

Detrital zircon geochronology of the Sangun metamorphic rocks: Implications to the evolution of an arc-trench system

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INTRODUCTION High P/T type metamorphic rocks in the Inner Zone of SW Japan have collectively been called the Sangun metamorphic rocks. Their protolith age and tectonic development, however, have not fully been understood. In this study, we carried out U-Pb analyses of detrital zircons from the Sangun schists to constrain the protolith age and provenance.

OUTLINE OF GEOLOGY The Sangun metamorphic rocks have been subdivided from K-Ar cooling ages and tectonostratigraphy as follows: the Renge (RMR; ca. 300 Ma), Suo (SMR; ca. 220 Ma), and Chizu (CMR; ca. 180 Ma) metamorphic rocks (Shibata and Nishimura, 1989) in apparently descending order. The protoliths of the metamorphic rocks are sandstone, mudstone, chert, and mafic rocks, suggesting that they are originated from accretionary complexes.

RESULTS We collected ten samples of pelitic and psammitic schist from the following areas. RMR: one sample each from the Kashii (RK), Wakamiya (RW), Saga (RS), and Iiba (RI); SMR: three samples from the Yame area (SY1 to 3), one sample from the Asakura area (SA) and one sample from the Hazumi-minami Formation (SH); CMR: one sample from the Maniwa area (CM). The results listed below are presented in the following order: the shape of the probability density plot (peak ages +/- width (Ma); main peaks are in bold letters), percentage of Precambrian zircons (%Pc), the youngest 206Pb/238U age with the 2SD error (YZ (Ma)).

RMR (K-Ar cooling age = 272 +/- 8 Ma (Shibata and Nishimura, 1989))

- RK: quasi-unimodal (**473 +200/-85**, small peaks >700), %Pc = 31.3%, YZ = 417.1 +/- 10.7

- RS: quasi-unimodal (**446 +95/-40**, small peaks >800), %Pc = 23.8%, YZ = 415.4 +/- 10.3

- RW: quasi-unimodal (**437 + 120/ - 90**, small peaks >600), %Pc = 37.5%, YZ = 361.7 +/- 11.9

- RI: quasi-unimodal (**460 +/- 160**, small peaks >900), %Pc = 13.3%, YZ = 299.5 +/- 5.5

The protolith age of the RMR is constrained between 428 Ma (Gorstian of Late Silurian) and 264 Ma (Wordian of Middle Permian).

SMR (K-Ar cooling age = 211 +/- 7 Ma (Shibata and Nishimura, 1989))

- SY1: quasi-unimodal (**273 +45/-33**, 1771 +/- 31), %Pc = 0.7%, YZ = 248.3 +/- 7.2

- SY2: quasi-unimodal (**259 +123/-32**, 1700 +/- 250, older 5 grains), %Pc = 14.6%, YZ = 236.6 +/- 4.1

- SY3: quasi-unimodal (**248 +97/-27**, 389 +/- 23, 1770 +/- 250), %Pc = 13.7%, YZ = 228.8 +/- 5.6

- SA: quasi-unimodal (**253 +50/-30**, 10 grains of 400-2700), %Pc = 7.1%, YZ = 231.5 +/- 7.2

- SH: quasi-unimodal (**254 +/- 45**, 1850 +/- 200, 2310 +/- 60), %Pc = 16.5%, YZ = 207.0 +/- 4.0

The protolith age of the SMR is constrained between 256 Ma (Wuchiapingian of Late Permian) and 204 Ma (Rhaetian of Late Triassic).

CMR (K-Ar cooling age = 178 +/- 6 Ma (Shibata and Nishimura, 1989))

- CM: multimodal (**176 +45/-8, 245 +/- 35**, 1970 +140/-250), %Pc = 42.4%, YZ = 174.1 +/- 4.6

The protolith age is constrained between 184 Ma (Pliensbachian of Early Jurassic) and 170 Ma (Bajocian of Middle Jurassic).

DISCUSSION The original accretionary complex of the RMR was likely formed along the Gondwana continental margin in the Late Silurian-earliest Permian age; the quasi-unimodal age distribution with small peaks between 400 Ma and 3000 Ma is common with the coeval sandstone on or near Gondwana-derived continental blocks in East Asia (e.g. Tarim block; Rojas-Agramonte et al., 2011). On the other hand, the SMR and CMR have downward-younging polarity in the youngest zircon age. In addition, zircon age distribution pattern gradually changes downward from a quasi-unimodal pattern to a multimodal pattern with a 2,100-1,700 Ma peak. 2,100-1,700 Ma is the age of igneous activity related to the amalgamation of the North China Craton.

Assuming that these high-P/T type metamorphic rocks were formed intermittently in a single subduction zone, it is presumed that the tectonic setting changed from the Gondwana continental margin (Late Silurian-Early Permian), through the margin of an oceanic island-arc (Late Permian), to the margin of the North China Craton (Late Triassic-Early Jurassic).

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, Sangun Metamorphic rocks, arc-trench system, eastern margin of continental Asia