

Province-Scale Controls on Abitibi Lode Gold Deposits

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Most of Canada's world-class gold deposits occur within a small region of the 2.75 - 2.68 Ga Abitibi subprovince. Shallow crustal features appear to control the specific location of gold deposits in this area. However, given the highly irregular distribution of gold deposits across the Superior Province, there may also be distinctive gold source characteristics required for the generation of highly mineralised provinces and giant gold deposits. These source factors must ultimately be related to the varying geologic histories of individual subprovinces.

A GIS-based study of the shallow-crustal factors controlling the distribution of gold deposits in the Abitibi subprovince established a strong association between the gold deposits and 100 km-long crustal-scale faults or shear zones. Over 80% of the gold deposits are sited less than 3 km from one of these structures, and concentrations of deposits occur where the faults strike ENE to E-W and WNW. On a smaller scale, over 80% of gold production has come from deposits sited within 2 km of >10 km long regional-scale faults. The distribution of Abitibi deposits indicates certain lithologies are preferred as hosts. In addition, about 80% of the deposits are located within 1 km of a regional-scale lithological contact.

The distribution of komatiites and a class of proto-arc style low-Ti tholeiites, across the Abitibi belt, indicates that the tectonic history of the belt probably included i) mantle plume – island arc interaction, ii) subduction zone step back and iii) two closely spaced accretionary events. The double orogeny scenario is consistent with the presence of multiple generations of lode gold deposits in the SVZ, given that tectonic disturbances to subduction zones can generate such mineralisation. These events distinguish the southern Abitibi belt from other greenstone belts in the Superior Province and most other cratons world-wide and can be incorporated into a model that relates the prodigiously gold-rich nature of the southern Abitibi belt to its complex accretionary history.