Poly-phase structural controls on ore deposits in northern Sweden

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The Norrbotten region in northern Sweden is one of the most active mining areas in Europe and hosts several of Europe's most important ore deposits. Important examples include the Aitik Cu-Au-Ag-(Mo) deposit and the Kiruna and Malmberget Fe deposits.

Recent studies currently reconstruct the origin and evolution of ore-bearing structures in northern Sweden with special focus on the Gällivare area. It is tentatively suggested that the majority of structures in the region originated as syn-extensional structures (D_1) forming synchronously with the deposition of ca. 1.9 – 1.89 Ga volcanic and volcano-sedimentary, the emplacement of related intrusive rocks and the formation of apatite iron ore deposits. This extensional phase is comparable to the D_1-extensional phase as reported for the Skellefte District further south (Skyttä et al. 2012). Subsequently the area was overprinted by at least to separate compressional deformation events. The first compressional deformation event (D_2) resulted in the formation of a strong and penetrative cleavage (S_2) and related isoclinal folding under amphibolite facies metamorphic conditions. Likely, the porphyry copper style mineralizations (e.g. early phase in Aitik in Wanhainen et al. 2012) formed during this stage. Furthermore, distinct biotite-rich D_2 shear zones are spatially related to the majority of the apatite iron ores in the region. A second compressional event (D_3) resulted in a strong strain partitioning. Within low strain blocks the S_2 fabric, the D_2 biotite zones and the related ore bodies are folded openly to closely. Most of the D_3-strain was localized in dominantly NNE-SSW-trending, likely reactivated high strain zones that control the location of potassic-epidote-garnet alteration and relating sulfide mineralizations (e.g. second stage in Aitik in Wanhainen et al. 2012).

References:

Skyttä, P., Bauer, T.E., Tavakoli, S., Hermansson, T., Andersson, J., Weihed, P., 2012. Pre-1.87 Ga development of crustal domains overprinted by 1.87 Ga transpression in the Palaeoproterozoic Skellefte district, Sweden. Precambrian Research, 206-207, 109-136.

Wanhainen, C., Broman, C., Martinsson, O., Magnor, B., 2012. Modification of a Palaeoproterozoic porphyry-like system: Integration of structural, geochemical, petrographic, and fluid inclusion data from the Aitik Cu–Au–Ag deposit, northern Sweden. Ore Geology Reviews, 48, 306-331.