New Insights to the Characterization of the Kiruna Deposit – Contributions from Deeper Exploration

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The Norbotten region, in northern Sweden, is well known for hosting several mineral deposits emplaced during the Paleoproterozoic (2000–1800 My) Svecokarelian orogen. The Kiruna IOA deposit hosts the world's largest underground iron ore mine and is located in the Kiruna-Naimakka deformation zone, which itself is in alignment with the NNE-strike magnetite mineralisation. Several exploration campaigns have been conducted since 2015 to identify the continuation of the mineralisation both northwards and at depth. Historically, two different ore types have been identified, a P-poor (B-type) and a P-rich (D-type) magnetite mineralisation, with the latter generally overprinting the former, although more complex relationships are present. Pervasive sodic alteration is widely observed, of which albite±hematite is the most representative assemblage. Potassic (biotite±magnetite) and sodic-calcic (actinolite±titanite±magnetite-albite) are the most prominent proximal hydrothermal alterations, where several overprinting stages might be encountered. Large structures at deposit scale have been modelled based on drill hole data, historical maps, and geophysical surveys. They are grouped in three faults systems: 1) NS thrust fault (reverse oblique to dip-slip); 2) NW-SE oblique-slip and 3) NE-SW oblique-slip. The pre-syn–mineral structures are closely related with early stages of the mineralisation whilst post-mineral structures may offset the mineralisation by up to 400 m in certain areas. Particularly, a special hydrothermal corridor has been identified in the northern part, for which the connection with the Luossavaara and Per Geijer deposits remains uncertain. Thanks to the LKAB exploration, it has been possible to better understand the main controls and multi-episodic character of the magnetite. Geological modelling has revealed that the mineralisation is present in three stratigraphic positions, which are in connection with faults and alteration domains that reinforce the published character of an IOCG district. These results and findings have contributed to refine the exploration targeting process and open a new window for further research.