

Geochemical characteristics of Fe-bearing hornblende gabbros of W Sabzevar, NE of Iran

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The Tertiary plutonic assemblage of W Sabzevar is situated on the south of ophiolitic range and contains three different magmatic phases include leucogranites, main granitoid unit (monzogranite, granodiorite, quartz monzodiorite and diorites) and Fe-bearing hornblende gabbros. Although hornblende and plagioclase are the main constituents of gabbroic rocks, the content of magnetite reach up to 10 volume percentage in some samples. Fe-ore minerals (>70% iron) appear as sporadic patches in limited occurrences of hornblende gabbros (ore hosted hornblende gabbros). The modal content of ore hosted rocks (OHR) is similar to other hornblende gabbros (HB) but trace element composition is clearly different. The OHR samples have higher Cu (102-140 ppm) and Zn (85-96 ppm); and lower Pb (12-16 ppm), Sn (0.3-0.7 ppm), Mo (0.8-1.1 ppm), Ta (0.2-0.3 ppm) and Nb (0.5-0.8 ppm) than HB [Cu (20-30 ppm), Zn (41-53 ppm), Pb (40-50 ppm), Sn (1.2-2.1 ppm), Mo (1.7- 2.2 ppm), Ta (6.5-7.8 ppm) and Nb (10.1-12.5 ppm)]. Furthermore, the rare earth elements (REE) characteristics of OHR and HB are completely different: Σ REE in OHR (17.1-21.4 ppm) is obviously lower than HB (69.6- 91.8 ppm); and Chondrite-normalized REE patterns of HB show more fractionated appearance with steeper LREE/HREE ratio ($La_N/Yb_N= 4.8-6.9$) than OHR ($La_N/Yb_N= 0.9-1.5$) which depicts relatively flat REE pattern.

The textural and geochemical relationships between hornblende gabbros and oxide ores in this area suggest crystallization of Fe-oxides from oxide ore melts. The exact formation of these melts is uncertain, but the abundance of hydrous phases (high amphibole) indicates that the separation of immiscible oxide melts from a ferrobaltic magma [1] could be probable scenario for the formation of iron ore deposits of W Sabzevar.

[1] Zhou *et al* (2005) *J.Petrol.* **46**, 2253- 2280