The three dimensional crustal architecture of the Aitik Cu-Au-Ag-(Mo)-deposit and the Malmberget Fe-deposit

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The Gällivare area is one of the most active exploration areas in Europe and hosts two of Europe’s most important metal mines, the Aitik Cu-Au-Ag-(Mo) deposit and the Malmberget Fe-deposit. Boliden’s Aitik mine produced since 1968 595 Mt of ore with 0.37 % Cu, 0.19 ppm Au and 3.5 ppm Ag. The ore reserves totalled 710 Mt with 0.25 % Cu, 0.14 ppm Au and 1.6 ppm Ag. Aitik is a conventional very large open-pit operation with a current dimension of the active mining area of 4500 x 1200 m and a depth of 450 m. LKAB’s Malmberget iron deposit is composed of approximately 20 ore bodies, whereas 13 ore bodies with 5-245 Mt each are presently mined in an underground operation. The ore reserves at beginning of 2012 totalled 290 Mt at 44% Fe. LKAB (Kiruna, Svappavaara and Malmberget) stands for more than 90% of the iron ore production in Europe.

Despite of the known mineralized areas in the Gällivare area little exploration has been conducted in northern Norrbotten. In particular the regional structural evolution in general and the structural setting of the deposits in specific is poorly understood and requires further investigations.

An on-going project aims at unravelling the structural geometries, relationships and control on ore formation and ore body transposition in different scales. This will result in a synthesis of the regional-scale tectonic history with constraints on local-scale ore-forming processes and subsequent deformation of ore bodies with the Aitik and Malmberget deposits as the main local study volume.

Recent results show the three-dimensional crustal architecture of the Aitik and Malmberget deposits. Both deposits have undergone at least two separate deformation events whereas the style of deformation differs. A crustal scale shear zone might have steered the formation of the Aitik ore body which was consequently overprinted by intense thrusting combined with strain partitioning (Fig. 1). Differing, the Malmberget ore bodies show indications for regional scale folding and the development of more penetrative fabrics.

Fig. 1: DEM of the Aitik open pit with thrust planes (red). Data source: Boliden