

Project 8403

The Martin Group, Beaverlodge Area

by P.K. Mazimhaka¹ and H.E. Hendry¹

Mazimhaka, P.K. and Hendry, H.E. (1984): The Martin Group, Beaverlodge area; *in* Summary of Investigations 1984, Saskatchewan Geological Survey; Saskatchewan Energy and Mines, Miscellaneous Report 84-4.

The area of the present study of the Martin Group and related rocks extends from the shores of Beaverlodge Lake to Tazin Lake in the north, Jug Bay in the southwest and Charlot Point in the west (Fig. 1). During the 1984 field season, work was confined mainly to the vicinity of Uranium City, where detailed stratigraphic sections were measured through the four formations of the Martin Group (Fig. 2).

Parts of the Martin Group have been studied and mapped several times in the past, most notably by Tremblay (1972). Maps and surveys of adjacent areas of the Martin Group and crystalline basement have been made by Christie (1953), Langford (1981) and Sibbald and Lewry (1980). A compilation geological map at 1:100,000 scale is also available (Macdonald, this volume). Sedimentological studies of the Martin have been conducted by Elliott (1982), Langford (1981) and Macey (1973). The stratigraphic subdivisions of Langford (1981) have been used in this report.

Sub-Martin Unconformity

The unconformity below the sedimentary rocks of the Martin Group was developed on the granitic, quartzitic and amphibolitic rocks referred to in earlier reports as the Tazin Group. The irregular topography of the unconformity, emphasized by Tremblay (1972), Langford (1972) and Macey (1973), is particularly well displayed east and southeast of Eldorado, around the Lorado mill, along the Lodge Bay road south of Beaverlodge Lake and east of Fredette Lake. Mapping of the unconformity has shown that the conglomerates and breccias in the lower part of the Beaverlodge Formation fill steep-sided basins up to 1000 m deep. In the vicinity of Eldorado townsite and the Fay shaft, and southwards towards Umisk Island, the basement surface forms a series of ridges and valleys along an eastward-facing scarp. The scarp is up to 300 m high but erosional

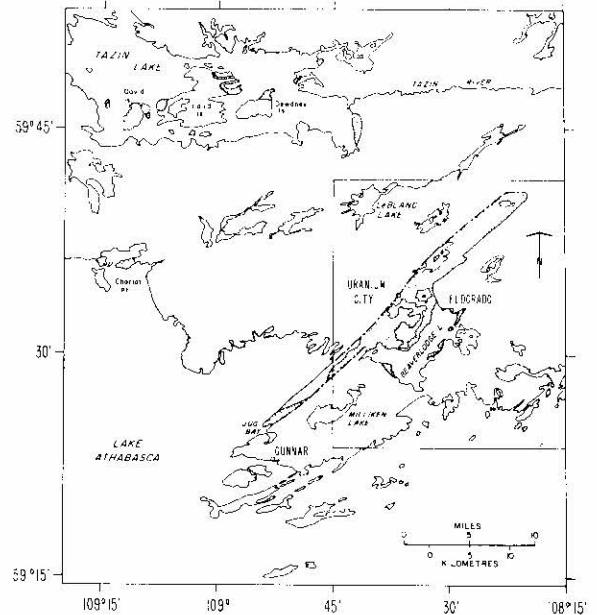


Figure 1 - Location map of the Martin Group, Greater Beaverlodge area.

relief on the surface could have been much less if the scarp developed by faulting during deposition of the Beaverlodge. In the area of the Lorado mill the basal breccias of the Beaverlodge fill a re-entrant in a 1400 m high scarp which faces southwest. The erosional relief that must have existed before deposition of the Martin Group is very difficult to determine.

Beaverlodge Formation

The Beaverlodge Formation (Langford, 1981) includes all of the basal conglomerate and part of the lower arkose of Tremblay (1972). The nature and thickness of the formation, and its relationship to the underlying basement, vary from place to place. The best picture of the features of the formation is obtained if it is described separately at each of the localities where it is well developed. There are good exposures of the Beaverlodge Formation around the Fay shaft and Eldorado townsite, along the south side

¹Department of Geological Sciences, University of Saskatchewan, Saskatoon. Project supported by contracts with the Saskatchewan Geological Survey in 1983-85.

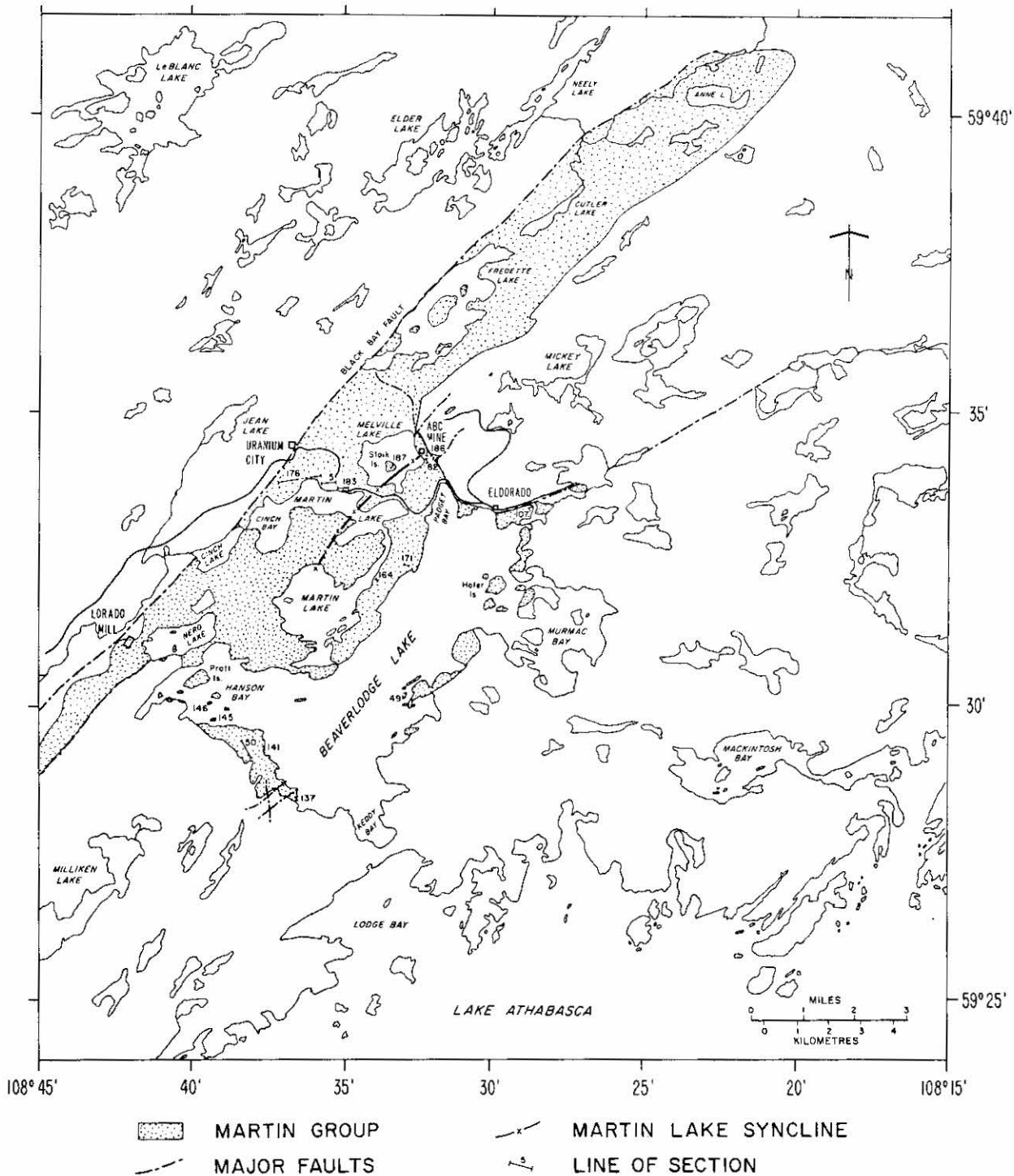


Figure 2 - Outcrop map of the Martin Group, Greater Beaverlodge area.

of Beaverlodge Lake, on Umisk Island and the neighbouring mainland, near Lorado mine and mill, and around Fredette and Anne Lakes (Fig. 2).

Fay Shaft and Eldorado:

Near the Fay shaft the basal conglomerate is thin and contains beds of siltstone (0 to 37.5 m in Fig. 3); clast size decreases

upwards from cobble (249 mm) to pebble (44 mm) and the thickness of siltstone beds increases upwards from a few centimetres to 20 m (Fig. 3). Individual conglomerate beds are finer grained towards their tops; bedding is mainly horizontal but there are a few planar crossbeds. Above the interbedded siltstone and conglomerate (37.5 m to 53.5 m) there are thin, lenticular cobble-grade (140 mm to 250 mm) conglomerates interlayered with medium- to very coarse grained sandstones. Bed thickness of the sandstones increases up-section. The sandstones and siltstones contain load deformation structures, wave and current ripple marks, sandstone dykes and desiccation cracks. The section is topped by a thick conglomerate (37.5 m to top) that passes into pebbly

sandstones and interbedded sandstones and siltstones to the southwest.

South of Beaverlodge Lake:

In this area the lowermost 21.5 m of the formation are composed of cobble conglomerates interbedded with coarse-grained and very coarse grained sandstones; bed thicknesses are from 1 to 4 m for the conglomerates and from 2 to 5 m for the sandstones (Fig. 4). From 21.5 m to 126 m the rocks are well-bedded and well-sorted cobble conglomerates which become finer grained up-section; the conglomerates generally overlie scoured surfaces on thin sandstone beds. The rest of the measured section consists of 370 m of pebbly sandstone, pebble- and cobble-grade conglomerates and coarse-grained sandstone, with abundant trough cross-bedding, scour channels, planar cross-bedding, horizontal bedding and some ripple cross-lamination. When allowance is made for gaps in the middle and top of the section, the total thickness of the Beaverlodge Formation here is estimated to be about 1150 m. Paleocurrents from the trough cross-bedding indicate southwesterly flow.

Umisk Island and Surrounding Area:

On Umisk Island and on the mainland to the northwest, the basal conglomerate is cobble to boulder grade and is up to 300 m thick. It is very crudely bedded and poorly sorted, and contains some imbrication indicating flow to the southeast. Deposition was on southeasterly-facing scarps with slopes of up to 60°. On the peninsula to the southwest of Umisk Island, the basal conglomerate is very thin and accumulated on a surface with a slope of less than 20° to the south. It appears that the thickest conglomerates were deposited on topographically lower parts of the pre-Martin surface, perhaps on the downthrown sides of faults.

Lorado Mill and Surrounding Area:

The basal conglomerate in the area of the Lorado mill may be as much as 1500 m thick, although the rock is very poorly bedded and in many places it is impossible to measure dip and strike, thereby making estimates of thickness difficult. The scarp against which the conglomerates were banked was steep and faced south. Changes in clast composition up-section from predominantly quartzitic to granitic indicate gradual unroofing of the granitic rocks presently exposed in spheroidally weathered masses at the Lorado mill.

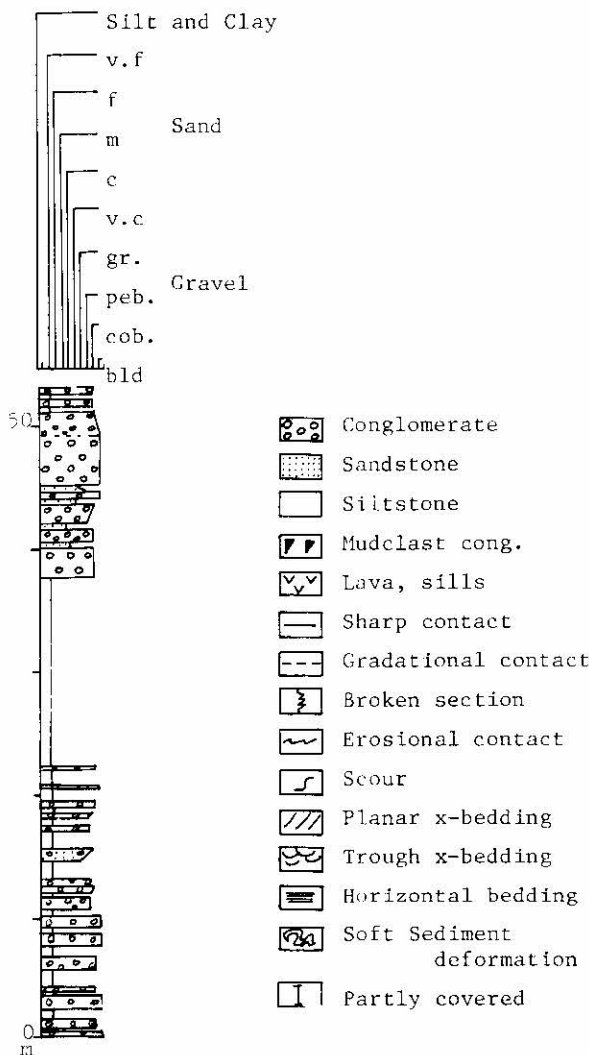


Figure 3 - Stratigraphic section of the lower part of the Beaverlodge Formation north and west of the Fay shaft, Eldorado mine (locality 107 on accompanying map).

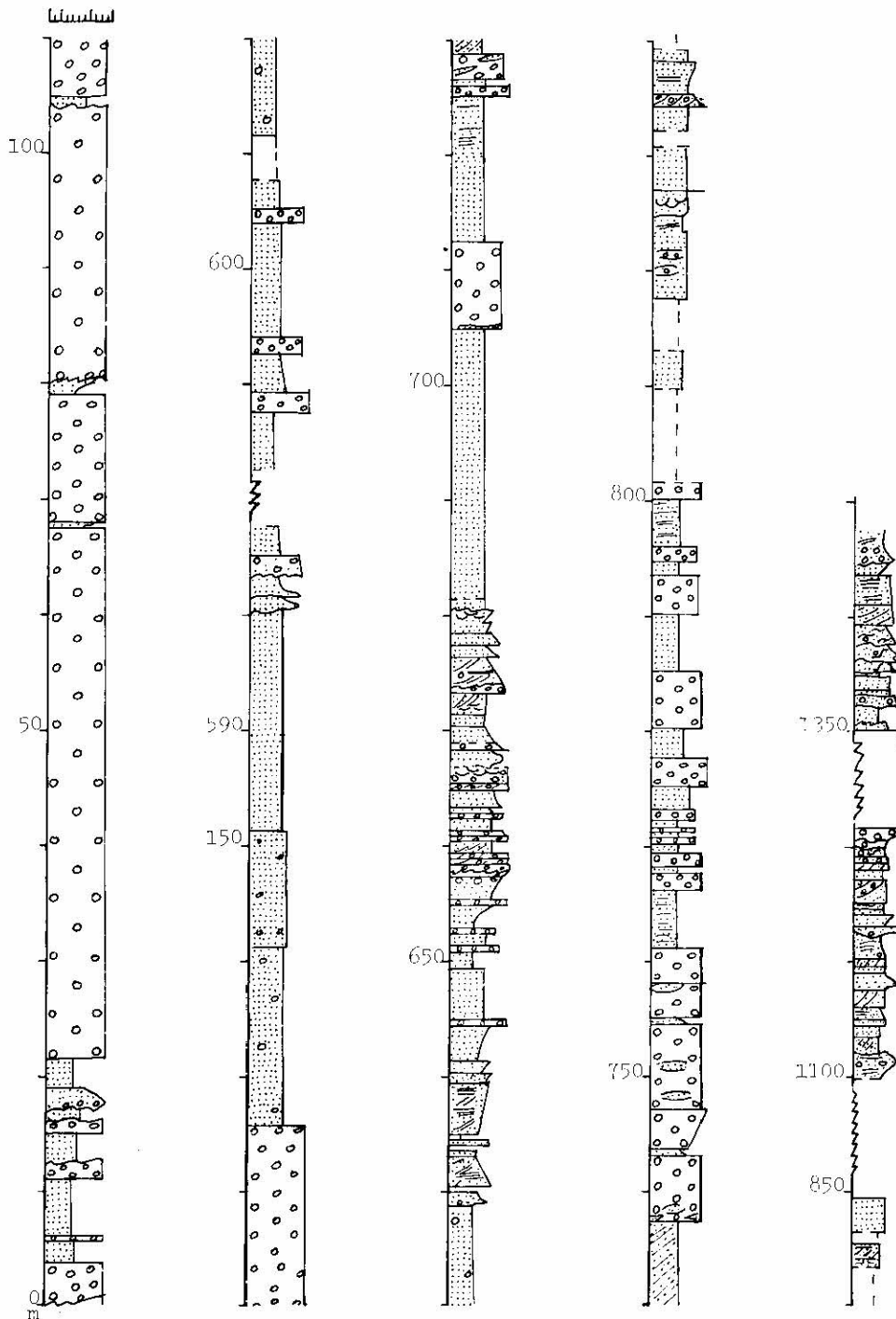


Figure 4 - Stratigraphic section of the Beaverlodge Formation south of Beaverlodge Lake (localities 137, 141, 50, 145 and 146 on accompanying map).

Fredette Lake and Anne Lake:

The Beaverlodge Formation is poorly exposed in these areas but the basal conglomerate overlies a fairly even surface of low relief. The conglomerate is about 600 m

thick in the Fredette Lake area and thins to 400 m in the Anne Lake area. It is overlain by a 300 m thick siltstone in the Fredette Lake area and an 800 m thick sandstone. In the Anne Lake section there is no siltstone and the sandstone is up to 500 m thick.

Within the conglomerates of the Beaverlodge Formation there is a wide range of textures and structures. Where the basal conglomerate of Tremblay (1972) is thick, it is poorly sorted and poorly bedded and contains such angular clasts in some places that it would be better termed a breccia; deposition likely was as talus, or from rock falls or torrential floods. Higher in the formation, the conglomerates are better sorted, contain mainly rounded clasts, and are both horizontally and cross-bedded; they are interbedded with sandstones and thin siltstones and were likely deposited in braided streams.

Gillies Channel Formation

Elliott (1982) subdivided the Gillies Channel Formation into a basal conglomerate (500 to 600 m), a central sandstone (800 to 1500 m) and an upper sandstone and volcanic unit (800 m).

The conglomerate is exposed best on Pratt Island in the west and on small islands off the eastern shore of Beaverlodge Lake, but the central sandstone is very poorly exposed around Padget Bay and north of Nero Lake. The estimated thickness of the conglomerate and sandstone is 1000 m in the Beaverlodge and Nero Lakes area, and at least 1500 m between Gillies Channel and the islands south of Hofer Island.

The central sandstone consists of coarse-grained sands, grey to red and purplish-grey pebbly sandstones, and pebble to small cobble conglomerates; it is poorly exposed and mostly covered by the waters of Beaverlodge Lake. The lower part of the sandstone is interbedded with conglomerates on the small islands off the eastern shore of Beaverlodge Lake (Fig. 5). It occurs as horizontally and cross-bedded units up to 30 cm thick. The conglomerates are well bedded (0.50 to 1.50 m thick), well sorted and of pebble to small cobble grade (30 to 95 mm). The cobbles are rounded to subrounded and some appear to have been derived from the Beaverlodge Formation. The contacts between sandstones and overlying conglomerates are commonly erosional with deep scours. The sandstone is coarse to very coarse and grey, chocolate brown, greyish-green or purple.

The upper sandstone unit consists of up to six lava flows, interbedded with sills and sandstone beds. The most complete sequence, although poorly exposed, occurs along the eastern shore of Cinch Lake and the western shore of Cinch Bay (Fig. 6 and accompanying map), where three sills and three lava flows

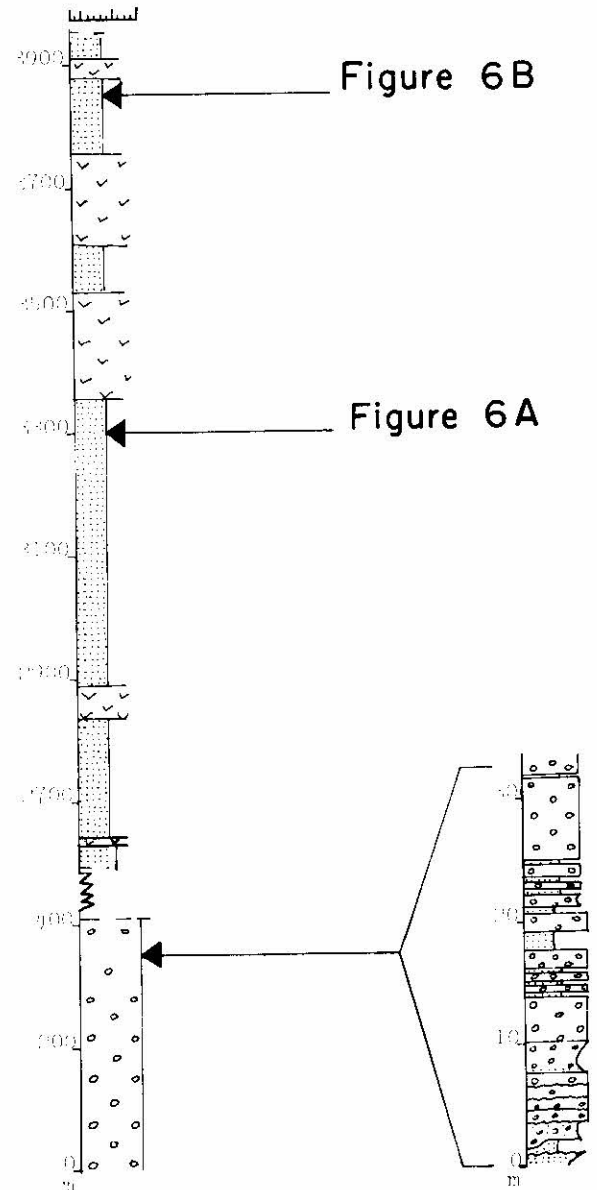


Figure 5 - Stratigraphic section of basal conglomerate and part of central sandstone, Gillies Channel Formation, islands in the eastern part of Beaverlodge Lake (locality 49 on accompanying map).

are interbedded with sandstones. The sills occur stratigraphically below the lava flows. The number of sills in the eastern part of the Gillies Channel Formation is not known. Assuming the same stratigraphic relationships throughout the formation, there may be some sills beneath Beaverlodge Lake. The flows number up to seven in the exposed section between Martin and Beaverlodge Lakes. The lava flows range from 50 to 150 m thick and Tremblay (1972) gives a comparable thickness for the sills. There is both structural and textural evidence for multiple

flows within each unit, as pointed out by Tremblay (1972).

The sandstones interbedded with or intruded by volcanic rocks and gabbroic sills are generally coarse and pebbly. The rocks range from small cobble conglomerates to medium-grained arkose. Although the larger clasts (pebbles and cobbles) commonly occur at the base of sand units, in the foresets of cross-beds or scattered in the sand, there are some discrete pebble and small cobble (30 to 90 mm) conglomerate units. Silt- and clay-grade rocks are very rare in the Gillies Channel Formation. Rocks of the Gillies Channel Formation form an overall upward-fining sequence and contain a number of small-scale (5 to 10 m) upward fining sequences (Fig. 6). The commonest structures in this unit are trough cross-beds that fill steep-sided scours, planar cross-beds up to 20 cm thick, horizontal bedding and laminations. Some soft-sediment deformation was observed at one locality in the lower part of the sequence.

Seaplane Base Formation

The Seaplane Base Formation is very well exposed along the shores of Martin Lake and in roadcuts between Uranium City and Eldorado, as well as to the west and south of

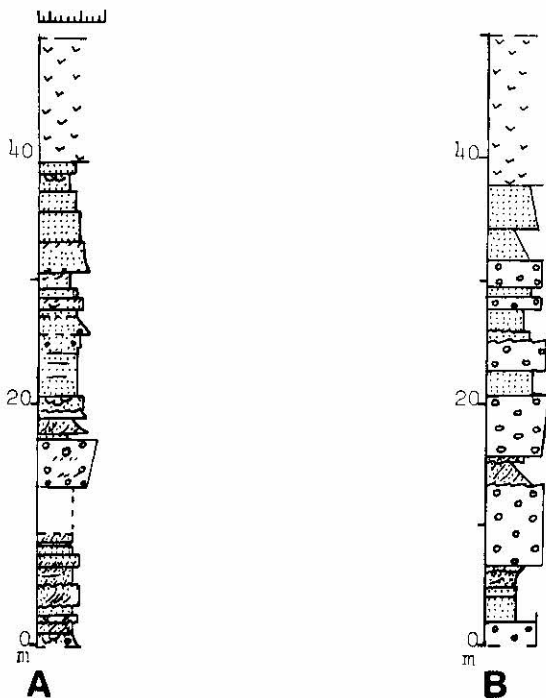


Figure 6 - Stratigraphic section of part of the upper sandstone, Gillies Channel Formation, between Beaverlodge Lake and Martin Lake (localities 171 and 164 on accompanying map).

Uranium City (see accompanying map). The formation consists of interbedded conglomerates, sandstones and mudstones, and is conglomeratic in the western and northern parts of the Martin Lake Syncline and sandy in the south and east. The total thickness is 1800 m and both the base and top are gradational. The sandstones of the Seaplane Base Formation are distinctively more red and generally better sorted than those of the Gillies Channel Formation. Langford (1981) drew the boundary on the basis of this distinction, but Elliot argued that such a distinction was too subtle to be easily recognized in the field and favoured placement of the boundary at the top of the uppermost lava flow. Langford's boundary criteria have been used in this report.

In the best-exposed, almost continuous section through the Seaplane Base Formation, the following major subdivisions can be recognized (Figs. 5, 6 and 7):

- 1) A lowermost unit of conglomerate and sandstone interlayered with thin siltstone beds (only the top 17.5 m is shown in Fig. 7).
- 2) A middle conglomerate, up to 80 m thick, consisting of upward-fining and trough cross-bedded units. The conglomerate is commonly of small cobble to pebble (24 to 65 mm) grade. The conglomerate-sand couplets thin up-section from a thickness of up to 20 m to less than 10 m (Fig. 7, 17.5 m to 109 m). The contacts between the couplets are scoured and the intensity of scouring, steepness of foresets in trough cross-beds and number of intraformational conglomerates increase upwards.
- 3) A sandstone unit, up to 300 m thick, interbedded with siltstone (109 m to 400 m). The sandstone is coarse- to very coarse grained and pebbly in places.
- 4) The uppermost part (up to 900 m), including the transition to the Melville Lake Formation, consists of conglomerates interbedded with sandstones, and mudstone drapes on rippled sandstones and siltstones (Figs. 8 and 9). Both upward fining and coarsening units, up to 30 m thick, occur in this part of the formation. The most common structures are ripple marks, mudcracks, sand dykes, intraformational conglomerates and scours.

In the area south and east of Martin Lake (see accompanying map), the Seaplane Base Formation contains very little conglomerate and consists mainly of sandstone with some siltstone beds up to a few centimetres thick. If the formation is followed along

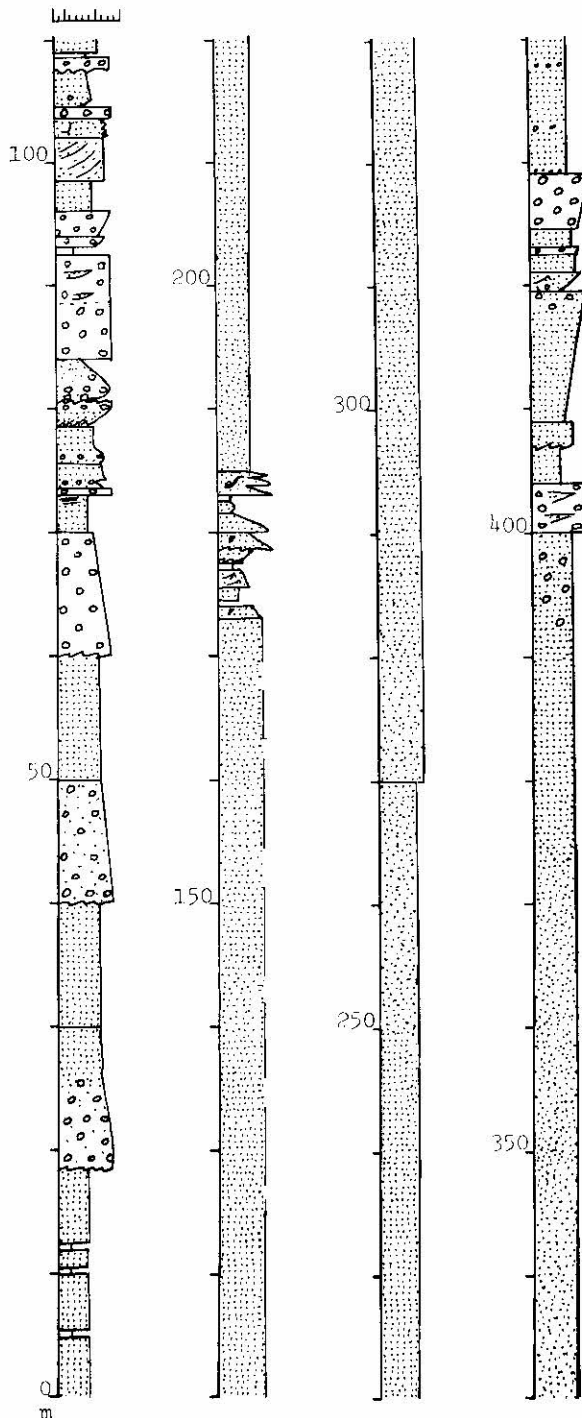


Figure 7 - Stratigraphic section of part of Seaplane Base Formation, northwest of Martin Lake (locality 176 on accompanying map). This section includes only the uppermost 17.5 m of lowermost unit in the formation. The section is continued in Fig. 6.

strike around the trend of the Martin Lake Syncline, the sequence changes from interbedded sandstones and conglomerates to

trough cross-bedded sandstones with some rippled sandstones and siltstones and then to planar-bedded sandstones with some rippled beds and mud drapes. This facies change indicates dispersal of the Seaplane Base sediments from the north and northwest. In both the conglomeratic and sandy parts of the formation, there is abundant evidence of repeated changes in the flow power, during which periods of gravel or sand transport alternated with periods of stagnation and mud deposition. Most of the Seaplane Base Formation has been interpreted as the product of deposition by repeated floods in a system of interconnected channels. Paleocurrent directions from cross-bedding indicate a mainly southeasterly flow.

Melville Lake Formation

The Melville Lake Formation includes all of Tremblay's (1972) siltstone member (Unit 26). He described it as a chocolate red siltstone interbedded with arkose and conglomerate.

The formation is well exposed in the road cuts along the Uranium City - Eldorado road, on Stoik Island and in the vicinity of the ABC mine. The base of the Melville Lake Formation is gradational and marked by an increase in the thickness of siltstone beds, as well as an abrupt colour change from pink to brown. The transition from the Seaplane Base Formation is fairly well exposed at the Fredette Lake road junction and in outcrops along the Fredette Lake road. The eastern part of the sequence is not so well exposed, but some of the lowermost rocks crop out by the Melville Lake road junction.

Whereas the southern part of the Melville Lake Formation is chocolate red (Tremblay, 1972) and dark red to maroon (Langford, 1983), the central and northeastern part is rather reddish pink and very similar to the Seaplane Base Formation.

Short sections (50 to 80 cm) have been measured along the Eldorado road, on Stoik Island and at the ABC mine (Fig. 10 and accompanying map). The lower part of the Melville Lake Formation has a higher proportion of silt and clay beds than the upper part (Fig. 10). Tremblay (1972) estimated the silt and clay in the Melville Lake Formation to be 60 percent. At the ABC mine clay and silt constituted up 24 percent of the section (Fig. 10C); up-section at the northern adit (Fig. 10D) the section contains 2 percent silt and clay beds, 7 percent conglomerates and 91 percent fine-grained sandstone.

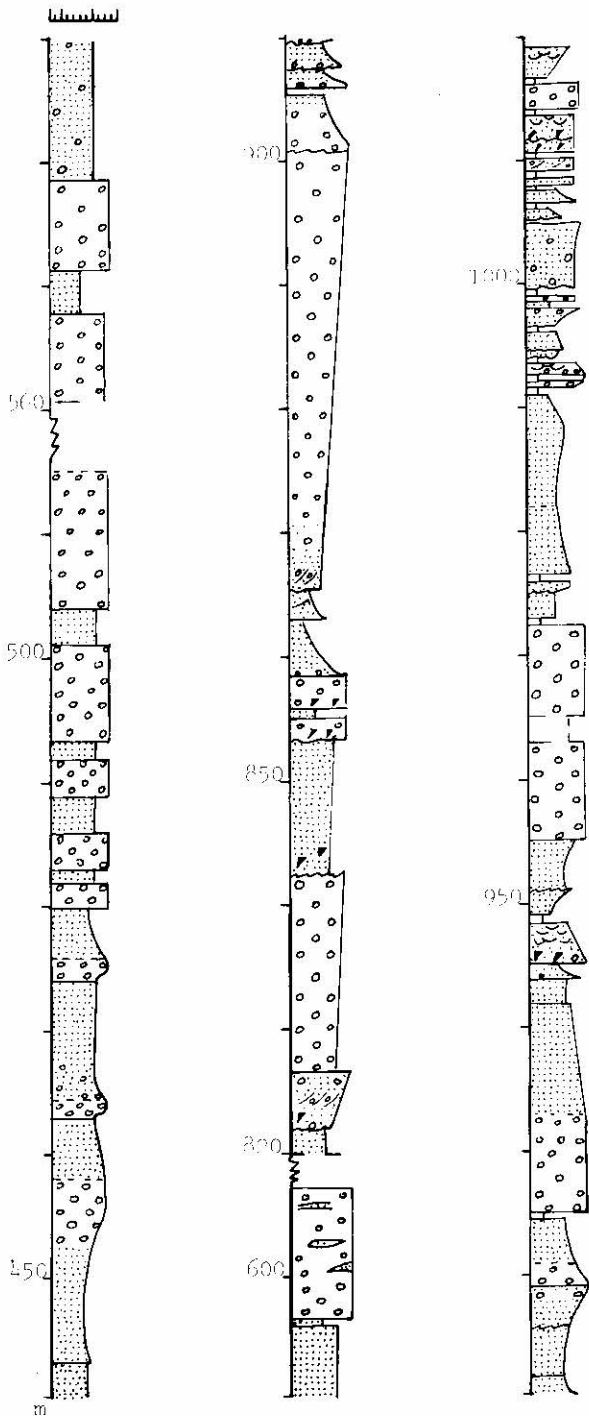


Figure 8 - Seaplane Base Formation. Continuation of section from Fig. 5 (locality 176 on accompanying map).

Although there is an increase in the proportion of sand upwards through the measured sections, the sand is fine to medium grained throughout the section (Fig. 10). Individual sand units (1.5 to 3 m) fine upward, although a few upward-coarsening units do occur (Fig. 10).

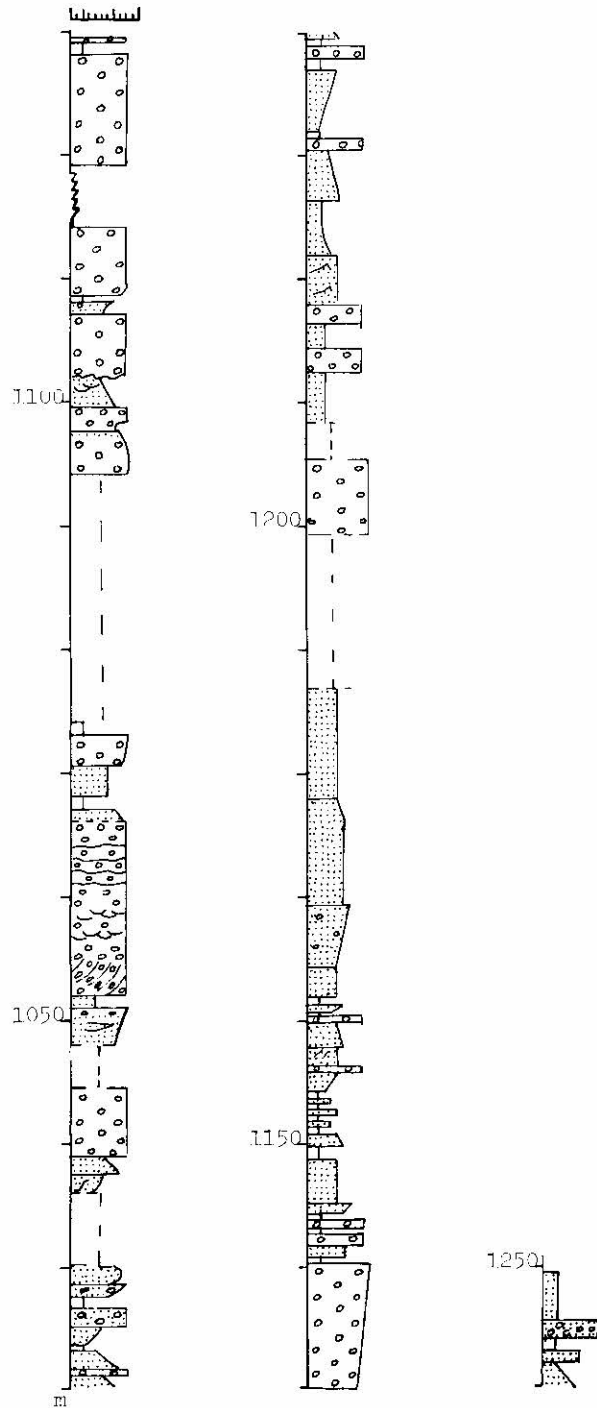


Figure 9 - Uppermost part of Seaplane Base Formation. Continuation of section from Fig. 6 (locality 5 on accompanying map).

The lowermost part of the Melville Lake Formation is characteristically thin bedded, less than 1.5 m for sand beds and a few centimetres for the silt and clay beds. The most common structures are ripple marks, mudcracks, sandstone dykes and mud drapes.

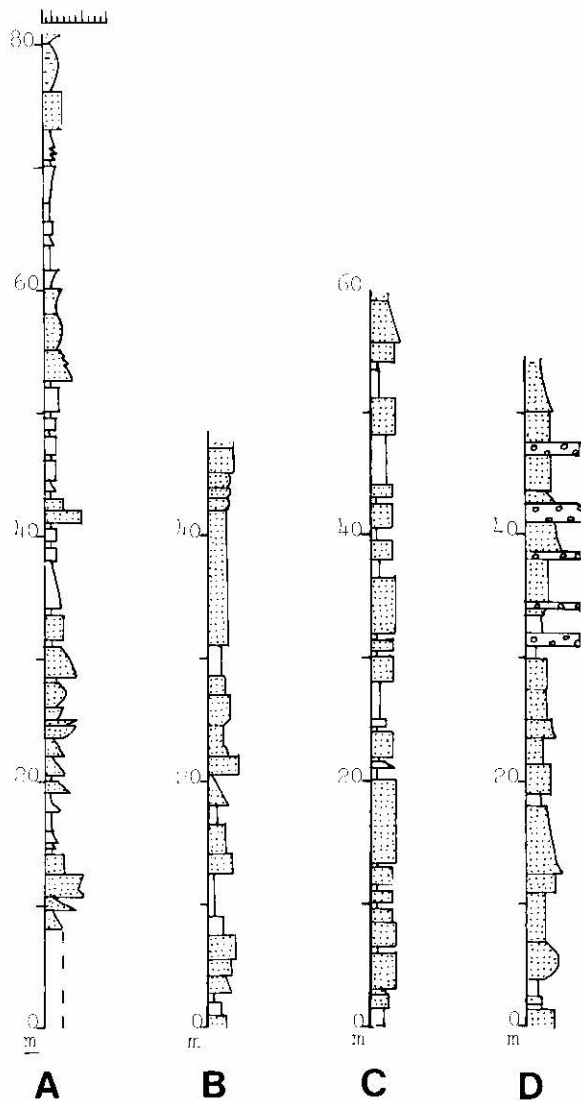


Figure 10 - Stratigraphic sections in Melville Lake Formation: (A) roadcut section (locality 183 on accompanying map); (B) Stoick Island (locality 187); (C) ABC mine (locality 82); (D) ABC mine (locality 186). Section A is stratigraphically lowest, section D is the highest.

The ripple marks are commonly symmetrical. There is some soft sediment deformation and very few intraformational clasts compared to the Seaplane Base Formation immediately below. The lower units of the Melville Lake Formation are typically chocolate brown and some of the clay beds are green or spotty green to chocolate pink; the sandstone is generally orange pink.

The middle part of the Melville Lake Formation, as it is exposed on Stoick Island and at the ABC mine (Figs. 10B and C), consists of thicker sandstone beds (up to 4 m thick) and contains fewer clay and silt beds than the lower part; the clay occurs as

drapes on rippled sandstones. The most common structures are ripple marks, both symmetrical and straight crested, mudcracks, sandstone dykes and, less commonly, intraformational clasts. Along the western shoreline of Melville Lake the thin siltstones are chocolate brown and the sandstone is very coarse and pebbly.

The uppermost exposed 50 m of the Melville Lake Formation consists of upward-fining, medium- to very fine grained and well-indurated pink sandstones (Fig. 10D). The sandstone beds are thick (up to 4 m), graded and gravelly in places. Towards the top of the section, thin conglomerate beds are interbedded with fine-grained sandstones. Ripple marks are less common, as are mudcracks and sand dykes.

Stromatolites have been found in scattered boulders of a pebble conglomerate at the ABC mine adit but the original bed described by Tremblay (1972) was not traced.

Summary and Conclusions

- 1) A total of 4193 m of section has been measured at the 1:50 scale in the Martin Group of the Beaverlodge area.
- 2) The general trend from bottom to top of the Martin Group is one of decreasing grain size, which is likely a result of basin-filling accompanied by lowering of relief in the source area.
- 3) In the early stages of basin development, during deposition of the Beaverlodge Formation, very coarse gravels accumulated adjacent to active faults in a series of small basins. Sequences of talus, alluvial fan and stream flood deposits up to 1600 m thick accumulated in parts of the basin where subsidence was most rapid. Well-sorted sands and thin-bedded gravels were deposited on slowly subsiding blocks as the initial irregularities were blanketed by sediment. Dispersal of sediment during deposition of the Beaverlodge Formation was mainly to the southwest, south and southeast.
- 4) Structural instability within the basin continued during deposition of the Gillies Channel sediments, but the pattern of sedimentation seems to have been relatively simple with more or less westward and southwestward dispersal of sands and gravels in braided streams. Lavas and sills were fed by fissures through the basement and the underlying Beaverlodge Formation.

- 5) The transition to the Seaplane Base Formation marks a change in dispersal pattern. Thickness changes, facies variations and sedimentary structures indicate that the sediments were transported to the east and southeast. The braided streams that carried the sediments had highly fluctuating discharges and shifting channels. Introduction of coarse-grained conglomerates near the top of the sequence may indicate tectonic rejuvenation of the source area.
- 6) The change to deposition of the relatively fine grained sediments of the Melville Lake Formation was gradual and could have resulted from reduction in relief of the source area, or scarp retreat and increasing isolation of the gravel source. The rocks are mainly the result of deposition in ephemeral lakes. Conglomerates may represent floods from adjacent alluvial fans.
- 7) There are clearly visible upward trends in grain size, both fining and coarsening, on several scales from thousands of metres to a few centimetres, that are likely related to factors such as rates of subsidence and intensity of tectonic activity, scarp retreat, migration of depocentres, geologically short-term climatic fluctuations, channel migration and periodic floods. Analysis of the measured sections is continuing in an attempt to evaluate the relative importance of each of these.

References

- Christie, A.M. (1953): Goldfields - Martin Lake map area, Saskatchewan; Geol. Surv. Can., Mem. 269.
- Elliot, C.G. (1982): A description of the Gillies Channel Formation, Martin Group; in Summary of Investigations 1982, Sask. Geol. Surv., Misc. Rep. 82-4, p31-38.
- Langford, F.F. (1981): The Martin Group in the greater Beaverlodge area; in Summary of Investigations 1981, Sask. Geol. Surv., Misc. Rep. 81-4, p38-43.
- Macey, G. (1973): A sedimentological comparison of two Proterozoic red bed successions (the South Channel and Kazan Formations of Baker Lake, N.W.T. and the Martin Formation at Uranium City, Saskatchewan); unpubl. M.Sc. thesis, Carleton Univ., Ottawa.
- Sibbald, T.I.I. and Lewry, J.F. (1980): Uranium metallogenic studies: Lodge Bay area, Lake Athabasca; in Summary of Investigations 1980, Sask. Geol. Surv., Misc. Rep. 80-4, p44-48.
- Tremblay, L.P. (1972): Geology of the Beaverlodge mining area, Saskatchewan; Geol. Surv. Can., Mem. 367.

