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Palaeoproterozoic metavolcanic and metasedimentary succession hosting the Dannemora iron ore deposits, Bergslagen region, Sweden

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The Dannemora inlier constitutes some of the best preserved primary structures and textures in the metavolcanic and metasedimentary rocks in the Bergslagen region. The aim for this study was to define and interpret the primary textures and deposition environment to obtain a better understanding of the palaeoenvironment in which the Dannemora iron ore deposit formed. In addition, the region has been subjected to at least two fold episodes therefore the establishment of stratigraphy and younging directions were crucial for structural interpretations.

The Bergslagen region, located in the south-central Sweden, represents a back-arc setting active c. 1.9 Ga and consisted of numerous large calderas, that accommodated pyroclastic deposits of great thicknesses. The Dannemora inlier is composed of the supracrustal the Dannemora Formation, which is dominated by of metavolcanic rocks and subordinated by marble. The succession is 700-800 m and is divided into a lower and an upper member. The latter hosts the second largest iron ore deposit in the Bergslagen region. The ore is hosted by manganiferous skarn and dolomitic carbonate (marble) and is situated within uppermost part of the upper member positioned in an isoclinal syncline. From reflection seismic imaging and 3-D processing, the ore has been interpreted to reach depths of c. 2000 m. The presence of an anticline west of the ore bearing syncline is suggested by the geochemical similarities of rock units.

Undisturbed layers of ash-siltstone with normal grading and fluid-escape structures, units of pyroclastic density currents and ash-fall in the eastern part of the Dannemora inlier indicate subaqueous deposition below wave base of the upper member. Reworking of the volcaniclastic deposits is evident in e.g. channels and cross-bedding, on the other hand, implies deposition above wave base of the upper member in the central part of Dannemora inlier. The thickness of the marble in the eastern part is c. 80 m and in the central part the < 20 m, and the magnetic anomaly is greater in the former compare to the latter. The Dannemora Formation consists mainly of ignimbrites and ash-fall deposits, and their pyroclastic origin is evident in characteristic textures e.g. fragmented crystals of mainly quartz, pumice clasts, cuspate and Y-shaped former glass shards. The presence of feldspar replaced pumice clasts, in the lower member, indicates deposition at high temperature. But, the scattered and scarcity of spherulites and lack of welding-compacted fiamme is interpreted as only slightly welding of the ignimbrites. The sericite-replaced glass shards with preserved primary shapes indicate that the upper member was not welded. Scattered epidote spots in the metavolcanic rocks were previously interpreted as altered limestone clasts and consequent subaquatic deposition. But as the matrix of their host rock and the “clasts” has similar textures, they were probably selectively altered, epidote-rich spots related to the intrusions of basaltic dykes.

We conclude that the pronounced positive magnetic anomaly and the thicker marble in the eastern part of the Dannemora inlier supports an interpretation of increased amount of iron ore in the eastern compared to the central part.