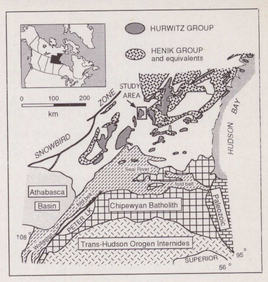
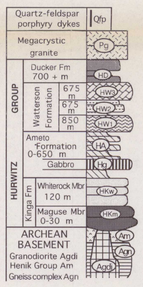
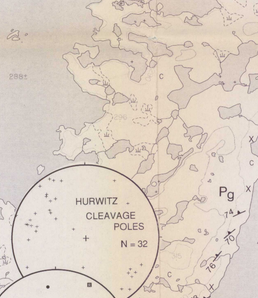
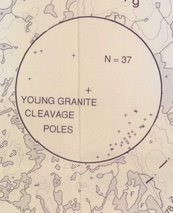
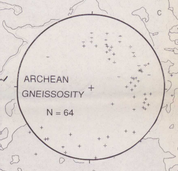
GEOLOGICAL MAP OF THE WATTERSON LAKE AREA

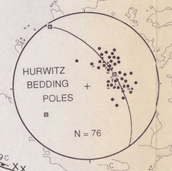


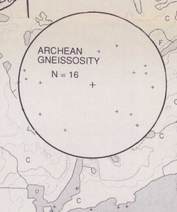


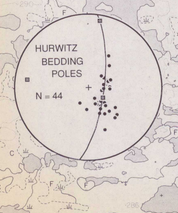












UNIT			DESCRIPTION	COMMENT/INTERPRETATION
QUARTZ-FELDSPAR PORPHYRY DYKES Qfp			On southeast side of sub-basin, four narrow (to 5 metres) north-trending, red, purple non-foliated quartz-feldspar porphyry dykes	Satellite dykes to body of Nueltin granite southeast of map area ? (see Eade and Chandler, 1975)
PROTEROZOIC GRANITE Pg			On western side of sub-basin: pink to beige megacrystic granite with quartz and K-feldspar phenocrysts up to 2 cm. Border zones contain partially melted xenoliths (to 3 metres) of Hurwitz Group xenoliths at margins. Differs from classical Nueltin granites in having a well-defined cleavage that is concordant with cleavage in adjacent Hurwitz Group.	Post Hurwitz Group sedimentation. In contrast to the Nueltin granite, appears to have been deformed together with the Hurwitz Group. Possibly equivalent to ca. 1917 Ma granitic rocks in Ellerton lake area ? (see Loveridge et al., 1988, p.20).
HURWITZ GROUP	GABBRO HG		Discontinuous gabbro sills, coarse-grained, poikilitic. Local crude layering concordant with country rock adjacent sills. Contact shear zones common. Typically within Ameto Formation. Locally within Watterson Formation or at Watterson-Ducker contact. At southern Yava Lake, contains Ameto Formation xenoliths that display sharp, angular borders.	Evidence of injection pre- Hurwitz Group titrification or of multiple injections is lacking. pre tilting of Hurwitz Group. Baddeleyite ZrO4 +26/-17 Ma Patterson and Heaman, L.M., and LeCheminant, A.N., 013 Ma Heaman and LeCheminant in press).
	DUCKER FM HD		Cm to dcm-scale fining-upward cycles of grey and tan arkose to blue argillite; discrete beds of arkose with parallel-stratification. Dm-m-scale interbeds of orange microbial laminites at base.	Local lagoons between Tavani coastal plain and Watterson carbonate ramp. Below wave-base mass flows alternating with arkose sheetbeds and algal mounds.
	WATTERSON FORMATION	HW3	Metre-scale interbeds of pink and orange-brown microbial laminated dolostone, white to tan bedded chert and siltstone to mudstone fining-upward sequences. Local beds of dolostone-chert clast conglomerate and breccia.	Intertidal to supratidal carbonate ramp)
		HW2	Mixed siliciclastic/carbonate unit in which siltstone to mudstone fining-upward sequences are predominant (typically 80%). Brown massive and microbial laminated dolostone forms cm- dcm-scale interbeds.	Below wave-base mass flows alternating with subtidal carbonate flats.
		HW1	White, flesh, rose and orange-stromatolitic and microbial laminated dolostone. local intraclastic breccia.	Intertidal to supratidal carbonate ramp)
	AMETO FM HA		At base: red, blue, green slate with mm-cm-scale parallel-stratified arkose. Up-section: cm-dm-scale arkose to slate fining-upward cycles.	Below wave-base sedimentation interrupted by turbidity currents; shoaling-upward to Watterson carbonate ramp.
	KENOJEVIS FM	Whiterock Member HKw	Supermature quartz arenite. With ubiquitous wave ripples. Paleodepth calculations based on symmetric current ripple indicates depths of 2 cm to 2 m for the entire sequence (Aspler et al., in press).	Vast , hydrographically-open, tide-free, fresh-water lake or series of lakes.
		Maguse Member HKm	Grit and conglomerate, framework intact and disrupted, with red and beige coarse sand matrix. Clasts dominantly of Archean basement rocks. Local beds to 10 m thick of massive and of parallel-stratified sandstone. Forms thin (to 30 metres) lenses on eastern and northern parts of sub-basin. Previously assigned to Padlei Formation (Eade and Chandler, 1975)	High energy unchannelled sheet floods foaming low-relief paleolithography
ARCHEAN BASEMENT	Agdi	Granodiorite	Well-foliated granodiorite intrusive into gneiss complex.	(2612+/- 112 ma; Rb/Sr whole rock; Ramsey and Eade, 1975)
	Am	HENIK GROUP	Mafic volcanic rocks preserved as rafts within Proterozoic granite (Pg) on west side of Elliott Lake	
	Agn	GNEISS COMPLEX	Gneiss with decimetre-metre scale alternations of felsic and amphibolite/biotitic components engulfed by variable proportions of granodiorite.	Assumed to be basement to Henik Group

- Geological contact: defined, approximate, assumed
- Bedding: upright; overturned; tops unknown
- Cleavage; inclined, vertical
- Gneissosity inclined, vertical
- Bedding/Cleavage lineation: azimuth and plunge
- Minor fold: azimuth and plunge, tick toward vergence
- Axial trace D1 syncline; D1 anticline,
- Axial trace D1 syncline, D2 anticline
- Oblique-slip fault: U, up-side; D, down-side
- Outcrop; outcrop area; frost heave

0 1 2 3 4 5
km
1:50,000

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CANADA-NWT MINERAL INITIATIVES 1991-1996
Canada CANADA-GNWT ECONOMIC DEVELOPMENT AGREEMENT

GEOLOGICAL SURVEY OF CANADA OPEN FILE 2767

Geology by L.B. Aspler, J.R. Chiarenzelli, D.L. Ozarko and K.Powis, 1993

Recommended citation:

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MARGINAL NOTES

This open file summarizes the initial results of 1:50,000-scale mapping in the Watterson Lake area and represents the continuation of a project designed to better understand the geology of Archean and Proterozoic supracrustal rocks in the south-central District of Keewatin (Aspler et al., 1989; 1993 a; b; 1994; Aspler and Bursey, 1990).

STRATIGRAPHY AND SEDIMENTATION

Supracrustal rocks of the Archean **Henik Group**, part of the Ennadai-Rankin greenstone belt, are preserved as local rafts of greenstone within Proterozoic granites on the western margin of the Watterson sub-basin. Potential basement to the Henik Group is exposed on the east side of the sub-basin and includes granitic gneisses and irregular bodies of massive and foliated granitic rocks.

The Early Proterozoic **Hurwitz Group** is preserved in a northeast-trending belt of outliers that represent the remnants of a large intracratonic basin thought to have formed due to compressive intraplate stress arising from the pre- ca 2.1 Ga convergence of the Buffalo Head terrane (Ross et al., 1991) with the western margin of the Churchill Province (Fig. 1; Aspler et al.,1992). Lower Hurwitz Group strata are arranged in a conformable onlap sequence of radial basin expansion. The Maguse Member is the lowest unit exposed in the present map area and forms isolated pods of quartz pebble conglomerate, grit and subarkose on the eastern and northern sides. It is conformably onlapped by quartz arenite of the Whiterock Member. Regional westward thinning of the Whiterock Member, leading to a pinchout in the Poorfish-Windy sub-basin, results in a maximum thickness of ca. 120 metres. Quantitative analysis of wave-ripples within the Whiterock Member indicate average water depths of 2 cm to 2 m over an area of about 100,000 km^2. It was deposited in a large, hydrographically open, tide-free lake or series of lakes that onlapped fluvial and eolian deposits of the Maguse Member within a low relief continental depression (Aspler et al., in press).

The upper Hurwitz Group stratigraphy defines a marine to terrestrial offlap sequence. The abrupt switch from shallow water lacustrine sedimentation of Whiterock Member quartz arenites to deep water mudrock and arkose of the Ameto Formation is attributed to sudden basin deepening and marine waters flooding through gaps in basement arches. With the source of quartz sand effectively cut off by drowning, the compositional maturity of arenites overlying the Whiterock Member decreased and carbonate rocks of the Watterson Formation accumulated on ramps that prograded away from low-relief arches. Accordingly, mudrocks of the Ameto Formation are considered a distal ramp facies, carbonate rocks of the Watterson Formation an inner ramp facies, isolated lenses of semi-pelite (+/- carbonate) of the Ducker Formation local lagoons, and arkose and subarkose of the Tavani Formation a coastal sand complex. The Ameto Formation thins within the Watterson sub-basin such that on the western and southern margins, carbonate rocks of the Watterson Formation are in direct contact with the Whiterock Member. The Watterson Formation, in this its type area, can be subdivided into three sub-units (similar to the Hawk Hill Lake and Otter-Ducker lakes sub-basins). In the Watterson Lake area, W_1 consists of white to cream microbial laminated dolostone with thin chert layers and mudstone partings. W_2 is a mixed siliciclastic-carbonate unit in which siltstone to mudstone fining-upward sequences are predominant (typically 80%) and brown microbial laminated dolostones form cm-dcm-scale interbeds. W_3 consists of metre-scale interbeds of pink and orange-brown stromatolitic and microbial laminated dolostone, white to tan bedded chert and siltstone to mudstone rhythmites, with local beds of dolostone-chert clast conglomerate and breccia. In the interior of Watterson Lake are local outcrops of Ducker Formation sandstone/siltstone to mudstone turbidites, considered to be lagoonal equivalents to carbonate rocks of unit W_3.

Gabbros within the Hurwitz Group constitute a set of discontinuous sills that extend for a strike length of about 350 km, from the Tavani area southwest to the Watterson Lake area. The gabbros are typically within weak pelitic rocks of the Ameto Formation, but form local splays within the Watterson Formation. The stratigraphically highest sills are at the contact between the Watterson and Ducker formations in the Griffin Lake area (Aspler and Bursey, 1990) and at the contact between the Whiterock Member and the Tavani Formation in the Tavani area (Park and Ralser, 1991). In the present map area, the gabbros form multiple sheets, up to 100 metres thick, within the Ameto Formation. The gabbros are folded with sedimentary rocks of the Hurwitz Group and thus were intruded before Hurwitz Group deformation. Bell (1968) suggested that the gabbros were coeval with the Happotiyik Member, a mafic volcanic unit exposed in the Kaminak Lake area, on the basis of possible sill-flow feeder relations. Yet the paucity of soft sediment deformation structures in rocks adjacent to the gabbros and the presence of angular Ameto Formation xenoliths that display sharp, well-defined boundaries, argue that the Hurwitz group was well lithified before gabbro emplacement. It is uncertain if there was more than one episode of gabbro injection: baddeleyite ages of 2094 +26/-17 Ma from the Kaminak Lake area and of 2111 +/- 0.6 Ma from the Montgomery Lake area 180 km to the southwest (Heaman and LeCheminant in press) are consistent with a single episode.

Two post-Hurwitz Group intrusive map units are exposed in the map area. On the western side of the sub-basin is a pink to beige megacrystic granite, with quartz and K-feldspar phenocrysts up to 2 cm. Border zones contain partially melted xenoliths (to 3 metres) of Watterson Formation carbonate and bedded siltstone to mudstone. This granite differs from the classical Nueltin suite in that it is typically well-foliated and appears to have been deformed together with rocks of the Hurwitz Group. On the southeast side of the sub-basin are four small (to 5 metres wide) north-trending, red and purple, quartz/feldspar porphyry dykes that may be unusual satellites to a body of Nueltin granite that lies further to the southeast.

STRUCTURAL GEOLOGY

The northeasterly-elongate ovoid shape of Watterson Lake is the geomorphologic expression of Early Proterozoic dome and basin fold interference, with Hurwitz Group rocks occupying a structural depression formed by the interference between a NE-trending D_2 syncline and a ESE-trending D_1 syncline. D_2 folds have an associated cleavage, D_1 folds typically do not. Around the periphery of the doubly-plunging syncline fan numerous small-scale oblique-slip faults that likely represent outer arc extension during flexural-slip folding. Foliation trends within the post-Hurwitz Group granite on the western side of the sub-basin are coincident with D_2 cleavage within the Hurwitz Group. The orientation of basement gneissosity adjacent to the Hurwitz Group typically parallels the basement-cover contact, a geometry that may represent deflection due slippage along the contact during basement-cover infolding. The Hurwitz Group was deformed before ca. 1.75 Ga, the age of the Nueltin granite (U/Pb, Loveridge et al., 1988; cf. Rb/Sr, Wanless and Eade, 1975). How long before is uncertain; a preliminary metamorphic zircon determination of ca. 1.83 Ga (L. Heaman p. comm. 1992) suggests that deformation of the Hurwitz Group may be related to collisional events in Trans-Hudson Orogen, signifying a large time gap between sedimentation (pre- 2111 Ma; Heaman and LeCheminant in press) and deformation.

ACKNOWLEDGMENTS

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