# Detrital zircons from the Higo and Abukuma metamorphic terranes, Japan: implication for the sediment provenance

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In the Cretaceous low-pressure and high-temperature metamorphic terranes of Japan, the Higo (south-west Japan) and Abukuma (north-east Japan) metamorphic terranes are characterized by the occurrences of peraluminous metapelitic rocks and impure marbles, and absence of chert, and zircon U-Pb age of ca. 260Ma, suggesting that these terranes might be the eastern extension of the North China-South China collision zone [1,2,3,4]. However, new results of our zircon SHRIMP and LA-ICP-MS U-Pb dating do not necessary support the possibility of eastern extension of the North China-South China collision zone. Lu-Hf isotopic data for the detrital zircon may imply that the possible provenance for the Higo and Abukuma metamorphic terranes is the South China Craton.

The metamoprhic age of ca. 260 Ma could not be replicated from the Higo and Abukuma metamoprhic terranes in this study. Detrital zircons from the Higo and Abukuma metamorphic terranes show an age peak around the Carboniferous to early Jurassic, wchich is agree with previous works [5,6; i.e. 330 to 184Ma and 280 to 200Ma, respectively]. These lines of evidence may imply that the age of ca. 260 Ma shows a protoligh age for the metamoprhic terranes. Moreover, the Permian-Triassic detrital zircons from the Higo metamorphic terrane are characterized by positive $\varepsilon Hf_{(T)}$ values ($+7 < \varepsilon Hf_{(T)} < +10$) with high Th/U ratio ($0.2 < Th/U < 0.5$). Many Permian-Triassic granites are present within the Yangtze and Cathaysia Blocks of the South China craton [7], and zircons with positive $\varepsilon Hf_{(T)}$ values were found in the Permian-Triassic felsic rocks of the Emeishan large igneous province [8]. We concluded that the provenance for the Higo and Abukuma metamorphic terranes may be indicative of the South China Block implying that they may not be the eastern extension of the North China-South China collision zone.

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# Chemistry and petrography of detrital magnetite applied to mineral exploration in glaciated terrains

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The spinel structure of magnetite has potential to carry unique chemical and petrographic signatures imposed by compositional and physico-chemical conditions during crystallization and subsequently during metamorphism or weathering. The chemical composition of detrital magnetite is applicable in provenance studies, in particular for mineral exploration. Its ubiquity in mineral deposits, its resistance to weathering and abrasion, and ease of magnetic separation have led magnetite to be considered an indicator mineral. This study aims to determine the usefulness of chemistry and petrographic features of detrital magnetite in mineral exploration in glaciated terrain. A total of 186 grains from the 0.18-2.0 mm ferromagnetic fraction of till deposited down-ice of the Halfmile Lake VMS deposit (Bathurst Camp) were investigated. To find out the effect of erosion of surrounding lithologies on the formation of till, 176 grains from hostrocks and magnetite alteration zones in the area were examined. Mineral grains were liberated from rocks using a small plate crusher. Minor and trace elements of the grains in till and bedrock (K, Ca, Al, Si, Ti, Mg, Mn, Cr, V, Cu, Zn, Ni ) were measured using the Electron Probe Micro-Analysis. Various plots of these elements show that till samples generally form a cluster of very similar compositions that are different from magnetite in the Halfmile deposit country rocks especially because of their lower Si and higher Ti and V content. Electron microscopy and Mineral Liberation Analysis (MLA) are also applied to study these till and bedrock grains to evaluate relationships between mineralogy, abundances and associations of minerals. Results indicate that up to 90 percent of magnetite in both till and country rocks are polymineralic, and that detrital magnetite is Ti-bearing and is most often accompanied with titanomagnetite, ilmenite and hematite. In the Halfmile deposit bedrock samples, in contrast, magnetite is mostly in association with sulfide and/or silicate minerals. These heterogeneities in composition and mineral associations of till and most of rock samples suggest that magnetite in till is largely derived from distant sources. Detrital magnetite shows the greatest chemical similarities with magnetite from nearby granitic rocks.