Age of Sanbagawa Metamorphism and Time Scales of Orogenesis

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Studies of metamorphic belts offer insights into processes operating at depth in convergent margins. Oceanic subduction-type metamorphic belts are especially important because they do not have complications caused by continental collision. An important constraint on the tectonic significance of such metamorphic regions is the time scale of orogeny: do the rocks record a continuous history since the inception of subduction or rather a single and less representative event in the evolution of the margin? One of the best-studied examples of oceanic-type subduction metamorphism is the Sanbagawa metamorphic belt of SW Japan. In the Sanbagawa belt mica Ar and zircon fission track ages record relatively slow cooling from 80 to 65 Ma. However, the peak age is less clear. Okamoto et al. [1] report U–Pb ages of zircon rims in eclogite of 132–112 Ma. This result suggests a relatively long-lived orogenesis, but no clear link with metamorphic history was established. In contrast, Lu–Hf dating of eclogite facies minerals [2] yields a peak metamorphic age of 89–88 Ma. In combination with relative chronology established by petrological and structural studies, the Lu–Hf results suggest a short-lived Sanbagawa orogeny with rapid exhumation—on time scales of less than a few million years. More recent zircon U–Pb ages are compatible with this interpretation [3]. Endo et al. [4] present additional Lu–Hf and petrological data suggesting the presence of an older stage of Sanbagawa metamorphism around 116 Ma that predates the main phase of orogenesis at 89 Ma and thus offering an explanation for both the Lu–Hf and older zircon U–Pb ages. The present state of knowledge suggests most of the structures and metamorphism of the Sanagawa belt formed over a few million years and reflects a snapshot in the evolution of the margin when conditions were favourable for rocks to return to the earth's surface.

References

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