
Garnierite in A Laterite-Ni Deposit from Kolonodale Area, Sulawesi, Indonesia: A Preliminary Study on Mineralogy

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Garnierite is generally used to refer to a group of green, fine-grained poorly crystallized Ni-bearing magnesium phyllosilicates in the laterite-Ni deposit (Springer, 1974; Brindley, 1978; Brand et al., 1998; Elias, 2002). It is highly concerned in recent years (Gleeson et al., 2004; Cluzel and Vigier, 2007; Talovina et al., 2008; Butt and Cluzel, 2013), not only because of its unique geological occurrence and extremely high nickel grade, but also because of its controversial mineralogical properties. In this study, we carry out a primary mineralogy study on some garnierite samples from Kolonodale area, Sulawesi Island, Indonesia, and present some new data about this specific laterite-Ni ore.

In study area, the garnierite occurs in the joints and fractures of the saprolite horizon in the laterite profile, and locally may extend into the underlying bedrocks along the fault zone. They exhibit markedly jade-green color and vein-like texture, and can be clearly distinguished from the adjacent saprolite with earthy texture and greyish-green color. They have an average 15.01% NiO content, which is 24 times higher than the cutoff grade of the general lateritic nickel ore. Petrographic observations and XRD analyses reveal that the garnierite is a mixture consisting of serpentine-like (7Å) minerals, talc-like (10Å) minerals, and a small amount of quartz. This mineral assemblage is comparable to those 7Å-10Å mixed type garnierite in various laterite deposits, such as Cerro Matoso S.A. deposit in Colombia (Gleeson et al., 2004), Goro deposit in New Caledonia (Wells et al., 2009), and Soroako deposit in Indonesia (Sufriadin et al., 2011). Chemical compositions determined by EPMA show that most of the talc-like (10Å) minerals are kerolite with NiO content ranging from 4.89 wt.% to 22.9 wt.%, and only a small number of them are pinnelite with NiO content up to 27.25 wt.%.

The formation of garnierite is ascribed to some specific geological and environmental conditions in study area, including the intensive lateritization of the ultramafic rocks under the rain forest climate, the high pH environment in the lower part of the laterite profile, and the syn-weathering fault activity. The complex mineralogical characteristic of the garnierite indicate that its formation is related to some various supergene processes: the talc-like (10Å) minerals are directly precipitated from the weathering solution by the secondary precipitation process, while the serpentine-like (7Å) minerals are probably formed by the ion exchange process.

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