

RAINY LAKE WRENCH ZONE: AN EXAMPLE OF AN ARCHEAN SUBPROVINCE BOUNDARY IN NORTHWESTERN ONTARIO; K. Howard Poulsen, Economic Geology and Mineralogy Division, Geological Survey of Canada

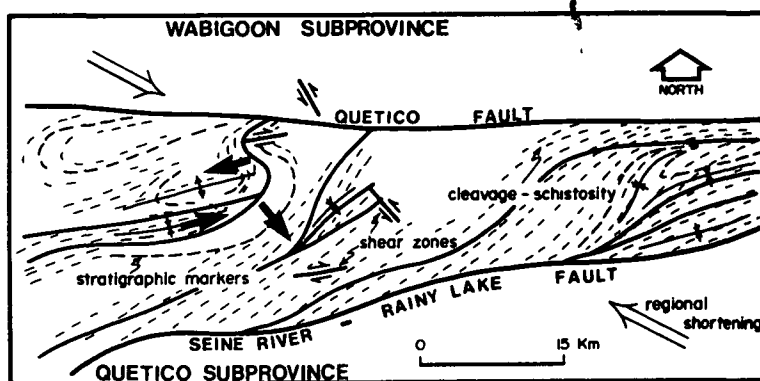


Fig. 1- Schematic diagram illustrating structural features of Rainy Lake Wrench Zone. Short solid arrows identify downward facing units.

The Superior Province of the Canadian Shield comprises an alternation of subprovinces with contrasting lithological, structural and metamorphic styles (1). Rocks of the Rainy Lake area form a fault bounded wedge between two of these subprovinces, the Wabigoon granite-greenstone terrain to the north and the Quetico metasedimentary terrain to the south (Fig. 1). The Quetico and Seine River-Rainy Lake Faults bound this wedge within which interpretation of the stratigraphy has been historically contentious. In the eastern part of the wedge, volcanic rocks and coeval tonalitic sills are unconformably overlain by fluvial conglomerate and arenite of the Seine Group; in the western part of the wedge, metamorphosed wacke and mudstone of the Coutchiching Group are cut by granodioritic plutons. The Coutchiching Group has previously been correlated with the Seine Group and with the turbiditic Quetico metasediments of the Quetico Subprovince and these correlations are the cornerstone of earlier tectonic models which relate the subprovinces (2,3).

The structural geology of the Rainy Lake area is characterized by the following attributes:

- (i) lenticular lithostratigraphic domains with discordant boundaries,
- (ii) steep boundary faults,
- (iii) regular orientation and sense of displacement of small ductile shear zones,
- (iv) regionally developed sub-vertical foliation which transects large lithological folds,
- (v) shallow bimodal orientations of minor folds and lineations and a preponderance of folds of dextral asymmetry,
- (vi) downward facing folds in the Rice Bay, Nickel Lake and Bear Pass areas (arrowed, Fig. 1).

These observations compare favourably with the known characteristics of dextral wrench or "transpressive" zones based both on experimental data and natural examples (4,5,6,7,8). Much of this deformation involved the Seine Group, the youngest stratigraphic unit in the area (9), and predates the emplacement of late-to-post-tectonic granodioritic plutons for which radiometric data indicate a Late Archean age.

The interpretation of a wrench zone separating the Wabigoon and Quetico Subprovinces has important implications regarding the tectonic models which can

be used to relate them. Of great importance is the high probability that this zone contains rocks which are actually allochthonous relative to those adjacent in the Quetico and Wabigoon. Given this type of structural environment, not only is correlation of stratigraphic units between individual lenticular domains difficult to establish simply on the basis of some lithological similarity but more important, the correlation with units exterior to the wrench zone is even more suspect. New geochronological data (9) which demonstrates a 40 Ma difference in age between the Seine and Coutchiching strongly supports this argument. Therefore the concept that Seine-type alluvial-fluvial rocks, which are restricted spatially to the wrench zone are transitional "facies" between Wabigoon volcanics and Quetico turbidites (2,3) finds little support in a wrench zone interpretation.

Pettijohn (10) was the first to emphasize that Seine-type sedimentary sequences occur all along the subprovince margin. Because these rocks also correlate spatially with a well defined wrench zone it is instructive to inquire whether an alternate hypothesis might account for these observed relationships without relying on the concept of facies equivalence. The link between alluvial-fluvial sedimentation and wrench zones is well-known in Cenozoic environments where thick alluvial, fluvial and lacustrine sequences are restricted to narrow "pull-apart" basins associated with large transcurrent faults (11,12,13). Such basins are localized by bends in marginal faults and by intersections with fault splays. Lateral and vertical facies variations are present within such basins (14) but these rocks are not contiguous with rocks external to the basin. The size and geometry of the wrench fault system at the southern margin of Wabigoon subprovince and the areal extent of the Seine-type rocks are comparable with younger examples in which there is also a juxtaposition of rocks of differing lithology. In many of these examples, and possibly in the present one as well, the juxtaposed terranes have depositional histories which are quite independent so that present geographic geometry has no simple paleogeographic significance.

The proposal that wrench faulting is significant at the subprovince boundary is not a new one. Hawley (15) first suggested a model of this type for rocks in the Atikokan area to the east of Rainy Lake but the emphasis in the past has been placed only on the late-stage displacements on the Quetico Fault (2,16) rather than the possibility presented here that such late faulting is merely a reflection of a broader zone of wrenching which also became a locus for sedimentation.

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