GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

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PRELIMINARY NOTES ON THE PROTEROZOIC HURWITZ GROUP, TAVANI (55 K) and KAMINAK LAKE (55 L) AREAS, DISTRICT OF KEEWATIN

(Report and 11 figures)

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Illustrations

ABSTRACT

The initial results of a continuing stratigraphic and sedimentological study of the Hurwitz Group and related rocks are summarized. The Hurwitz Group and related rocks are largely confined to two down-folded and faulted belts – the Kaminak belt in Kaminak Lake map-area (55L) and the Whiterock belt in Tavani map-area (55K).

The Hurwitz Group in these areas is divisible into seven distinct mappable units. Exposure is poor to mediocre except for the orthoquartzite units which form the 'backbone' of the Hurwitz Group and have been considered to be the most typical lithology.

The studies have established sedimentological trends suggesting that the southwest end of the Kaminak belt and the area southwest of Kaminak Lake map-area may be favourable for exploration for uraniferous (and auriferous) placer deposits but in Tavani area conditions are not auspicious.

PRELIMINARY NOTES ON THE PROTEROZOIC HURWITZ GROUP, TAVANI (55K) AND KAMINAK LAKE (55L) AREAS, DISTRICT OF KEEWATIN.

INTRODUCTION

The area is about 250 miles north of Churchill, Manitoba and lies within the region mapped in 1952 by the Geological Survey of Canada on its first helicopter supported survey (Lord, 1953). Observations made within this and adjacent areas led Wright (1955) to define the Hurwitz Group. After detailed studies in the Kognak River area, Eade (1964, 1966) subsequently refined the stratigraphy of the Hurwitz Group. Davidson (1968) and Heywood (1968) have recently completed more detailed studies of the geology of the Kaminak Lake and Tavani areas.

The present work was initiated principally as a stratigraphic and sedimentological study of the Hurwitz Group with the purpose of determining the stratigraphic relationships within the group and with similar sedimentary rocks tentatively assigned to it. This report presents field data obtained during the summer of 1967. Refinement of the stratigraphy of the Hurwitz Group is presented, but no new lithostratigraphic names are proposed; instead, the group's subdivisions are designated by upper case letters, i.e., Hurwitz A. Hurwitz G. These informal stratigraphic units are briefly described with an outline of the dispersal patterns determined.

Transportation in the field was supplied under contract with Lamb Airways and Autair Helicopter Services. The author wishes to acknowledge the cheerful and able services of the air crews. The author was ably assisted by H. Stewart. My colleagues, A. Davidson, K.E. Eade, and W.W. Heywood provided much assistance and information in the initial phases of the work and have continued to be sources of much encouragement.

STRATIGRAPHY

The author recently outlined a preliminary subdivision of the Hurwitz Group into (1) a conglomeratic succession, an orthoquartzite succession, a mudstone succession, and a volcanic succession, and (2) a younger unnamed succession of impure quartzites, and feldspathic and micaceous sandstones. This report discusses these units in greater detail with minor revisions of earlier estimates of thicknesses (Bell, 1968). Figures 1 and 2 illustrate the areal distribution, and Figures 3 to 8 illustrate the structural configuration of the Hurwitz and its subdivisions.

The unnamed succession was mapped previously with what is now known as the Hurwitz Group (Lord, 1953; Wright, 1955) and for simplicity is herein referred to as Hurwitz G, although there is some evidence suggesting that it should be separated from the Hurwitz terminology (Bell, 1968).

Ms. received 8 May, 1968

Preliminary observations on the Hurwitz-like sediments at Rankin Inlet and metasediments north of Kaminak Lake are summarized at the end of this section.

Conglomeratic Sequence

Hurwitz A

Hurwitz A is limited to the southwestern end of the Kaminak belt (Figs. 2, 7, and 8) and is best exposed along the southern limb of the syncline southwest of the northwest corner of Kaminak Lake. The unit is about 300 feet thick at section I-J and together with Hurwitz B may be as much as 1,000 feet thick near Carr Lake.

Polymictic boulder-, cobble-, and pebble-conglomerates are characteristic of Hurwitz A. The framework is typically open and comprises rounded pink, grey and green granitic and dioritic clasts and subangular greenstone clasts, with subordinate rounded to subangular chert, quartz, quartzite, jasper and slate fragments. The matrix is commonly light to medium green and brown, poorly sorted, feldspathic, quartzose and chloritic siltstone and sandy siltstone. Boulders are common near Carr Lake but the maximum size of the framework constituents decreases to pebble-size as the unit thins to the northeast.

Hurwitz B

This unit is limited to the southwest end of the Kaminak belt. Although generally poorly exposed, there is sufficient outcrop about 20 miles from the northwest end of Kaminak Lake to determine that the unit is about 600 feet thick (section I-J, Fig. 8). The thickness decreases eastwards to less than 100 feet near the north-central shore of Kaminak Lake (Fig. 7). Bedding surfaces are poorly defined.

Hurwitz B is typically a grey, green, and brown, micaceous, siliceous siltstone, but locally contains gritty and pebbly bands.

Although the contact with the overlying orthoquartzites is nowhere satisfactorily exposed nowhere does it appear to be other than conformable. The thinning of Hurwitz A and B together is possibly due to facies change but it is possible that the conglomeratic succession is slightly truncated at a shallow angle by the orthoquartzite succession to the northeast.

Orthoquartzitic Sequence

Hurwitz C

This unit is limited to the southwest end of the Kaminak belt and is well exposed. Best exposure is about 20 miles southwest from the northwest end of Kaminak Lake on the north limb of the synclinorium where it is about 900 feet thick. The unit thins towards Quartzite Lake where it may be only about 20 feet thick.

White, pink, and light greenish grey, medium- to coarse-grained and gritty, slightly feldspathic orthoquartzites typify Hurwitz C. Disperse tiny grains of jasper characterize the lower part of the unit. The sandstones are well-sorted, thickly bedded, well-indurated, and locally exhibit planar cross-stratification that suggests sediment transport from the south

Exposure of the contacts near Quartzite Lake is poor. On the north limb of the syncline at Quartzite Lake the lower part of the succession contains a few poorly exposed lenses of pinkish, quartz-pebble conglomerate.

Hurwitz D

This unit forms the 'backbone' of the Hurwitz Group in Tavani and Kaminak Lake areas; its excellent exposure in prominent ridges contrasts sharply with the poor exposure of preceding and succeeding units, with the exception of Hurwitz F. One of the many excellent exposures of Hurwitz D is 3 miles northwest of the west end of Whiterock Lake where it is about 850 feet thick (Fig. 4, near A). The unit is characterized by uniformity of thickness and appearance from the north shore of Kaminak Lake to Whiterock Lake.

Pink and white, fine-grained orthoquartzite typifies Hurwitz D. The orthoquartzites are characteristically thinly bedded, well-sorted, very well indurated, and spectacularly ripple-marked (Fig. 10). Planar cross-stratification occurs in thin tabular units largely in the lower half of Hurwitz D, but is not common. Cross-stratification data from Hurwitz D suggests sediment transport from the southeast, and is in agreement with asymmetric and gymmetric ripple-mark data of more than 500 measurements from 20 stations which show a consistent pattern of sediment transport from the southeast. Desiccation cracks are very rare, and were seen at only four locations; it appears that these structures are restricted to the upper 50 feet of Hurwitz D.

In the Whiterock belt, basal relations are obscure as there is usually a 50- to 200-foot recessive and covered interval between the orthoquartzites and the Archean basement. In this interval are scattered frost boils containing pink and red, sheared, slightly hematitic quartzite and phyllite fragments, and more rarely, brown and pink grit and pebble fragments. About 3 miles northwest of the west end of Whiterock Lake the lower 20 feet of Hurwitz D contains less indurated quartz arenites and a few thin beds of red mudstone. At locations R and S (Fig. 2) the quartzite directly overlies granitoid and metavolcanic rocks without either a basal gritty and arkosic zone or a regolith.

Mudstone Sequence (Hurwitz E)

This unit outcrops very poorly in the Tavani and Kaminak Lake areas, as does its apparent correlative in the Kognak River area (Fig. 9; also Eade, 1964 and 1966). Slaty fragments littering the ground in topographically low areas may be the only evidence of the presence of this unit. The best exposure is at the southern end of the Whiterock belt. In the Whiterock belt Hurwitz E is estimated to be about 800 feet thick and in the Kaminak belt about 700 feet thick. Local variations from these thicknesses are probably due to folding and faulting.

Grey, black, brown, green, and red mudstones typify Hurwitz E. Commonly the mudstones display thin bedding laminations and graded bedding in the coarser units. The rocks usually display a prominent steeply dipping slaty cleavage.

At Quartzite Lake a pink, cherty aphanitic dolostone member about 50 feet thick displays intraformational conglomerates and large collenia-like stromatolites (usually about 4 to 7 inches thick and 10 to 50 inches in diameter, Fig. 11). This member lies about 50 to 150 feet above Hurwitz D. In the southern half of the Whiterock belt dolomitic fragments litter the ground near the top of Hurwitz D and one exposure of pink aphanitic dolostone indicates a thin dolostone member at the base of the Hurwitz E.

Volcanic Sequence (Hurwitz F)

Hurwitz Fa

This unit outcrops only in the Kaminak belt and is best exposed along the north shore of Kaminak Lake and the south shore of the west arm of Quartzite Lake. The unit is cut by numerous faults and shear zones and it is difficult to assess an accurate thickness. No succeeding units are present, and therefore only a minimum thickness can be determined.

Hurwitz Fa comprises greenish grey and green fine-grained volcanic rocks, minor slates, argillites and tuffs. The volcanic rocks are commonly structureless, but locally are pillowed and have aphanitic selvedges and irregular chert lenses between the pillows. Mafic minerals, largely hornblende and actinolite, with some chlorite and epidote, together with lath-shaped andesine, are the major constituents with pyrite, magnetite, and leucoxene as common accessory minerals. Minor amounts of quartz, in part introduced, is present in some flows. In other flows calcite has selectively replaced much of the feldspar; elsewhere the feldspar is completely altered.

Hurwitz Fb

Gabbroic lenses occur in both belts, either within the upper half of Hurwitz E or capping it. The exception to this generalization is at Quartzite Lake where the gabbro cuts Hurwitz D at a shallow angle to the bedding on the east side of the north arm of Quartzite Lake and gradually rises in the succession to the top of Hurwitz E to the southwest. This intrusion is roughly parallel with the top of Hurwitz D on the north side of the west arm of Quartzite Lake. The intrusion becomes concordant at the base of the volcanic suite.

In the Whiterock belt (and indeed in the Kognak River area, and even as far west as Watterson Lake), small sills and discontinuous pods, 50 to 300 feet thick, intrude Hurwitz E about 500 to 700 feet from the base of the mudstone unit.

Amphibole and chlorite, derived from pyroxene that is present as rare relics, and highly altered plagioclase, are major constituents with magnetite, pyrite, epidote, chalcopyrite, leucoxene, calcite, quartz, and biotite as common minor constituents. The sills have fine-grained margins and the enclosing mudstones are hard and baked in appearance along a contact zone about 1 foot to 2 feet wide.

The relationship between the gabbro and Hurwitz Fa suggests that these rocks are probably coeval. It is difficult to distinguish fine phases of the gabbro intrusion from some of the flows in Hurwitz Fa.

Unnamed Group (Hurwitz G)

Hurwitz G outcrops in the Whiterock belt, and similar rocks are present on Pork Peninsula. The best exposures of Hurwitz G are about 20 miles southwest of Whiterock Lake. Although no contact relationships are directly observable, mapping in this region suggests that Hurwitz G has a minimum thickness of about 1,800 feet and lies with slight unconformity upon Hurwitz E.

Hurwitz G is typified by pink and brown, and subordinate grey and green, quartzose, micaceous, lithic, and feldspathic sandstone; locally it may be calcareous. In some places the unit contains pods and lenses of red, pink, and greenish grey silty mudstone; in others it is marked by thin festoon cross-stratification, and more rarely by ripple-marks. A quartzite-pebble conglomerate lens occurs at the base at the southwest end of the Whiterock belt (Fig. 3, loc. T).

In contrast to Hurwitz D paleocurrent data for Hurwitz G indicate sediment transport from the southwest.

Sediments on Pork Peninsula are similar to, and tentatively correlated with Hurwitz G. They differ from those of the Whiterock belt in that greenish grey and coarser textured sandstones predominate over the pink and brown beds. No contact relationships were observed on Pork Peninsula, but it appears that Hurwitz G directly overlies Hurwitz D. Indeed at the western end of the basin, Hurwitz G may overlie Archean greenstones, but exposures are not satisfactory to resolve this relationship unequivocally.

Marble Island Quartzites

Along the north shore of Rankin Inlet a succession of thinly bedded, ripple-marked, white, pink, and grey quartzites are at least 600 feet thick. These strata overlie, with apparent conformity, about 1,000 feet of interbedded greenstones, phyllites, and carbonate rocks. The latter appear to overlie Archean greenstones unconformably. Robert Bell (1885, 1887) briefly described and named the quartzites after Marble Island, including within this formation those quartzites at Nevill Bay and at White Rabbit Lake (Whiterock Lake ?) on which he had reports only. Tyrrell (1898) retained Bell's nomenclature and extended it to include quartzites in the Kaminak and Whiterock belts.

The author suggests tentative retention of the term 'Marble Island Quartzites' only, for the rocks at Rankin Inlet and Marble Island and the use of the now widely accepted name Hurwitz Group for the quartzites and related rocks just described south and west of Corbett Inlet. The author briefly examined the quartzites and associated rocks at Rankin Inlet, finding differing stratigraphic succession, and also that the quartzites are somewhat chloritic near the base and dolomitic throughout, features not observed in Hurwitz C or D. Moreover they are more highly deformed and metamorphosed. In addition, ripple-mark data from the quartzites at Rankin Inlet suggest transport from the south-southwest. Poorly exposed metagreywackes, in places conglomeratic, structurally overlie the quartzites at Rankin Inlet.

MacKenzie Lake Metasediments

About 25 miles northwest of Quartzite Lake there is a belt of highly deformed and poorly exposed metasedimentary rocks that are similar to the Hurwitz Group only in that they contain a very pure, thinly bedded quartzite unit and a granite-boulder metaconglomerate unit. The succession contains units of granite-boulder metaconglomerate, quartz-mica schist, metaquartzite and associated quartz-pebble oligomictic metaconglomerate. Contact relations between the lithologic units, and with the basement are obscure. Cordierite knotted schists present in the metagreywackes immediately south of this succession are almost certainly correlative with the Archean greywackes near the Kaminak belt.

DISCUSSION

The Quartzite Problem

The quartzites in the Kaminak and Whiterock belts, and most of the Marble Island quartzites, are remarkably pure and fine-grained. It is difficult to imagine a primary source, and conditions of weathering and dispersal that would give rise to sediments of such compositional and textural maturity other than older quartzites. The presence of orthoquartzite pebbles in the lowermost conglomerates in the Kaminak belt strongly suggests that the succeeding quartzites are at least second cycle. If this is true then correlation of all dominantly quartzite basins in the District of Keewatin becomes suspect.

On the basis of close compositional, textural, and structural features, coupled with sequential stratigraphic similarities, it is a simple matter to correlate the Hurwitz Group, and individual components from the Whiterock belt to the Kaminak belt, and hence to the Padlei and Kognak River basins (Fig. 9). In contrast, there are sufficient differences between the Marble Island quartzites and those of the Whiterock belt, 35 miles apart, to suggest that they are not correlative. Also, it appears impossible to correlate the MacKenzie Lake metasediments with the sediments of the Kaminak belt, less than 25 miles away.

Therefore, keeping in mind the strong probability that Hurwitz quartzites are second (or higher order) cycle mature sediments, caution must be used in correlating the 'Hurwitz' rocks north of Baker Lake with the

Hurwitz of the Whiterock, Kaminak, and Kognak basins, a minimum distance of about 130 miles.

Age Relationships

Robert Bell (1885, 1887) and Tyrrell (1898) were the first to study these rocks and to suggest that they are Huronian. Scattered radiometric dates support this view in general. Lord (1953), Wright (1955), and Stockwell (1964) interpret the Hurwitz as Proterozoic and more precisely as Early Proterozoic (Aphebian of Stockwell, 1964). There is no special problem in fitting the 'true' Hurwitz rocks and all Hurwitz-like rocks which may be considerably older or younger than the Hurwitz Group into the Aphebian Era (730 m.y.).

Figure 9 summarizes the author's views on correlation of the Hurwitz Group.

Uraniferous Deposits

If sedimentary origin of the uraniferous deposits at Elliot Lake, Ontario, is accepted then Early Proterozoic rocks such as the Hurwitz bear close inspection. It is worth noting here that no Hurwitz rocks of the Tavani and Kaminak Lake areas were observed to resemble the ore-bearing Matinenda Formation of the Elliot Lake area (Roscoe, 1957). If any such rocks are present, they may be in the covered zones along the edges of the Whiterock belt, although the author thinks this unlikely. Pink and red hematitic beds are present within the Hurwitz Group, and are characteristic of the lower beds of the orthoquartzite units. In contrast, hematitic beds are totally absent in the uraniferous beds of the Elliot Lake area (Roscoe, personal communication).

Heywood and Roscoe (1967) and Bell (1968) briefly visited the Padlei area about 35 miles southwest of Carr Lake and discovered quartz-pebble, pyritic conglomerates (accompanied by higher than normal scintillometer readings) in the Hurwitz Group. These conglomerates are probably older than Hurwitz D. Trends established in this study in the Kaminak Lake and Tavani areas suggest that more favourable areas for uranium-bearing conglomerates lie southwest of the Kaminak belt, probably in the Kognak River and Padlei basins.

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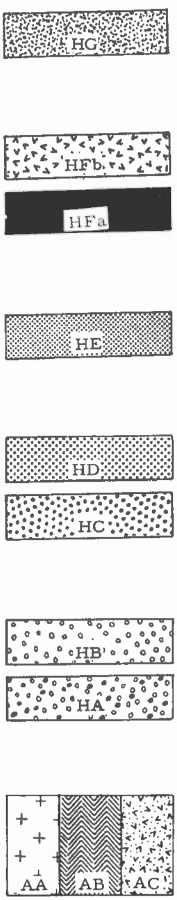
Figure 1. LEGEND HURWITZ GROUP FOR FIGURES 4 TO 8



PROTEROZOIC (APHEBIAN?)

Unnamed Group (Hurwitz ?): HG

Grey, pink, brown, and green quartzose, micaceous, feldspathic and lithic sandstone; minor mudstone and conglomerate.

Hurwitz Group Volcanic Sequence: HFa & HFb

Light to medium green-grey volcanic rocks; massive to pillowed; inter-related mudstones and tuff.

Gabbro.

Mudstone Sequence: HE

Black, grey, and varicoloured mudstone and siltstone; minor pink dolomite.

Orthoquartzite Sequence: HC & HD

White and pink, fine-grained orthoquartzite; thin bedded, ripple-marked.

Pink, white, and grey, coarse- to medium-grained orthoquartzite; thick bedded to massive; minor grit and quartz-pebble conglomerate; minor hematitic sandstone.

Conglomeratic Sequence: HA & HB

Green-grey and brown siltstone; minor pebbly bands.

Grey and green-grey, polymictic, pebble to boulder conglomerate and conglomeratic siltstone.

ARCHAEAN

AA, largely granitoid rocks; AB, largely sedimentary and meta-sedimentary rocks; AC, largely volcanic and metavolcanic rocks.

penetrative cleavage

fault

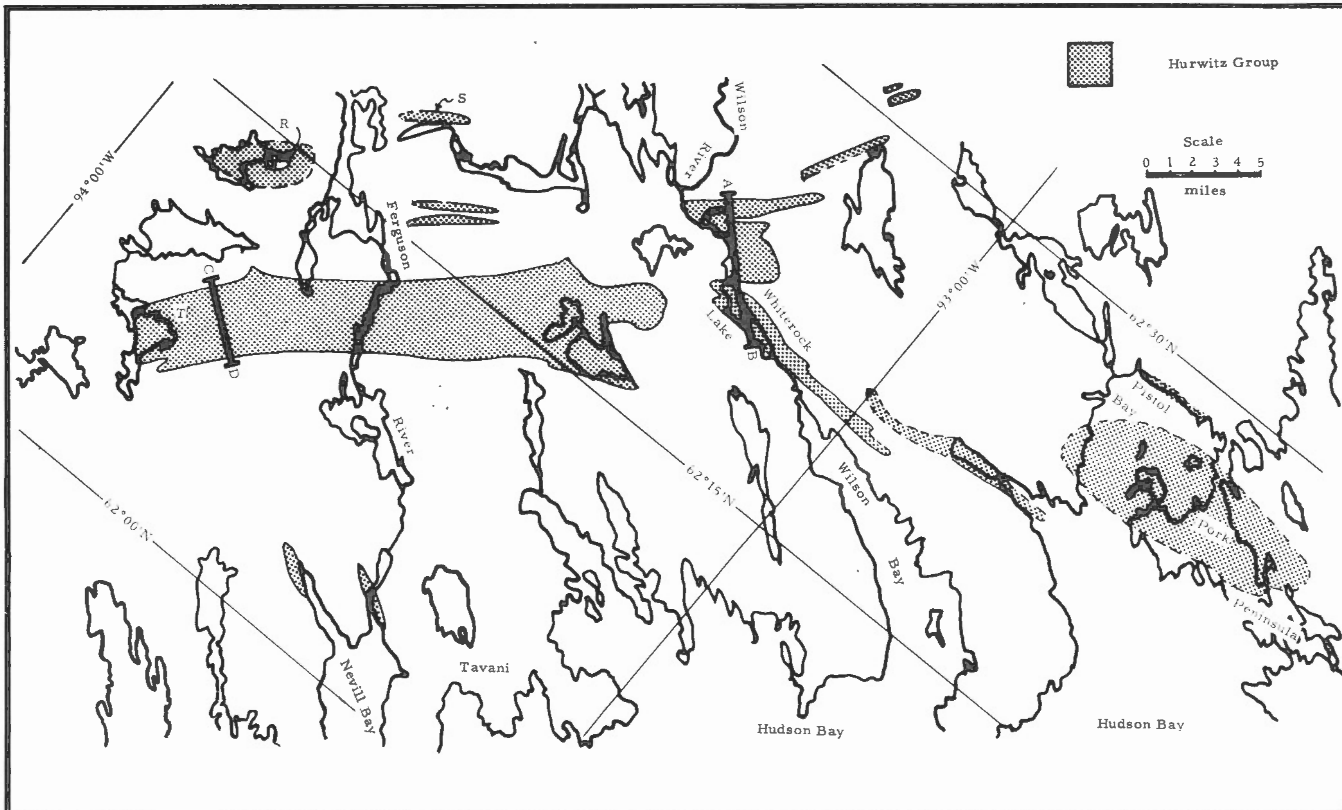


Figure 2: Map of Whiterock Belt

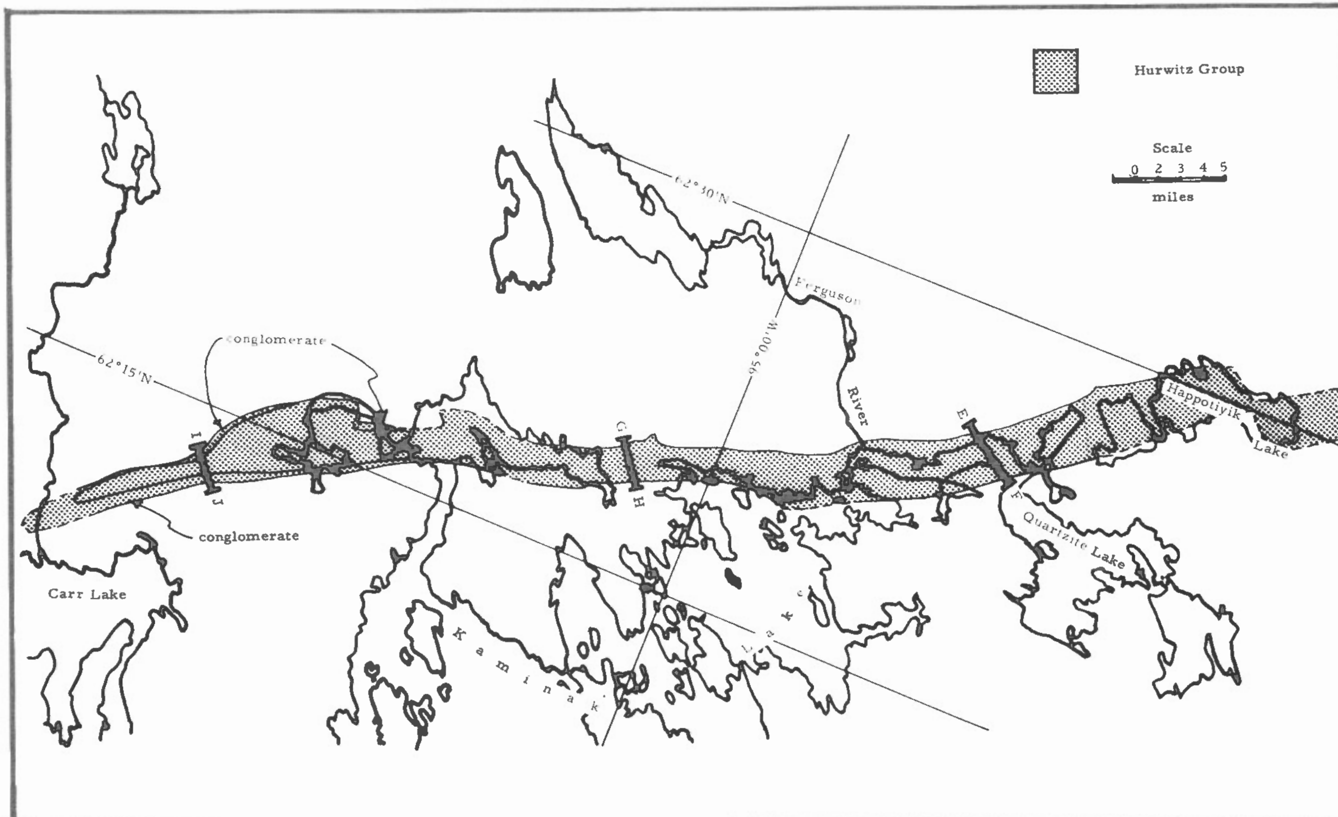


Figure 3: Map of Kaminak Belt

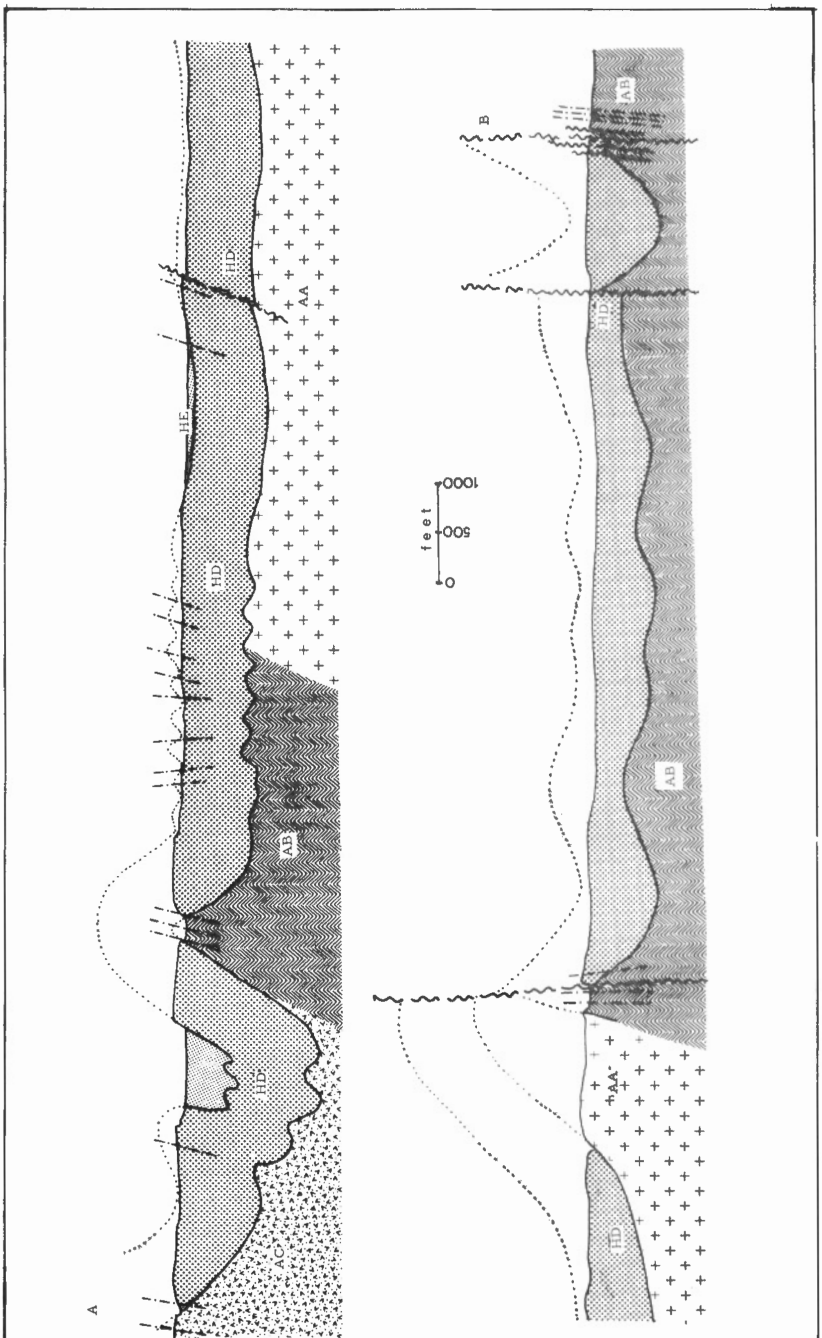


Figure 4: Cross-section AB, Whiterock Belt

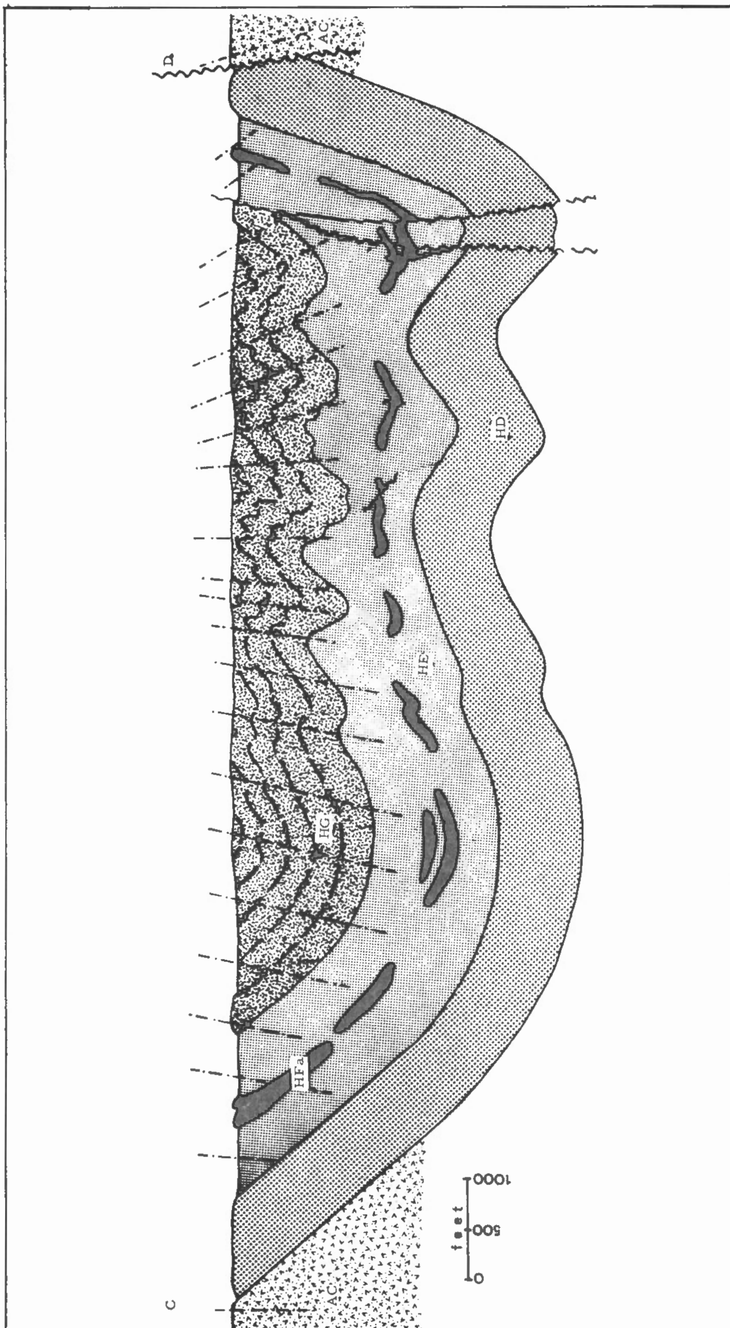


Figure 5: Cross-section CD, Whiterock Belt

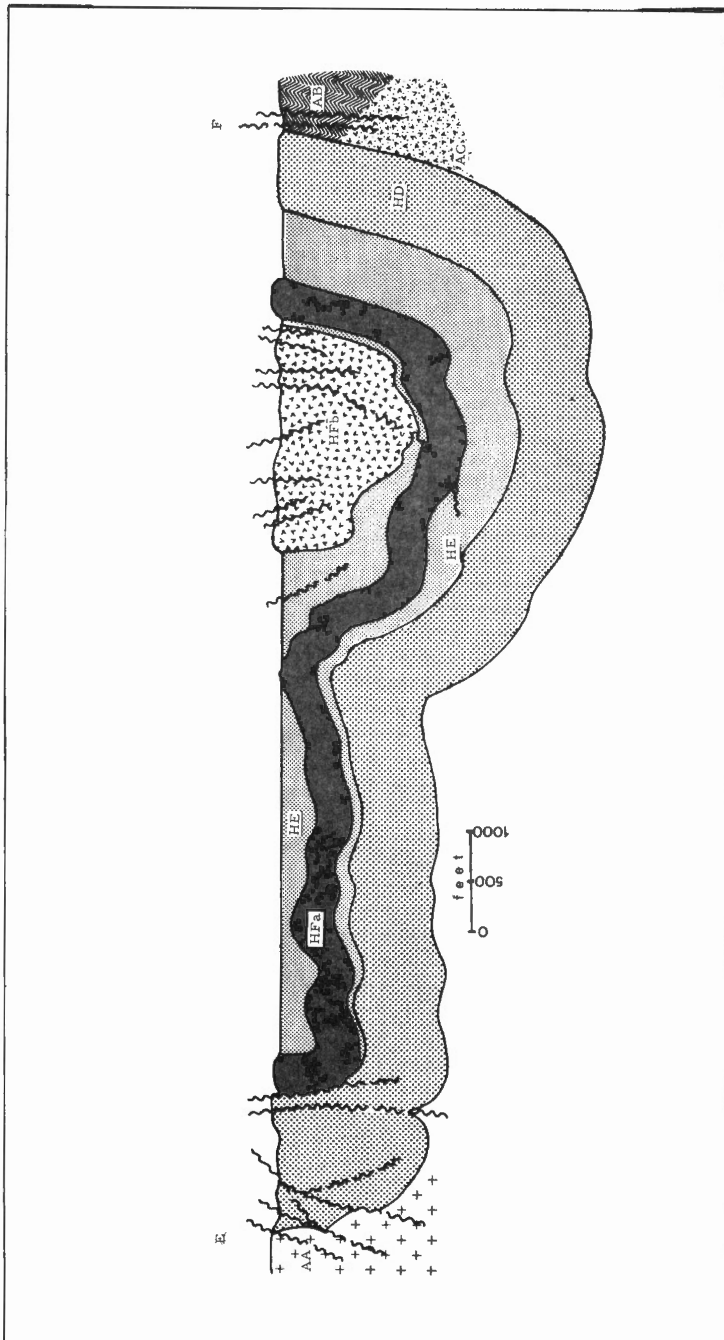


Figure 6: Cross-section EF, Kaminak Belt

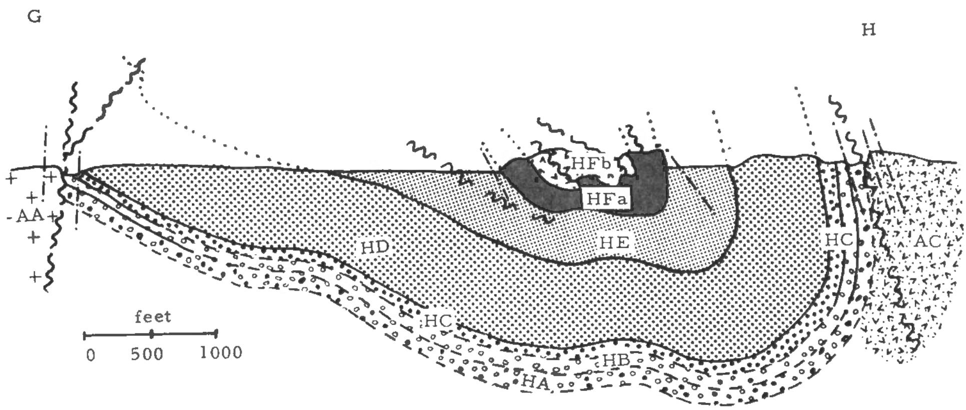


Figure 7: Cross-section GH, Kaminak Belt

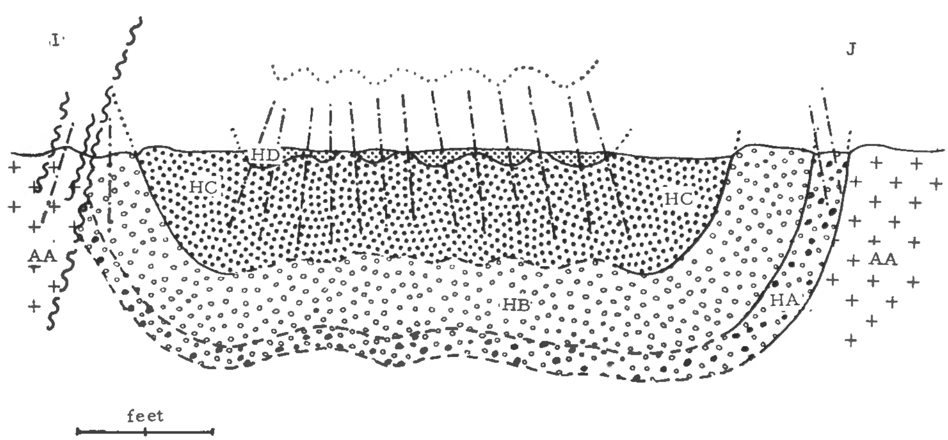


Figure 8: Cross-section IJ, Kaminak Belt

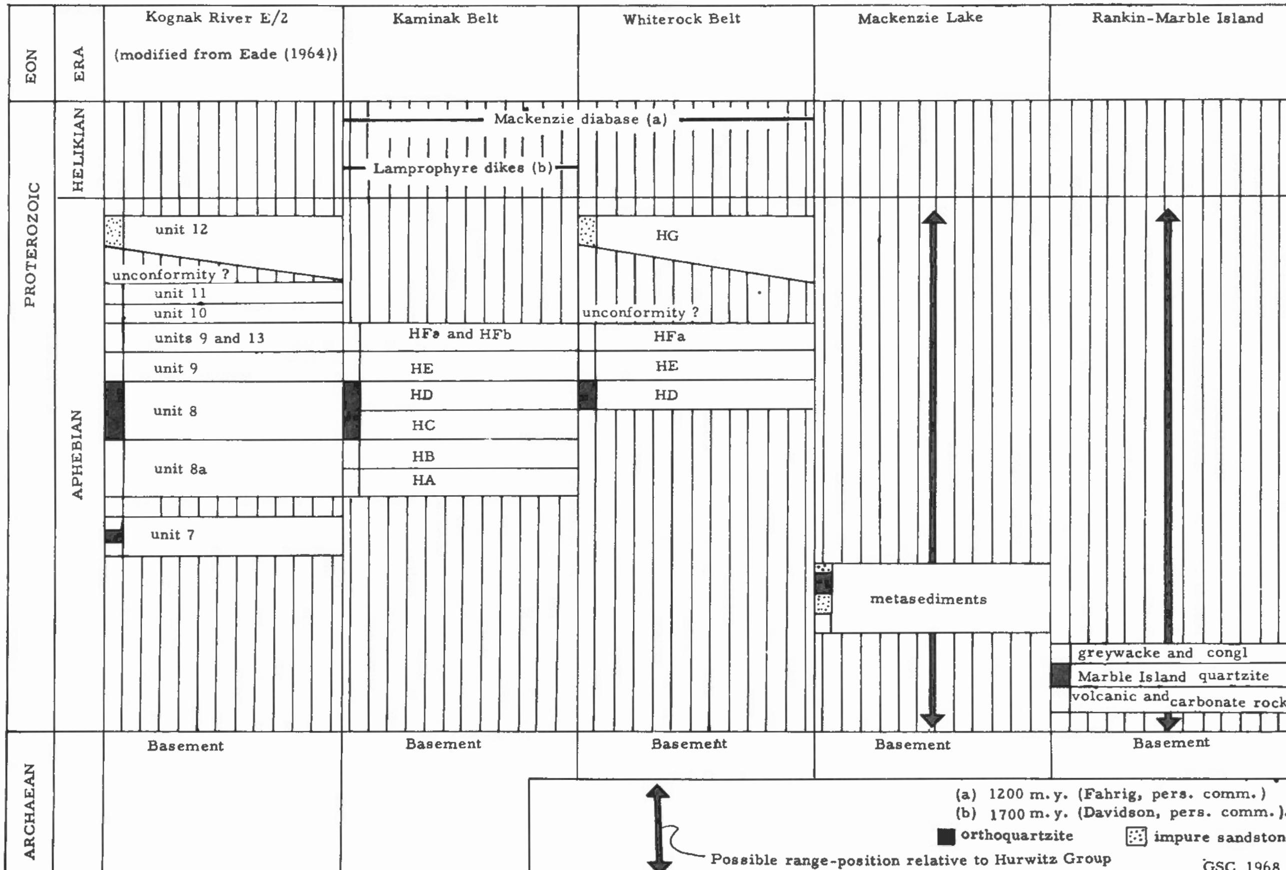


Figure 9: Hurwitz Group, Tentative Correlation Chart. (GSC 200746-D)

Figure 10. Ripple-marked orthoquartzite, Hurwitz D, north shore of Pistol Bay. (RTB 9-10-67)

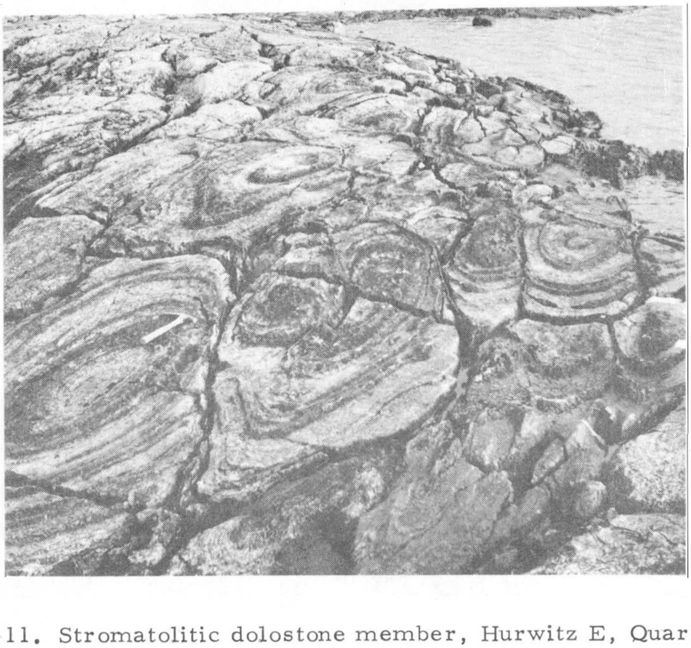


Figure 11. Stromatolitic dolostone member, Hurwitz E, Quartzite Lake. (RTB 4-5-67)