostratigraphy of Upper Devonian and Mississippian Rocks along Wasatch Front and Cordilleran Hingeline, Utah. Brigham Young Univ. Geology Stud., 26, 3, 107 - 133.
- \_\_\_\_\_, Ziegler, W., Leuteritz, K. & Brill, S.M., 1978. Phylogeny, speciation and zonation of Siphonodella (Conodonta, Upper Devonian and Lower Carboniferous). News1. Stratr. 7, 102-120.