

300 million years of indium-forming processes in A-type igneous environments in the Fennoscandian Shield

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Indium has an increasing demand for liquid crystal displays, high-definition televisions and other products of modern electronic industry. Most of the indium on the global market is a by-product of zinc mining from a number of ore types. However, even if many mines in Sweden and Finland (VMS ores in the Bergslagen, Skellefte and Pyhäsalmi regions) currently are major Zn producers, they are not significant In producers. Instead, since the first indium discovery in the Fennoscandian Shield (Pitkäranta, Ladoga region, in 1910), almost all recent indium discoveries in the Precambrian of Finland and Sweden were made in veins and skarn mineralizations, in close association with 1.85-1.54 Ga anorogenic granites, none of them in current production. A review of them follows:

Moderate grades (up to 83 ppm In) have been recorded in greisen veins in A-type granites of various ages in the *Trans-scandinavian Igneous Belt*: 1.85 Ga (Gillerdrågen and Tyfors) and 1.67-1.70 Ga (Van and Norra Hålen), all located to the northwest of Bergslagen. 1.85 Ga anorogenic granites are also responsible for the metal supply to the polymetallic ores in the Svecofennian supracrustal formations in westernmost Bergslagen (among them Getön, Hällefors, Gruvåsen and Långban), where up to 100 ppm In has been recorded.

A number of In-bearing polymetallic mineralizations occur in the western parts of the 1.64 Ga *Wiborg batholith*, SE Finland. High grades are recorded for the Zn-Pb-Ag-rich vein at Jungfrubergen (up to 600 ppm In) and the Cu-As-Sn-rich Korsvik veins (up to 1500 ppm), the latter with In in roque-site, sphalerite and chalcopyrite (Cook et al. 2011). Indium also occurs with grades of c. 40 ppm in compact magnetite-sphalerite bodies at Getmössmalmen and Pahasaari.

Indium-rich polymetallic veins occur within and outside the 1.57 Ga *Eurajoki stock*, SW Finland, with up to 570 ppm In.

Indium is abundant (up to 600 ppm) in the Zn-rich skarn ores at Pitkäranta, along the western margin of the 1.54 Ga *Salmi batholith*. It is usually sphalerite-hosted but tiny roque-site grains occur in the Hopunvaara deposit (Valkama et al., subm.).

References:

- Cook, N.J., Sundblad, K., Valkama, M., Nygård, R., Ciobanu, C.L., Danyushevsky, L., 2011. Indium mineralization in A-type granites in southeastern Finland:... *Chemical Geology* 284, 62-73.
Valkama, M., Sundblad, K. & Cook, N.J. Geochemistry and petrology of the polymetallic skarn ores at Pitkäranta, Ladoga Karelia, Russia. Submitted to *Mineralium Deposita*.