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A new style of rare metal granite with Nb-rich mica: The Early Cretaceous Huangshan rare-metal granite suite, northeast Jiangxi Province, southeast China

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Abstract

In rare-metal granites, niobium and tantalum are generally hosted by Nb–Ta oxides. However, in SE China, the Nb-specialized Huangshan granites are a unique occurrence in which Nb is essentially hosted by Li–Fe micas. The Huangshan granites are part of the Early Cretaceous (Late Yanshanian) Lingshan granite complex and belong to the A-type granite series, with two facies differing by their mica compositions: medium-grained "protolithionite" granite and medium-grained lithian (lithium-rich) annite granite. The granites are characterized by elevated whole-rock Nb contents (average 144 ppm in "protolithionite" granite and 158 ppm in annite granite), quite low Ta contents (average 9 and 4 ppm, respectively), leading to very high Nb/Ta ratios (average 15.3 and 31.2). Niobium is mainly hosted in the micas, with an average Nb content of 1347 ppm in the lithian annite and 884 ppm in the "protolithionite," which is the highest ever reported in granitic mica. With an estimated endowment of ~80 kt Nb, the Huangshan granites represent a new style of potential Nb resource. Contrasting with the great rarity of columbite, there is abundant Hf-rich zircon, Y-rich fluorite, and Th-rich fluocerite included in the Huangshan micas. Such accessory minerals being typical of alkaline rhyolitic magmas and niobium enrichment in the Huangshan granites results from A-type melt. The extreme Nb enrichment in the micas results from the highly compatible behavior of Nb in this melt, combined with the high magma temperature (estimated at 790–800 °C) and possibly enhanced magma oxidation.

Keywords: Nb-rich mica, huangshan granite, rare metal, south China; From Magmas to Ore Deposits