Geochemical characteristics of metamorphic and igneous rocks from the Hida belt: whole-rock major and trace elements, and multiple S isotope compositions

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The Hida belt is one of the Japanese basement units, indicating relationships with the North China block [1] and/or the South China block [2]. Some studies consider that these metamorphic rocks were formed during the collision between the North and South China blocks [3]. Accordingly, the formation history and the origin of the Hida belt will be of great significance to understand establishment of the eastern Asia continent and processes of continental growth. We collected samples of metamorphic rocks and granitoids from the Hida belt for geochronological and geochemical analyses. In this abstract, we present some geochemical data of the Hida granites including multiple S isotope compositions.

The Hida belt consists of the Hida metamorphic rocks, the Unazuki metamorphic rocks and the Hida granites [4]. The Hida metamorphic rocks, composed mainly of orthogneisses, paragneisses, amphibolite and marble, were formed by several times of metamorphism, and the last regional metamorphism occurred in the eastern margin of the Eurasian continent during Early to Middle Triassic period (250–235 Ma; [5]). The Metamorphic grade reached from amphibolite to granulite facies, with eclogitic rocks [6]. Protolith of the Unazuki metamorphic rocks derived from late Paleozoic sediments, limestone and acidic volcanic rocks was also metamorphosed around 250 Ma at medium P/T conditions [7, 8]. The Hida granites consists of the Triassic Hida older granites and the Jurassic Hida younger granites [4]. We already reported 240 Ma and 190–180 Ma of ^{238}U–^{206}Pb weighted mean ages from the older and younger Hida granites, respectively [9].

SiO_2 content of the Hida granites ranges from 52.7 wt.% to 75.1 wt.%. Both of the older and younger Hida granites show I-type granitic trends in $_2$–ASI diagram and have intermediate composition between sub-alkaline and alkaline series [10]. All samples are plotted in volcanic arc field of tectonic discrimination diagrams for granitoids (Nb+Y–Rb [11] and Rb/30–Hf–Ta*3 diagrams [12]). Additionally, many samples of the Hida granites have adakitic composition (high Sr/Y ratio) and show depleted patterns toward HREE in REE pattern diagram. Negative anomalies of Nb and Ta in trace element patterns suggest that their origins are related to subduction zone magmatism. The Hida granites exhibit small variations in $\delta^{34}S$ ranging from −2.1‰ to +5.2‰ and $\Delta^{33}S$ from −0.02‰ to +0.00‰, suggesting sulfur was mainly derived from the mantle and subsequent high temperature mass-dependent processes. Our results of whole-rock geochemistry are consistent with the idea that the Hida granites were generated by melting of the mafic lower continental crust under high pressure environment where garnet coexists [13, 14]. It is considered that non-adakitic granites resulted from crustal melting under relatively low-pressure. Moreover, geochemical characteristics of the Hida granites suggest that the continental crust had grown in subduction zone of the margin of the eastern Eurasian continent.

[1] Horie et al., 2018. Chem. Geol., 484, 148–167.
[2] Wallis et al., 2020. Island Arc, DOI: 10.1111/iar.12339.
[3] Kunugiza et al., 2010. J. Geol. Soc. Japan, 116, 83–101.
[4] Takahashi et al., 2010. Gond. Res., 17, 102–115.

[5] Takahashi et al., 2017. Island Arc, DOI: 10.1111/iar.12220.
[6] Suzuki, 1973. J. Japan Assoc. Mineral. Petrol. Econ. Geol., 68, 372–382.
[7] Hiroi, 1978. J. Geol. Soc. Japan, 84, 521–530.
[8] Hiroi, 1983. Contrib. Mineral. Petrol., 82, 334–350.
[9] Yamada et al., 2019. Ann. Meet. Geol. Soc. Japan, abstr., 66–66.
[10] Miyashiro, 1978. Contrib. Mineral. Petrol., 66, 91–104.
[11] Pearce et al., 1984. Jour. Petrol., 25, 956–983.
[12] Harris et al., 1986. Collision Tectonics, Geol. Soc. Spec. Pub. 19, 67–81.
[13] Arakawa and Shinmura, 1995. Chem. Geol., 124, 217–232.
[14] Ishihara, 2005. Bull. Geol. Surv. Japan, 56, 117–126.

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