

Research Paper

Late Permian radiolarians from the Ajima Formation of the Ultra-Tamba Terrane in the Sasayama area, southwest Japan

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Abstract

The Ajima Formation of the Ultra-Tamba Terrane has been regarded as Mesozoic fore-arc sediments and is mainly distributed in the western part of the Sasayama area, southwest Japan. The formation consists mainly of clastic rocks with a small amount of basalt and hydrothermal chert, and tectonically overlies the Middle Triassic Kamitaki Formation. The Ajima Formation is previously considered as Mesozoic or Late Jurassic, the newly discovered radiolarian fauna from the siliceous mudstone intercalated with sandstone and siltstone of the formation, however, corresponds to the upper part of the *Neobaillella ornithoformis* assemblage zone and the *Albaillella levis* abundance zone (early Changhsingian). Although the Ajima Formation and Ultra-Tamba Terrane in the Hokusetsu area are regarded as Late Jurassic fore-arc sediments (Inagawa Group of Ishiga, 1990a), unconformably overlying the Permian subduction-related accretionary complex, this study suggests that these strata tectonically overlie the Triassic and Jurassic subduction-related accretionary complex of the Tamba Terrane or Middle Triassic formation, as Permian strata. Then the radiolarian fauna from the Ajima Formation implies that the highly abundant fauna of *A. levis* thrived not only in the central Panthalassa but also in the western margin of the Panthalassa.

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Keywords: Inagawa Group; Inagawa complex; Upper Permian; Takatsuki Formation; *Albaillella* abundance zone; Panthalassa

1. Introduction

The Ultra-Tamba Terrane is one of the Pre-Jurassic terranes in the Inner Zone of the Southwest Japan (Fig. 1) and Far East Russia (e.g., Kojima et al., 2000). This terrane was defined by Caridroit et al. (1985) as the Permian strata between the Maizuru and Tamba terranes. Ishiga (1986a) added the Hikami Formation (=“green sandstone” of Caridroit et al., 1985) to the Ultra-Tamba Terrane. Ishiga (1990a) subdivided the terrane into UT3 (Kozuki Formation), UT2 (Oi Formation), and UT1 (Hikami Formation and Jurassic Inagawa Group) units in tectonically descending order. The main constituents of the Ultra-Tamba Terrane occur in the Maizuru-Obama, Kozuki-Mimasaka, Sasayama, and Hokusetsu areas (Fig. 1).

The Inagawa Group, distributed in the Hokusetsu area (the northern Osaka Prefecture) and the Sasayama area (the middle eastern Hyogo Prefecture), was defined as the Upper Jurassic strata overlying the Permian subduction-related accretionary complex of the UT1 unit by Ishiga (1990a); Late Jurassic radiolarians were found in the Takatsuki Formation (an equivalent of the Inagawa Group) in the Kyoto Nishiyama area (the eastern part of the Hokusetsu area) (An’yoji et al., 1987). However, in the Hokusetsu area (Fig. 1), the Takatsuki Formation and the Inagawa Group regarded as Late Jurassic fore-arc sediments (Nakae, 1993) contain Permian radiolarian clastics (Sugamori, 2006) and are interpreted as a subduction-related accretionary complex (Sugamori, 2006, 2009).

The equivalent of the Inagawa Group in the Sasayama area is named the Ajima Formation (Arai and Sakaguchi, 1955; Ishiga et al., 1987; Ishiga, 1990a; Kurimoto et al., 1993). Sugamori (2009) pointed out that it is important for the study of the Ultra-Tamba Terrane to know whether or not the Ajima For-

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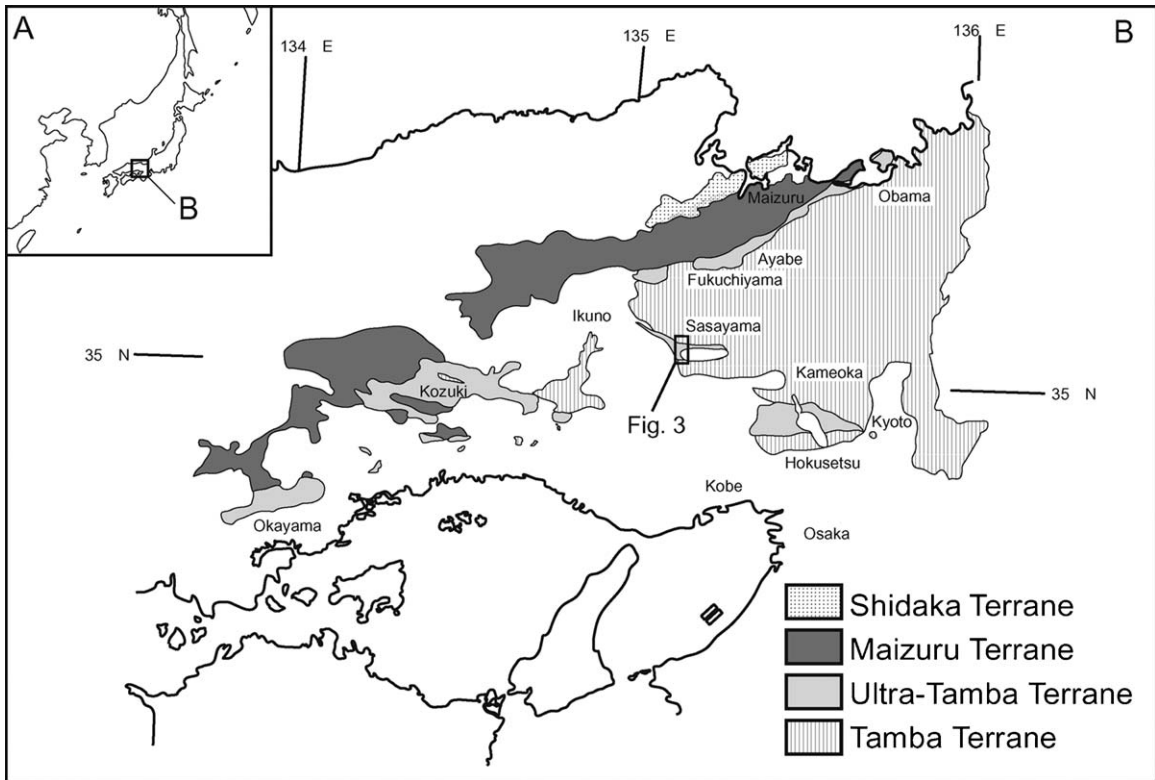


Fig. 1. (A) Map showing Japanese Islands. (B) The tectonic units in the Inner Zone around the Kinki district. Modified from Sugamori (2009).

mation is the Mesozoic formation unconformably overlying the Permian subduction-related accretionary complex. The present study documents the presence of Late Permian radiolarians from the Ajima Formation and its geologic age.

2. Geological overview of the study area

The study area is situated in the west of the Sasayama basin, middle eastern Hyogo Prefecture, southwest Japan (Fig. 1). The Ultra-Tamba Terrane in the study area is investigated by many workers since Onoyama (1931) (Fig. 2). According to Kurimoto et al. (1993), pre-Cenozoic strata in the western part of the Sasayama area are divided into the Ultra-Tamba Terrane, the Tamba Terrane, and Cretaceous strata and dykes. The geological map and geological cross section in the study area are shown in Fig. 3.

The Ultra-Tamba Terrane consists of the Ajima and Kamitaki formations in the study area, the former tectonically overlying

the latter formation. The Ajima Formation is composed mainly of clastic rocks with basalt and chert. The Kamitaki Formation is composed mainly of massive sandstone and mudstone with a small amount of basalt. Sugamori (2008) discovered the Middle Triassic radiolarians from the clastic rocks of the Kamitaki Formation.

The Tamba Terrane in the study area is composed of the Fujioka Complex, containing clastic rock, chert, and mafic-rock blocks of various sizes within a muddy matrix. This complex contains Early Jurassic and Late Triassic clastic rocks, Permian and Triassic chert, and Permian limestone (Kurimoto et al., 1993; Takashiroyama Research Group, 1993). This terrane tectonically underlies the Ajima and Kamitaki formations.

Cretaceous strata are subdivided into the Lower Cretaceous Sasayama and Upper Cretaceous Arima groups. The Sasayama group unconformably overlies the Ultra-Tamba Terrane. The Arima group unconformably overlies pre-Upper Cretaceous

Onoyama (1931)	Arai and Sakaguch (1955)	Sakaguchi (1959)	Ishiga et al. (1987)	Tokura and Takashiroyama Research Group (1987)	Ishiga (1990)	Kurimoto et al. (1993)	Present study
			Ajima F. (U-T)	Ajima F. (U-T)	Ajima F. (U-T?)	Ajima F. (U-T)	Ajima F. (U-T)
Taki Group	Ajima F.	Takashiroyama F.		Kamitaki F. (U-T)	Kamitaki F. Takashiroyama F. (U-T)	Kamitaki F. (U-T)	Kamitaki F.
			Takashiroyama F. (U-T)			Fujioka C. (T)	Fujioka C. (T)
	Taki Group	Manajo F. (T)				Takashiroyama F. (T)	
						Fujioka C. (T)	

Fig. 2. Correlation of stratigraphic units in the study area: U-T, Ultra-Tamba Terrane; T, Tamba Terrane; F., Formation; C., Complex.

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