New constraints on the tectono-thermal history of the Ryoke Belt (Iwakuni-Yanai area, Yamaguchi Prefecture)

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We present new structural, petrological and geochronological data on magmatic and metamorphic rocks from the Iwakuni-Yanai area (Yamaguchi Pref.), and discuss the tectono-thermal evolution of the Ryoke Belt in this region.

Schistose rocks in the northern part of the area preserve a sedimentary bedding structure, while gneissic rocks in the southern part exhibit a penetrative, bedding-parallel metamorphic foliation. Structural mapping suggests that a vertical shortening event (D0) affected the lithologies located to the south of the schist/gneiss transition, but probably not those present to the north. It is confirmed by the structural difference between the northern Shimokuhara (isotropic) and southern Namera (gneissose) granite. The whole area was subsequently affected by E–W upright folding (D1), the intensity of which is stronger to the south where sills of the Gamano granodiorite are folded together with their host metamorphic rocks. The orientation of the porphyritic Kibe granite is concordant with the E–W strike of D1 structures, whereas the latter are cross-cut by the Iwakuni pluton. Crystallization-deformation relationships indicate that andalusite or cordierite blasts initially formed along the margin of the western (Shimokuhara and Namera) granitoids, and were later overgrown by regional assemblages which define a metamorphic gradient increasing from north to south. New LA-ICP-MS U–Pb zircon analyses yield ages of 105–103 Ma for the western granitoids, 100–94 Ma for two Gamano granodiorite samples, 98–97 Ma for the Kibe granite and ~96 Ma for the Iwakuni granite. Zircon grains in Grt-Crd gneissic rocks yield age results scattered between 103 and 94 Ma. EMP monazite dating in Kfs-Crd and Grt-Crd gneisses reveals a major age peak at ~95 Ma, but several younger domains of about 85–75 Ma are also identified.

We use the combination of data to propose that, first, the western Shimokuhara and Namera granites generated contact metamorphism at a relatively shallow crustal depth (~105 Ma). It was shortly followed by the intrusion of the deeper Gamano granodiorite and by syn-D0 regional metamorphism (~100 Ma). The subsequent D1 upright folding event predated or was coeval with the intrusion of the Kibe granite, but was postdated by the Iwakuni intrusion (~96 Ma). Monazite age domains younger than 95 Ma correlate with published EMP monazite and K-Ar biotite ages for granitoids. We believe that they reflect the period of vanishing medium temperature conditions (>500°C), and not the prograde metamorphic history.