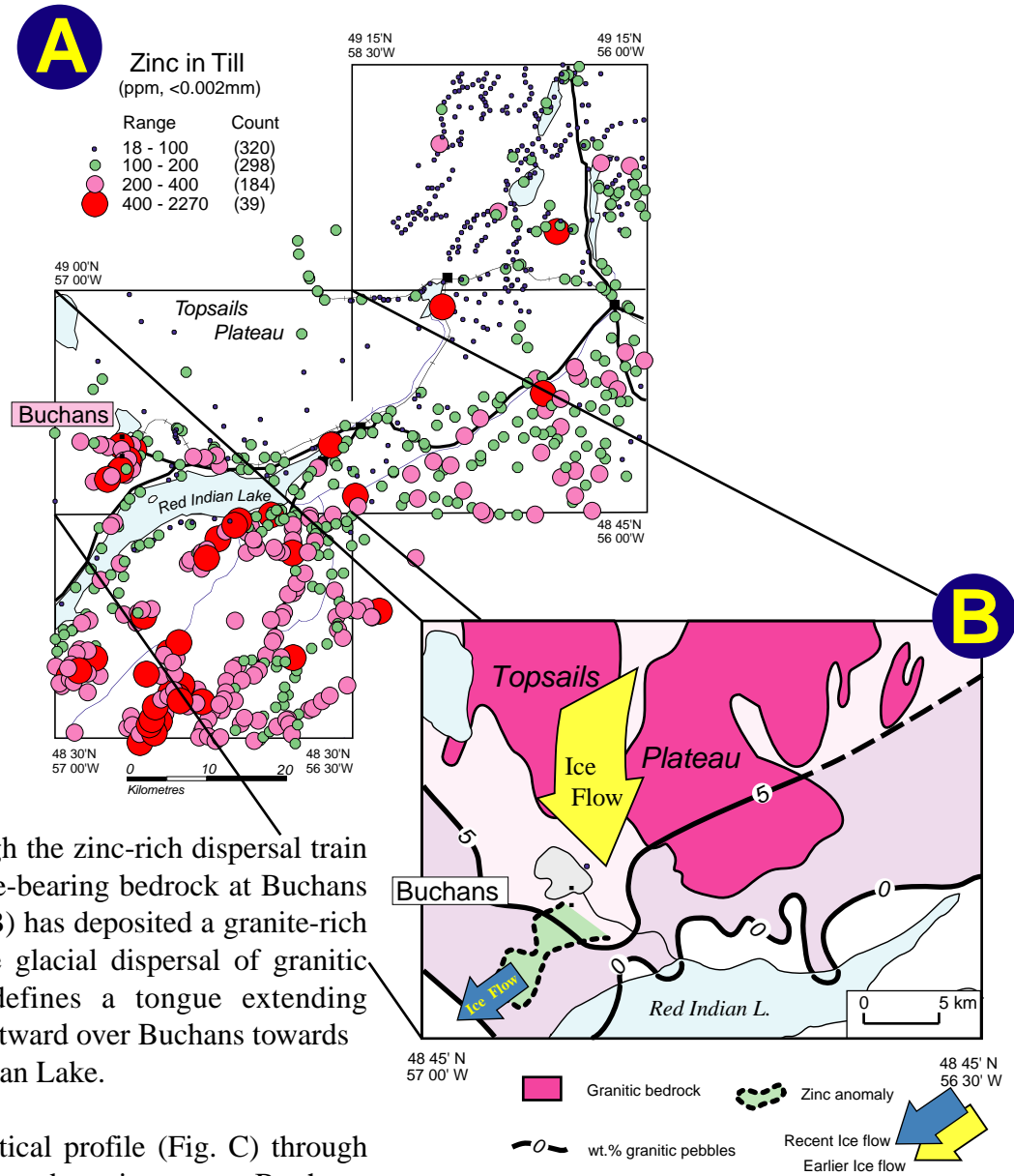
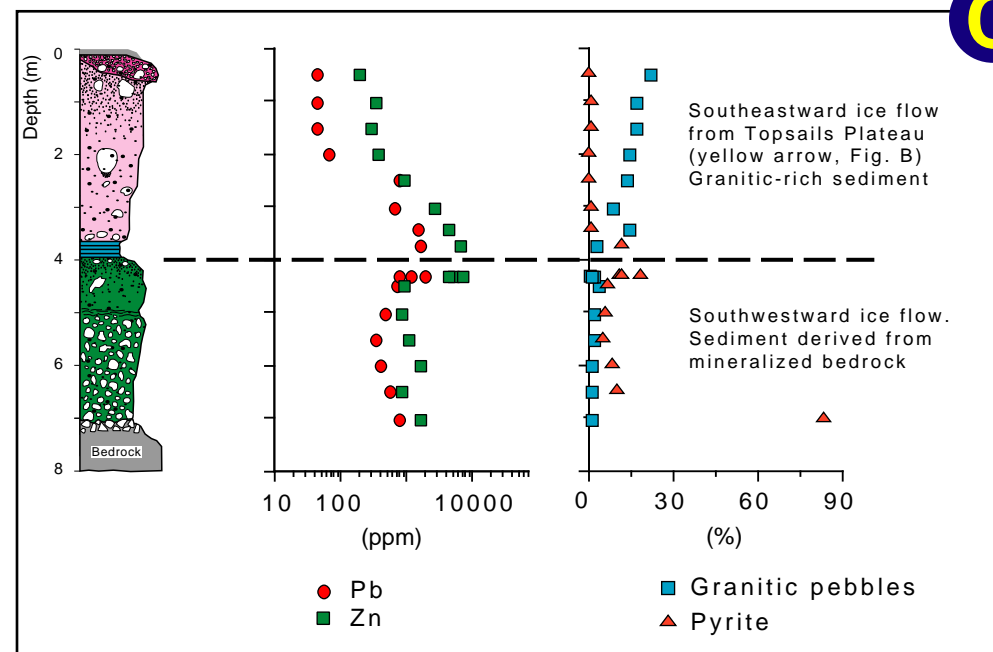


Glaciation, Bedrock Composition and Trace Metals in the Environment

In the surficial deposits of Canada, trace metal concentrations vary widely, reflecting both bedrock composition and the effects of glaciation. In some areas, trace metals occur naturally at concentrations that are commonly associated with pollution, and well above levels set for the purposes of environmental protection. Whether they are "high" or "low", the trace metal concentrations reflect the natural 'background' of the environment.

Geochemical maps of central Newfoundland (Fig. A) illustrate linkages between glaciation and bedrock composition for trace metals in the environment. South of Red Indian Lake, where surficial deposits are derived from volcanic and sedimentary bedrock, arsenic and zinc are naturally enriched ($As > 100$ ppm; $Zn > 200$ ppm) and may represent increased risk to the food chain. In contrast, north of Red Indian Lake where till is derived from igneous and metamorphic rock of the Topsails Plateau, arsenic and zinc are depleted ($As < 40$ ppm; $Zn < 100$ ppm).

At a more detailed scale (Fig. B), glacial erosion removed lead and zinc associated with the now closed mines at Buchans. The lead and zinc-rich debris was transported and dispersed by glaciation up to 10 km southwest of the mines (blue arrow and zinc anomaly (green), Fig. B). The high zinc concentrations illustrate how rocks and minerals can be widely dispersed across the landscape by glaciation. Although the zinc-rich dispersal train provides a clear signal useful for mineral exploration, surficial deposits overlying the ore-bearing bedrock at Buchans are zinc-poor. At Buchans, later ice flow from the Topsails Plateau (yellow arrow, Fig. B) has deposited a granite-rich (>5wt%) but zinc-poor sediment that masks the underlying ore-bearing bedrock. The glacial dispersal of granitic debris defines a tongue extending southeastward over Buchans towards Red Indian Lake.



A vertical profile (Fig. C) through surficial deposits at Buchans illustrates the masking effect of the granite-rich debris. There, the oldest glacial sediments at the bottom of the profile (shown in green, Fig. C) in contact with ore-bearing bedrock are enriched in lead and zinc, as well as other sulphide minerals (e.g. pyrite). In contrast, the uppermost sediments are enriched in granitic debris (shown in pink, Fig. C) and are low in lead and zinc. The vertical profile illustrates that what lies at the surface may be compositionally unrelated to underlying sediments and bedrock. At Buchans, potentially "hazardous" materials, such as metal-rich and easily weathered sulphide minerals, have been naturally buried and protected from surface weathering as the result of glacial geological history. Improper land use and careless surface disturbances could expose these potentially "hazardous" materials to mobilization and uptake into the food chain.