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Tectonic environment of Triassic sandstones in NE Japan: Constraints from detrital zircon geochronology

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INTRODUCTION U-Pb LA-ICP-MS dating of detrital zircons was carried out of the South Kitakami, Nedamo, and North Kitakami belts, NE Japan. The analyzed samples were taken from (1) the Osawa, Fukkoshi and Isatomae formations of the Lower-Middle Triassic Inai Group, and the Chonomori Formation of the Upper Triassic Saragai Group in the South Kitakami Belt (SKB), (2) age-unknown Takinosawa Unit in the Nedamo Belt (NB), and (3) age-unknown Kamatsuda calcareous sandstone in the North Kitakami Belt (NKB). All of the sandstone samples are of lithic sandstone with abundant volcanic-rock fragments. We aim to constrain, from the dating, the age of Takinosawa and Kamatsuda sandstones, and evaluate the tectonic environment of Triassic sandstones in Northeast Japan.

OUTLINE OF GEOLOGY The **SKB** retains Ordovician to Early Cretaceous continual succession of shallow-marine strata (e.g., Kawamura et al., 1990), and is very important in analyzing the long-term tectonic and environmental history of the Japanese Islands. The **NB** lies in northwest direction between the SKB and NKB on the northeast (Ehiro and Suzuki, 2003). The Nedamo Complex, the main constituent of the NB, has been lithologically subdivided into the Tsunatori and Takinosawa units. The Tsunatori Unit occupies the southwestern, apparently upper half of the Nedamo Complex, and contains Late Devonian chert (Hamano et al., 2002) and probably Early Carboniferous siltstone (Uchino et al., 2005). The **NKB** lies on the northeast of the SKB and NB, and consists mainly of Jurassic to earliest Cretaceous accretionary prism. Nakae and Kurihara (2011), however, recently reported the Kirainai Unit with Late Permian mudstone along the southwestern margin of the NKB. The Kamatsuda sandstone is lithologically very similar with Kirinai sandstone.

RESULTS (1) **Triassic sandstone samples of the SKB**: All of the zircon ages clustered at 320-195 Ma. The concordant age of the youngest zircons in each sample ranged from 248 Ma to 195 Ma, and had upward-younging polarity. (2) **Takinosawa sandstone**: All of the zircon ages clustered at 330-240 Ma, and the concordant age of the youngest zircons was 241.2 +/- 6.5 Ma. (3) **Kamatsuda sandstone**: 58 zircon ages out of 65 clustered at 290-240 Ma, with smaller clusters or age distributions at 320 Ma, 360 Ma, 460-415 Ma, 1405 Ma, and 2475 Ma. Only two Precambrian zircons were detected, and the concordant age of the youngest zircons was 240.4 +/- 6.4 Ma.

DISCUSSION The age of most zircons analyzed in this study fell between 330 Ma and 195 Ma, except for 6 zircon ages from the Kamatsuda sandstone. The age distribution of detrital zircons from the Kamatsuda sandstone was also close to that of other sandstone samples. The unimodal (330-195 Ma) age distribution pattern emerged from the present study is quite different from that of Permo-Triassic sandstone in South Korea with 80% of Paleoproterozoic zircons (Lee et al., 2012). The Ordovician-Devonian and Middle Jurassic-Early Cretaceous sandstone samples of the SKB do not show a unimodal pattern, either (Shimojo et al., 2010; Okawa et al., 2012). Since all the studied samples are those of lithic sandstone with abundant volcanic-rock fragments, the Triassic sandstone of the SKB and the Takinosawa sandstone of the NB were most likely deposited in an island arc-trench system apart from a continent with Precambrian rocks. Although the Nedamo Complex was considered to be an Early Carboniferous accretionary prism, the Takinosawa Unit, having the youngest detrital zircon age of 241 +/- 6.5 Ma, must have formed in Middle Triassic or later. We further interpret that the Takinosawa Unit was accreted to an island arc that accumulated the Triassic sandstone of the SKB, in Middle to Late Triassic times, because of the close resemblance of the age distribution pattern between the Triassic sandstone of the SKB and the Takinosawa sandstone, both with abundant volcanic-rock fragments.

Keywords: U-Pb age, LA-ICP-MS, South Kitakami Belt, Nedamo Belt, North Kitakami Belt, oceanic island arc