Lead Isotope Studies of Volcanogenic Sulphides: Applications to Paleotectonic Interpretations of the Newfoundland Dunnage Zone

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Lead isotope data from 25 volcanogenic sulphide deposits in the Newfoundland Dunnage Zone define three distinct fields on conventional lead isotope diagrams: (1) a field of relatively radiogenic lead representing Llanvirnian-Llandeilian island arc-related deposits of the Exploits Zone; (2) a field of slightly less radiogenic lead representing Cambrian island-arc deposits of the Exploits Zone; and (3) a field of non-radiogenic lead representing Tremadocian to Arenigian island arc and ophiolitic deposits of the Notre Dame Zone. There is no overlap between the fields and they are readily interpreted in terms of the recently-proposed tectonostratigraphic subdivision of the Dunnage Zone.

Lead in the Cambrian arc deposits, the oldest known volcanogenic sulphide deposits in the Dunnage Zone, plots in a tight field on or near the crustal growth curves of theoretical multi-stage lead models. Lead from the Llanvirnian-Llandeilian arc sequences plots in a steep linear trend, the base of which is near the Cambrian deposit field. This trend is interpreted as a mixing line between the Cambrian arc-deposit lead and lead from a more radiogenic source, perhaps continental crust which lay to the south and east of the Hermitage Flexure. The Cambrian arc sequences may, therefore, have been basement to the younger arc activity. Lead in the Notre Dame Zone deposits is markedly less radiogenic, possibly reflecting a predominant mantle contribution and/or lead from very non-radiogenic crustal sources (perhaps the Grenville Orogen).

The clear contrast in the lead isotope composition of volcanogenic sulphides in the Exploits and Notre Dame zones respectively, supports the concept of a fundamental structural break between them. The arc magmatism in the two zones apparently occurred in very different tectonostratigraphic settings. It is tentatively suggested that the Notre Dame Zone represents the "traditional" central Newfoundland island arc/back arc system related to the widely - postulated, east-dipping subduction zone. Sequences in the Exploits Zone represent a different, although in part coeval, tectonostratigraphic environment, and perhaps a completely different subduction system. The two may have been unrelated in space prior to their juxtaposition in the Mid- to Late-Ordovician.

Lead in deposits on the Burlington Peninsula and New World Island (i.e., the north and northeast extremities of the Notre Dame Zone) is more radiogenic than in the rest of the Zone, suggesting that further subdivision may be necessary.