HEPBURN LAKE AREA (86K), NORTH-CENTRAL WOPMAY OROGEN, DISTRICT OF MACKENZIE

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TABLE OF FORMATIONS

UNCONSOLIDATED SEDIMENTS:

Post Last Glaciation

QUATERNARY

Last Glaciation

ALLUVIAL DEPOSITS: stream-deposited material related to the Holocene drainage regime.

Qaf — Modern Floodplain Sediments: silt and fine sand, widely scattered ice rafted boulders; thickness unknown.

Qat — Terraced Sediments: fine to coarse sand with minor gravel lenses; wood and peaty material common; 3-10 m thick; terrace surfaces commonly gullied or channelled.

GLACIOLACUSTRINE DEPOSITS: materials deposited in or at the margin of a lake formed by an ice dam.

Qd — Deltaic Sediments: sand, gravel and silt in an upward coarsening sequence; 10-30 m thick; surface flat or channelled.

Ql — Offshore Glaciolacustrine Sediments: silt, fine sand, minor clay; 5-35 m thick; varved.

Qg — GLACIOFLUVIAL DEPOSITS: gravel and sand 2-30 m thick, forming ridges and terraced, flat topped hills, deposited in or near glacial ice largely as a result of meltwater stream flow.

TILL DEPOSITS: poorly sorted, generally sandy, silty sediments deposited directly by glacier ice.

Qtb — Till Blanket: 2-15(?)m thick, gently rolling surfaces, fluted in places; dominantly lodgement till.

Qtv — Till Veneer: 0.5-2 m thick, surface mimics form of underlying rock; in many places reworked by solifluction and commonly contains colluviated rock.

Moraine ridge (major)

Esker

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major unconformity

COPPERMINE HOMOCLINE: cratonic basin

1220 ± 20 Ma (Rb/Sr)

MACKENZIE INTRUSIVE SUITE: continental tholeiite

Mackenzie Dykes: gabbro, diabase, basalt; north-northeast trending dykes; minor east-northeast trending dykes may be much younger.

Muskox Intrusion:

Mgr — Granophyre

Mgg — Mafic granophyre, granophyric gabbro

Mgb — Gabbro, granophyre-bearing gabbro, minor pyroxenite

Mpx — Pyroxenite, minor gabbro and peridotite (serpentinized)

Mol — Dunite and peridotite (serpentinized)

Mb — Feldspathic peridotite (serpentinized), picrite, bronzite gabbro; lower border zone.

Bronzite gabbro, picrite; feeder dykes.

EARLY PROTEROZOIC-II (PALEOHELIKIAN)

Hs — HORNBY BAY GROUP: fluviatile sandstone, minor siltstone, conglomerate and breccia; basal regolith locally present.

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major unconformity

GREAT BEAR MAGMATIC ZONE: continental volcano-plutonic arc depression

GREAT BEAR INTRUSIVE SUITE: I-type plutonic rocks

1870 ± 5 Ma (U/Pb)

Gsg — Syenogranite; minor McTavish Supergroup xenoliths.

McTAVISH SUPERGROUP: calc-alkaline volcanic rocks and intrusive porphyries, intercalated fluviolacustrine sedimentary rocks.

Dg — Gabbro; altered; intrusive; age uncertain.

Dp — Porphyritic dacite and rhyodacite; intrusive.

Ds — Volcanic-lithic sandstone, siltstone, mudstone

Db — Basalt flows; minor intercalated sedimentary rocks

Dm — Mudstone, thin bedded; minor siltstone and sandstone

LATE PROTEROZOIC-I (LATE APHEBIAN)

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major unconformity

ASIAK THRUST BELT:

1890 ± 10 Ma (U/Pb)

HEPBURN INTRUSIVE SUITE: S-type plutonic rocks

Hgb — Gabbro, commonly biotite and/or bronzite bearing; minor associated anorthosite; melt-back granite locally abundant; certain intrusions mostly pyroxenite (Hpx) or peridotite (Hpd); massive to weakly foliated.

Hdi — Diorite, generally biotite-bearing; melt-back granite locally abundant; certain intrusions mostly hornblendite (Hhb); massive to weakly foliated.

Hal — Alaskite, leucocratic, fine grained, granite-granodiorite composition; massive to foliated.

Hqd — Quartz diorite, biotite exceeds hornblende; local melt-back granite; mostly foliated.

Hsg — Syenogranite, very coarse granited, biotite only; grades into marginal medium-grained granodiorite (Hgd); massive; prominent east-west jointing.

Hto — Tonalite, biotite greatly exceeds hornblende, quartz globules common; local melt-back granite; certain intrusions garnet mega-crystic (Hgt); mostly foliated.

Hgd — Granodiorite, biotite only, commonly a tonalite with symogranite patches or K-feldspar megacrysts; local melt-back granite; mostly foliated.

Hkg — Megacrystic granite, biotite only, large K-feldspar megacrysts; certain intrusions also garnet megacrystic (Hgg); mostly foliated.

Amphibolite; syn-plutonic(?) dykes.

Hgr — Protomylonitic granite, leucocratic, biotite only; grades into megacrystic granite; strongly foliated and/or lineated, xenolith-rich zones are tectonically banded.

LATE PROTEROZOIC-I (LATE APHEBIAN)

CORONATION SUPERGROUP: continental margin deposits

Gabbro, diabase, minor quartz diorite pegmatite; mostly thick compound sills; intrusive, adjacent sedimentary rocks hornfelsed.

RECLUSE GROUP: foredeep deposits

Ra — Asiak Formation: feldspathic-lithic greywacke of plutonic-metamorphic provenance; medium to thick bedded, graded, flute and groove casts; paleocurrents directed southeast to south-southeast; submarine fan deposits; derived migmatite is agmatite-like.

Rf — Fontano Formation: black, pyritic, carbonaceous, aluminous pelite; characteristic varve-like laminations composed of more- and less-carbonaceous layers; minor nodular carbonate beds; tongues of megabreccia and detached blocks derived from Stanbridge Formation dolomite and Vaillant Formation basalt occur adjacent to Lupin Fault; locally, as at 66°53', 114°25', Fontano Formation pelite fills submarine canyons cut down through the Rocknest Formation into the underlying Odjick Formation.

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significant disconformity

EPWORTH GROUP: subsiding passive-margin deposits

Er — Rocknest Formation: cream to buff, stromatolitic and intraclastic, cherty dolomite; brown, very thin bedded, argillaceous dolomite; shoaling-upward peritidal cycles; abrupt westward pinch-out into very thin-bedded, non-stromatolitic, dolomite rhythmite, locally with slump breccias; facies change from shelf through shelf-edge to upper slope environments, the shelf break coinciding with the major compound Recluse Group syncline that extends the fulll length of the map area 20-25 km from its eastern boundary.

Eo — Odjick Formation: orthoquartzite, siltstone, greenish pelite, minor conglomerate, arkose, dolomite; facies change westward from mainly crossbedded quartzite to mainly pelite with thin graded quartzite beds coincides with the Rocknest Formation pinch-out but its much more gradational; both the shelf facies on the eastern border of the map area and the rise facies in the central part have higher quartzite/pelite ratios than the intervening slope facies..

AKAITCHO GROUP: initial rift deposits

As — Stanbridge Formation: cherty stromatolitic dolomite; in part brecciated (indicated by black triangles) and extending as tongues and isolated blocks into the Fontano Formation across Lupin Fault.

Av — Vaillant Formation: basalt; massive, fragmental, pillowed; intercalated with Stanbridge dolomite.

relations uncertain

Gabbro sills; mostly intrusive into Aglerok Formatio pelite.

LATE PROTEROZOIC-I (LATE APHEBIAN)

Aq — Purplish siliceous siltstone; overlain conformably by Odjick Formation 5 km north of Hepburn Lake.

Aa — Aglerok Formation: olive-green pelite, minor siltstone, sandstone (Aas), conglomerate.

Ac — Carbonate; minor discontinuous units at various stratigraphic levels; generally associated with mafic volcanic rocks.

Am — McGregor Amphibolite: highly metamorphosed basalt; intercalated with Aglerok Formation pelite southwest of McGregor Lake.

Ab — Basalt; minor units at various stratigraphic levels includes large amphibolite xenoliths in Hepburn intrusions probabl derived from Ipiutak and Tuertok basalts.

Ak — Kapvik Tuff: mafic tuff; mainly intercalated with Aglerok Formation pelite.

Ax — Sinister Rhyolite: felsite with broken K-feldspar penocrysts; intercalated with Aglerok Formation pelite.

At — Tuertok Basalt: basalt flows; massive, pillowed and fragmental; minor undifferentiated rhyolite; megacrystic gabbro (Atg).

Ar — Rhyolite; mostly aphyric; includes a major build-up above the Zephyr Formation and below Kapvik Tuff northeast of Wentzel Lake.

Ao — Okrark Porphyry: K-feldspar-plagioclase-quartz-phyric rhyolite; intrusive equivalent of Sinister Rhyolite.

Ap — Okrark Porphyry: plagioclase-phyric rhyolite; intrusive into Zephyr Formation arkose.

Az — Zephyr Formation: arkose, siltstone, pelite; thin to medium bedded; graded; underlies Tuertok Basalt and Kapvik Tuff.

Aw — Wentzel Tuff: mafic tuff, tuffaceous pelite, pelite; intercalated with Ipiutak Amphibolite and Zephyr Formation arkose.

Ai — Ipiutak Amphibolite: highly metamorphosed basalt, minor mafic tuff.

Note: An apostrophe before the unit symbol (for example 'Eo, 'Az) is used to denote areas of anatectic migmatization in rocks of the Coronation Supergroup.

METAMORPHISM

M3: The metamorphic aureole of the Muskox Intrusion has been mapped where it intersects medium-grade Coronation Supergroup rocks east of Speers Lake. The outerlimits of two zones are indicated by the isograds:

inner zone: andalusite-orthoclase-corundum-cordierite

outer zone: older andalusite, staurolite and biotite retrograded to chlorite.

M2: Metamorphism of the McTavish Supergroup is anchizonal to greenschist grade, locally higher, probably related to the Great Bear Intrusive Suite. It has not been studied.

M1: Metamorphism of the Coronation Supergroup is regionally at greenshist grade but increases markedly in a low-pressure facies-series to almost granulite grade coincident with the cluster of Hepburn Intrusions in the central part of the map area (Hepburn Batholith) and near the western boundary (Wentzel Batholith). This metamorphism post-dates D2 thrusting and pre-dates D3 folding. The metamorphic rocks were unroofed before deposition of the McTavish Supergroup. Metamorphic isograds around Hepburn Batholith are inverted (dip inward) but around Wentzel Batholith are normal (dip outward). The metamorphism is attributed to rise of the Hepburn Intrusions during uplift of the D2 thrust complex late in the first collision in Wopmay Orogen. The following metamorphic isograds have been mapped throughout the area in all Coronation Supergroup pelites and semi-pelites.

cordierite + garnet in; sillimanite out

orthoclase + sillimanite in; muscovite out

first appearance granitoid (melt) pods

sillimanite in; andalusite out

andalusite in

staurolite in

biotite in (microscopic)

DEFORMATION

D6: Normal faulting due to east-west extension that post-dates the Hornby Bay Group and, partly at least, the Muskox Intrusion. Faults in part north-trending but strongly controlled by reactivation of D5 transcurrent faults and thrusts. Backsliding on D5 thrusts is indicated by preferential preservation of Hornby Bay Group outliers on the hanging-wall side. D2 thrusts are not reactivated.

D6 Normal Faults:

"U/D" indicates net relative vertical displacement (D5+D6), determined from metamorphic pressure data.

D5: Conjugate transcurrent faulting (northeast-trending dextral and northwest-trending sinistral) that post-dates the Great Bear Intrusive Suite and pre-dates the Hornby Bay Group. The major transcurrent faults appear to be linked by northerly-trending, west-dipping thrust faults. The linked system of conjugate faults and thrusts controls the main pattern of post-metamorphic structural relief in the area. The D5 deformation is related to east-west compression attributed to the second collision in Wopmay Orogen.

D5 Transcurrent Faults:

D5 Thrust or Reverse Faults:

D4: Oblique slip on the north-trending Wopmay Fault Zone, west-side-down and dextral, is contemporaneous and/or younger than the McTavish Supergroup, but older than the late syenogranites of the Great Bear Intrusive Suite. North to northwest trending folds and foliations in the McTavish Supergroup and older rocks occur adjacent to the Wopmay Fault. The D4 deformation is attributed to oblique plate convergence prior to the second collision and resultant dextral shear across the north-trending magmatic arc.

D4 Wopmay (Oblique-Slip) Fault Zone:

Related D4 Folds (may be tightened in D5):

D3: Upright folds of northerly trend affect the otherwise gently-dipping tectonic foliation within the major Hepburn Intrusions and in the adjacent high-grade metamorphic rocks. The foliation itself strongly transposes the D2 folds and foliation. The D3 folds affect the M1 metamorphic isograds but are truncated by the Wopmay Fault Zone. The D3 folding is attributed to late-stage east-west compression during the first collision in Wopmay Orogen.

D3 Folds (Antiform, Synform):

D2: A regional complex of east-vergent, north-trending, thin-skinned thrust faults and related folds involves all of the Coronation Supergroup, including the gabbro sill swarms intrusive into the Recluse Group. The D2 thrusts pre-date the peak of metamorphism and do not displace the isograds. The deformation is attributed to attempted underthrusting of the continental margin during the first collision in Wopmay Orogen. The Recluse Group foredeep is seen as being fed from the north and migrating in front of the advancing D2 thrust-fold complex.

D2 Thrust Faults:

D2 Folds (Anticline, Syncline):

(These folds may in part be younger, D3 or D5.)

D1: Along the west margin of the tight Akaitcho Group anticline in the eastern half of the map area, Stanbridge Formation dolomite is faulted against upper Odjick Formation or Fontano Formation pelite. Tongues and isolated blocks of Stanbridge dolomite breccia occur in the Fontano Formation adjacent to the fault. This relation is interpreted as a syn-Fontano Formation normal fault, west-side-down, attributed to east-west extension during the down-flexing and attempted westward subduction of the passive continental margin early in the first collision in Wopmay Orogen. The occurrence of Fontano-filled submarine canyons cut deeply into the Epworth Group, as at 66°53', 114°25', also suggests major block faulting during collapse of the Rocknest Formation shelf into the Recluse Group foredeep.

D1 Normal Faults:

CREDITS

This map is based on field work carried out in 1977-1980 under the direction of P.F. Hoffman, with mapping assistance by M.R. St-Onge, R.M. Easton, D.M. Carmichael, and J.P. Grotzinger. The Quaternary geology was mapped and interpreted by D.A. St-Onge. The Akaitcho Group was mapped mostly by R.M. Easton and the metamorphic isograds in the Coronation Supergroup were mapped mostly by M.R. St-Onge. Interpretation of the bedrock geology and preparation of the map and notes were done by Hoffman in March-April, 1981. The U/Pb ages cited are based on zircon chronometry carried out by S.A. Bowring and W.R. Van Schmus at the University of Kansas, Lawrence, supported by the National Science Foundation (USA). The cooperation and support received from the Geology Office, Department of Indian Affairs and Northern Development, are gratefully acknowledged, as are the information and assistance received in the field from BP Minerals Ltd.

Additions and corrections to this preliminary map will be welcomed by Paul F. Hoffman, Precambrian Division, Geological Survey of Canada, 588 Booth St., Ottawa, Ontario K1A 0E4.

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kilometres

Scale 1:100 000

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