Did the Ryoke belt form beneath the Cretaceous volcanic arc?

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The tectonic relation between the Sambagawa and Ryoke belts has been an enigma since the Miyashiro's (1961) proposal of the paired metamorphic belts. In his theory, the high *P/T* metamorphic belt like the Sambagawa belt forms at the subduction zone, whereas the low *P/T* metamorphic belt like the Ryoke belt forms beneath the volcanic arc. There is an arc-trench gap typically about 100 km wide between them, however, the Sambagawa and Ryoke belts are at present in contact with each other by the Median Tectonic Line. How did the two belts come together? That is the problem. Ito et al.(2009) made a substantial progress on this issue. They studied the crustal structure of the Southwest Japan by the integrated seismic experiment and showed an magnificent result with respect to the subsurface structure of the Ryoke belt. They found a prism structure named the SSP (Seto Subsurface Prism) that is a 60 km wide and 20 km thick prism with cross section of an isosceles triangle. The SSP is bordered to the south with the Sambagawa belt by the MTL and grades into the Jurassic nappe units of the inner zone of the Southwest Japan to the north. The SSP consists of the Ryoke metamorphic rocks and Ryoke and Sanyo granites at the surface, and probably so does the subsurface constituent. In the Ryoke belt at the Chugoku and Shikoku districts, basic intrusives of Cretaceous in age occur sporadically in granites in the south (Nakajima et al., 2004), and the metamorphic rocks occur in the north of the belt, of which metamorphic grade generally increases southward except local thermal disturbance (Nakajima, 1994; Ikeda 2004). Granites of the Ryoke belt belong to the ilmenite series and grades to the magnetite series from the Sanyo to San-in belt to the north (Ishihara, 1977).

The morphology and tectonic location of the SSP is very similar to that of the Great Valley forearc basin in the West Coast of north America. The essence of my new hypothesis is that the SSP formed as accumulated accretionary complex at the tectonic location equivalent to the forearc basin. That is, the Ryoke belt formed in situ at the present position (the past forearc basin). The protolith of the Ryoke metamorphic rocks are known as Jurassic accretionary complexes. During the formation of Jurassic accretionary prism, the thickening of accretionary complex was enhanced by out-of-sequence thrust (Kimura, 1998). The thickened complex developed laterally towards the arc from the subduction zone to make nappes on the arc. At the forearc, the thickened complex caused subsidence of the forearc region with a flexure of middle crust, finally making the SSP. The sediments within the SSP was then heated by radiogenic heat and also by basic magmas intruded into the lower part of the SSP, leading to the partial melting of the SSP sediments to form granitic magams. Thus the sediments in the SSP were converted into granites and low *P* metamorphic rocks, which are now recognized as the Ryoke belt. The fact that the Ryoke granites belong to I-type granites may contradict the above hypothesis, however, the ilmenite series nature of the Ryoke granites represents reduced condition for the genesis of Ryoke granites, which strongly suggests the partial melting or assimilation of sediments.

The Ryoke metamorphic rocks represents the burial depth of about 15 km (e.g. Ikeda, 2004), therefore, the original depth of the SSP may have reached 35 km. Such thick sediments in the SSP may pressurized the structurally lower Sambgawa belt to make it squeezed out to the surface. Thus the formation of the SSP may be a cause of the exhumation of the Sambagawa belt. The thick SSP may have uplifted due to buoyancy to keep isostacy, then the upper portion of the SSP may have been eroded out to crop the lower portion, consisting of metamorphic rocks and plutonic rocks, out to

the surface.

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