Potential for Iron Oxide-Apatite Deposit and Iron Oxide-Copper-Gold Deposit in Japan: A new paradigm beyond current metallogeny

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The Naka-Osaka Mine in Shimonita, Gunma Prefecture, Japan, is the geosite of the Shimonita Geopark. This mine is also an industrial heritage site where iron manufacturing was carried out in the early Meiji era in Japan. It was produced high-grade magnetite ore. In the Naka-Osaka deposite, fine-grained euhedral apatite is commonly observed as inclusions of magnetite ore. The apatite containing chlorine has similar chemical property as the altered minerals associated with magnetite, which suggests that apatite has the same origin to magnetite. Magnetite with apatite in a neutral to alkaline alteration zone at high temperatures above 500˚C in close to the large-scale tectonic line. These features of the Naka-Osaka mine strongly suggests that the magnetite ore deposit belongs to the iron oxide-apatite (IOA or Kiruna) type.

In addition to current results from the Naka Osaka deposit showing the probability of IOA (Iron-Oxide Apatite or Kiruna) type deposits in Japan, based on that iron oxide type (IOA and IOCG) deposits were discovered around the world from the Precambrian to the Mesozoic ages, therefore, we will reconsider a potential iron oxide type deposits (IOA and IOCG) among magnetite -bearing hydrothermal deposits in Japan. In the vicinity of the Naka-Osaka Mine, there are magnetite ores with gold-containing skarn at the Nakatsu deposit in the Chichibu Mine, and magnetite ores with gold-containing skarn and loellingite at the Kobushi Mine. The origin of these ore deposits needs to reconsider whether an iron oxide-copper-gold type (IOCG).

Iron oxide (IOA and IOCG) deposits, which is occasionally attracting attention as rare earth resources, have recently been explained by a hydrothermal origin with high-temperature iron-chloride fluid penetrating tectonic zone, which is becoming more convincing than an igneous origin related to solidification of iron oxide melt (so-called magnetite lava). Adding to the result from Naka-Osaka deposit, we will propose a new metallogeny based on identifying the presence of apatite in the magnetite ore and their chemical compositions by expanding a scope of magnetite bearing hydrothermal deposits including Kamaishi and Ashio. We also explore a possibility of discovery for a giant copper deposit in Japan by reviewing the formation temperature, pressure (depth) as well as Cu / Au ratio of these deposits.

Keywords: Hydrothermal Magnetite deposit, Iron Oxide-Copper-Gold deposit, Iron-Oxide Apatite deposit, Copper resources, Shimonita Geopark, Naka-Osaka Mine

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