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Exploration for REEs in Historic Iron Mining Districts – a Focus on Sweden

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The Olserum-Djupedal project in southern Sweden comprises a significant rare earth element (REE) resource with potential for near-term production. REEs occur in monazite, xenotime, and apatite hosted in intense biotite-magnetite alteration and veining located within gneisses of the Västervik formation and the Småland granite. The Olserum deposit was previously considered to be a high-temperature contact metamorphic-hydrothermal mineralising system (Andersson et al., 2018), with REEs and P probably derived from the Olserum-Djupedal granite by fluid interaction with the crystallising magma and hosted in metasediments near the granite contact. Recent re-logging of the core and mapping indicates that mineralization is shear zone hosted with characteristics of a deep IOA-IOCG-REE system and district-scale potential. Mineralisation is hosted in altered shear zones crosscutting the Småland granite intrusion. Intense alteration and shearing of the host granite has obliterated original textures and replaced original mineralogy. Recent rock chip sampling and historic drilling in the former small-scale iron mining district has shown that many of the other magnetite occurrences are mineralised with potentially ore-grade REEs. Widespread shear-hosted magnetite alteration indicates REE mineralization could be widespread in this district.

The genetic model for the Olserum-Djupedal REE mineralisation needs to be reconsidered, as REE mineralisation is hosted in heavily altered shear zones in a district that fits the IOA/IOCG model. Several iron oxide-apatite (IOA) or Kiruna-type deposits globally are known to be associated with enrichments of REEs, e.g., Per Geijer in Kiruna, the Adirondack deposits of New York, USA, and the Pea Ridge magnetite orebody in Missouri, USA, which hosts four REE-rich breccia pipes and is located in an IOA province.

The Olserum district warrants further exploration to assess the potential for additional economically extractable REEs in order to secure a domestic European supply of these critical metals.