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The Naka-Osaka Magnetite Ore Deposit is the First IOA (Kiruna) Type in Japan

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The Naka-Osaka Mine in Shimonita, Gunma Prefecture, Japan, is the geosite of the Shimonita Geopark. This mine produced high-grade magnetite ore. It is also an industrial heritage site where iron manufacturing was carried out in the 19th century. We confirm the Naka-Osaka magnetite ore deposit is the IOA (Kiruna) type.

The Naka-Osaka Mine is located on the north side of the Ookitano-Iwayama tectonic line (the Median Tectonic Line of Japan). The iron ore deposit is composed of small but high-grade magnetite orebodies, and it is embedded in both the Nanjai Formation and the Name Granite. The Nanjai Formation is correlative with the Jurassic Tanba-Mino accretionary complex. The 70 Ma Name Granite is correlative with the Cretaceous Ryoke I-type granite.

The magnetite orebodies are lenticular and/or vein-shaped with wide alteration zones which are composed of actinolite or hydro-biotite + chlorite with carbonate stock-work veinlets. Magnetite contains Si up to 3 wt % and often contains euhedral Cl-apatite micro inclusions (Fig. 1A). The Fe-Si-Al-O amorphous phase (quenched melt?) is found among magnetite and actinolite (Fig. 1B). The minor amounts of sulfides (pyrrhotite, pyrite, lollingite-arsenopyrite composite grains) are associated with the magnetite ore suggesting a low sulfidation state. The filling temperatures of primary fluid inclusions in fine fluorite veins are above 500°C, which is a higher-temperature as compared with common hydrothermal deposits.

The Naka-Osaka magnetite ore deposit has the feature that the main ore mineral assemblage (Mgt + Apa) with a neutral to alkaline alteration zone at high temperatures above 500°C is close to the large-scale tectonic line. This feature of the Naka-Osaka Mine strongly suggests that the magnetite ore deposit classified as the IOA (Kiruna) type. The formation age of the ore deposit assumes 62.5 Ma - 2.2 Ma, which is one of the youngest IOA types in the world.

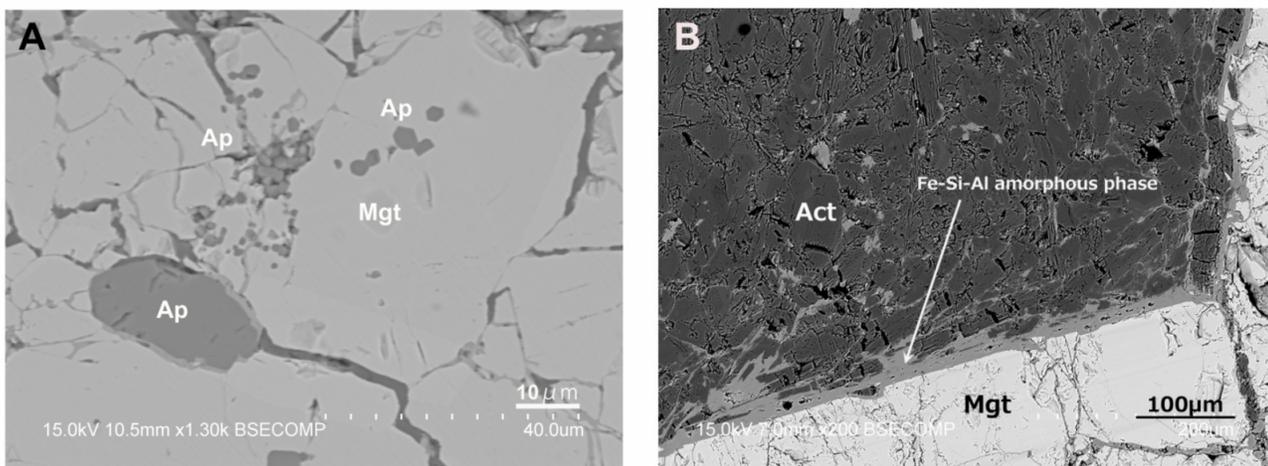


Fig. 1. Back Scattered Electron Images (BEIs) of magnetites of the Naka-Osaka Mine.: A: NO18. Apatite (Ap) inclusions in magnetite (Mgt); B: NO76, Fe-Si-Al amorphous phase occurs among euhedral magnetite and actinolite (Act).