Geology of the Fort Liard Region, Yukon and NWT: New Insights from the Central Foreland Natmap Project

L.S. Lane, K.M. Fallas,
Geological Survey of Canada,
3303 - 33 St., NW, Calgary, Alberta
llane@nrcan.gc.ca kfallas@nrcan.gc.ca,

and

W.F. Miles.
Geological Survey of Canada,
615 Booth St., Ottawa, Ontario
wmiles@nrcan.gc.ca

ABSTRACT

Regional mapping at a scale of 1:50,000, in parts of the Fort Liard and La Biche River map areas (NTS 95B, 95C), was carried out during 2000 by the Geological Survey of Canada and the Yukon Geology Program as part of the Central Foreland NATMAP program. The Fort Liard and La Biche River map areas lie at the southern termination of the Mackenzie Mountains at the territorial border with British Columbia. They encompass the transition from undeformed strata in the east through the foothills and into the frontal part of the Main Ranges. Topography in the area is structurally controlled, with anticlines underlying the ranges and synclines underlying the valleys (Douglas, 1976; Douglas and Norris, 1976). The eastern half of the La Biche River area and the west half of the Fort Liard area are known to hold important gas reserves in structural plays, as exemplified by the Beaver River, Kotaneelee, Pointed Mountain, and La Biche fields. Mapping by the GSC focused on the Mount Martin (95C/1), Fisherman Lake (95B/5), and Mount Flett (95B/12) map areas. This continues work begun in 1997 with new mapping in Babiche Mountain (95C/8) and Chinkeh Creek (95C/9) (Currie et al., 1999a,b).

In the outer foothills near Fort Liard, the exposed strata range from the Late Devonian - Carboniferous Besa River Formation to the Late Cretaceous Wapiti Formation. Much of the area is underlain by Carboniferous and Permian strata of the Prophet, Flett, Mattson and Fantasque formations (Currie et al., 1998). With the exception of local exposures of Triassic strata, the upper Paleozoic succession is unconformably overlain by Lower Cretaceous rocks of the Chinkeh Formation and younger units (Fallas and Lane, 2001). Facies changes and sub-Cretaceous erosion are major controls on the distribution of these units within the project area. Although the regional distribution of map units on existing reconnaissance maps is broadly appropriate, our new mapping already has resulted in substantial revisions and updates.

The structural style in the eastern foothills comprises a series of en-echelon folds with a box fold geometry controlled largely by the competence of the Mattson Formation. The sinuous appearance in map trace of major structures is largely due to en echelon linkages of smaller culminations (Currie et al., 1999a; Fallas, 2001). Nearly vertical bedding dips on the flanks of several structures may have led previous mappers to interpret thrust faults in some of these areas. In at least some cases, these interpreted faults are not required by the distribution of the map units. Where mapped, the thrust faults appear to sole into a décollement horizon in the Devonian - Carboniferous Besa River Formation.

Newly released total-field aeromagnetic anomaly data for the Fort Liard - La Biche region are dominated by large elliptical anomalies commonly greater than 20 km in diameter. These probably reflect Abasement@ features at depth. A prominent northeast trending anomaly coincides with the Liard Transfer Fault, an inferred basement feature that has been interpreted to control to the dramatic eastward deflection of the Cordilleran deformation front, as well as Paleozoic facies trends (Cecile et al., 1997). Only in the western part of the project area do the anomalies reflect surface and near-surface features. Small elliptical magnetic highs correspond to mapped (and unmapped) Cretaceous and/or Tertiary intrusions and plugs. Locally, steep linear gradients approximate large mapped thrust faults.

A map of the second vertical derivative of the total-field aeromagnetic anomaly data reveals features in the shallow crust superimposed upon the major crustal features seen in the total-field data. The shallow features are most impressive in the central part of the project area where the Liard, Kotaneelee, and La Biche anticlines are clearly outlined. Farther east the Bovie Fault and its northern extension are well imaged.

These data show, in part, the relationship between shallow structures and deeper crustal features, and support the hypothesis that deeper crustal features influence surface structures in the area.

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