Energy, Mines and Resources Canada   Énergie, Mines et Ressources Canada

GEOLOGICAL SURVEY OF CANADA   COMMISSION GÉOLOGIQUE DU CANADA

LEGEND

Reference letters in legend appear on sheet 1 only

QUATERNARY

Undivided, unconsolidated glacial deposits. Includes till and glaciofluvial gravel and sand forming eskers and terraces

MIDDLE PROTEROZOIC

COPPERMINE RIVER GROUP

MACKENZIE DYKES: diabase, gabbro

EARLY PROTEROZOIC

CORONATION SUPERGROUP

RECLUSE GROUP

COWLES LAKE FORMATION: limestone-argillite rhythmite, subordinate fine grained greywacke turbidites, about 1 km thick, interbedded lower contact

ASIAK FORMATION: feldspathic lithic greywacke, dark grey medium to thick bedded turbidites, commonly gritty. Minimum thickness 1.5 km

KIKERK FORMATION: pelite with calcareous concretions, 2-5 cm in diameter. Thickness 50-100 m; conformable base

FONTANO FORMATION: pelite; laminated, graphitic and sulphidic. Thickness is 50-250?m, increasing eastward, conformable base

Undivided

TREE RIVER FORMATION: pelite and fine grained quartzite, thinly interbedded, with a few ferrugenous and/or glauconitic dolomite beds, 50 m thick; disconformable with Rocknest Formation

EPWORTH GROUP

ROCKNEST FORMATION

Undivided Rocknest Formation

Top member: dolomitic microbial tufa, grey, with microdigitate and less common domal stromatolites; branching columnar stromatolites at top. Thickness is typically 100 m; conformable base

Striped member: argillaceous dololutite interbedded with subordinate dolomite containing domal stromatolites and microbial tufa. Thickness is typically 60 m; conformable base

Thin member: cherty dolomite with domal stromatolites; interbedded with minor argillaceous dololutite. Thickness is typically 40 m; conformable base

Red shale member: argillaceous dololutite and dolosiltite; minor intercalated dolomitic intraclast/oöid packstone, recessive. Thickness 60 m; conformable base

Domal stromatolite member: cherty dolomite, dark grey, with abundant linked, domal stromatolites, and minor microbial tufa; minor interbedded argillaceous dololutite; about 60 m thick; conformable base

Pink chert member: dolosiltite/arenite, pink and cream, wave-rippled, with abundant nodular chert; minor stromatolites, argillaceous dololutite; 40 m thick; conformable base

Thrombolitic member: stromatolitic and thrombolitic cherty dolomite; subordinate argillaceous dololutite; cream cherty conical stromatolites at top

Intraclastic member: dolomite with partially linked, elongate columnar stromatolites at base; dolomitic intraclast grainstone/packstone with minor stromatolites at top; conformable base

Lower shale member: argillaceous dololutite with minor stromatolitic dolomite; dark grey, cherty, dolomitic microbial tufa with minor dolosiltite at top; 60 m thick, conformable base

Basal member: dololutite with subordinate stromatolitic dolomite; dark grey, cherty conical stromatolites and microbial tufa at top. About 300 m thick

ODJICK FORMATION

Upper member: argillite, with subordinate thin quartzite or dolomitic quartzite and granulestone; interbedded dolomite stromatolitic mounds and beds increase upward. From 100 to 300 m thick, conformable base

Middle member: orthoquartzite and feldspathic quartzite, medium to thickly bedded, commonly trough crossbedded, with infrequent pebble conglomerate lenses. Interbedded argillite increases westward; at least 500 m thick, base not exposed

Waterfill
Geological boundary (defined, inferred or covered)
Restoration line
Fault (defined, inferred or covered)
Fault with strike-slip (defined, inferred or covered)
Fault with dip-slip (solid circle indicates downthrow side)
Fault with oblique-slip
Thrust fault (defined, inferred or covered)

The greatest proportion of geological mapping was by R. Tirrul and P.F. Hoffman, 1982 to 1983. Significant contributions were made by M.E. Grier, J.P. Grotzinger, B. Johnson and S.B. Lucas, M. Cunnane, M.D. Daynecka. C.A. Gittins and M.R. St-Onge also provided data

Compiled by R. Tirrul 1985, 1986

Geological cartography by the Geological Survey of Canada

DESCRIPTIVE NOTES

The youngest compressional structures in Wopmay orogen belong to a widespread system of conjugate transcurrent faults (Freund, 1970, 1974; Sylvester, 1988) that postdate the youngest intrusions (1.84 Ga) of the Great Bear magmatic zone and predate the oldest stratigraphic units (1.7 Ga) of the Coppermine homocline (Hoffman, 1984; Hoffman and Bowring, 1984; Bowring and Ross, 1985). The fault system manifests a regional pure shear deformation in which east-west shortening is accommodated by north-south extension approximating horizontal plane strain. The Asiak foreland thrust-fold belt is well suited for documenting the fault system because numerous piercing points are provided by pre-transcurrent thrusts and folds involving units for which there is excellent stratigraphic control (Hoffman et al., 1988; Tirrul, 1982, 1983, 1987, in press; Grotzinger, 1986a,b).

The region is segmented by regular arrays of NE trending right-slip and NW trending left-slip faults, found at all scales and in mutually exclusive domains for a given scale. Major right-slip faults, typically longer then 50 km, and with 1-9 km spacing, far outnumber their left-slip counterparts. Displacement reaches a maximum (up to 15 km) along segments of most northerly trend, and diminishes progressively with changing azimuth. Geometric arguments, map reconstruction, and the rotation of pre-transcurrent structures (clockwise rotation in left-slip fault arrays; anticlockwise in right slip arrays), relative to areas lacking transcurrent faults, indicate that both fault sets initiated at 25-30° to the shortening direction (E-W), and thereafter rotated about vertical axes away from it. During late stages of deformation, some left-slip faults propogated across right-slip faults, utilizing pre-transcurrent structures previously rotated into favourable orientations for slip. Bulk strain approaches regional pure shear, with up to 25% shortening and N-S extension. Deviations from plane strain occur in regions of maximum fault rotation, where some thickening is indicated by reverse splays and new chevron folds, and in areas of minimum fault rotation, where swarms of secondary E-W normal faults occur. Both dip-slip faulting and fault-block distortion minimize boundary problems due to differential N-S extension.

The Calliope Lake map (Sheet 1) exemplifies an area of maximum bulk strain by conjugate transcurrent faulting in Wopmay orogen. The amount and kinematics of strain have been estimated by restoring (back-rotating) individual fault blocks such that pre-transcurrent structures have a N-S orientation, parallel to that in regions lacking transcurrent faults. Correlative pre-transcurrent structures are lined up, while gaps and overlaps are minimized. The resulting restoration is shown in Sheet 2. The shaded ellipse on the actual map (Sheet 1) corresponds to the shaded circle in the restoration (Sheet 2) and is, in effect, a strain ellipse indicating approximately 34% E-W shortening.

As an exercise, the actual map (Sheet 1) can be cut up along the fault traces and restored by block rotation to a pre-transcurrent state (Sheet 2).

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in press: Geology, Asiak River area, northern Asiak foreland thrust and fold belt, Wopmay orogen, District of Mackenzie, Northwest Territories; Geological Survey of Canada Map 1653A, scale 1:50 000

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Copies of this map may be obtained from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8
3303-33rd Street, N.W., Calgary, Alberta T2L 2A7

Canada

MAP 1654A

SHEET 2

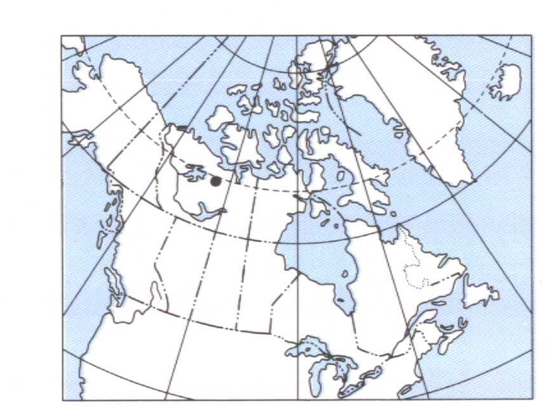
GEOLOGY AND STRUCTURAL RESTORATION OF THE EAST-CENTRAL PART OF ASIAK THRUST-FOLD BELT, WOPMAY OROGEN

DISTRICT OF MACKENZIE

NORTHWEST TERRITORIES

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres



INDEX MAP

Sheet 2 of 2, Map 1654A, Geology

Recommended citation:
Tirrul, R.
1992: Geology and structural restoration of the East-Central Part of Asiak Thrust-Fold Belt, Wopmay Orogen, Northwest Territories; Geological Survey of Canada, Map 1654A, scale 1:50 000