Fission-track study of the Omgon accretionary complex on Western Kamchatka (Russian Far Eeast): Possible northern continuation of the Shimanto belt (Japan)

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ABSTRACT

Detrital zircon fission-track ages from sedimentary rocks of the Omgon accretionary complex (Western Kamchatka) suggest deposition and deformation of this wedge resulted from Cretaceous subduction of Pacific oceanic plates under the Eurasian continental margin. The Omgon accretionary wedge was originated in very similar geodynamic setting and same time as Cretaceous Shimanto Belt much farther to the south (older part of the belt). The similarity of ages, lithologic similarity, and tectonic setting may suggest the Omgon is the northern continuation of Shimanto. If the Omgon is a northern continuation, and if it is in place, this suggestion has important implications for the evolution of the Sea of Okhotsk to the east.

Key **words**: *fission-track, zircon, accretionary wedge, Kamchatka*

INTRODUCTION.

A detailed understanding of accretionary complexes can provide important insight into the formation and development of continental crust in subduction zones. On-land fission-track investigations on accretionary wedge were carried out in a number of places including in southwest Japan (Shimanto belt (Hasebe, Tagami, 2001)), western coast of North America (Franciscan Complex (Dumitru, 1989) and Olympic Subduction Complex (Brandon and Vance, 1992; Stewart, Brandon, in press)). An ancient accretionary complex exposed on the eastern coast of the Sea of Okhotsk in the Omgon Range (Western Kamchatka) has only recently been discovered by our mapping. Map relations, lithological, structural and detrital fission-track studies indicate that the Omgon represents an accretionary complex (Fig. 1 B, C) formed in Cretaceous as result of offscraping and underplating of the upper part of the oceanic crust during subduction of Pacific oceanic plates under the Eurasian continental margin. The Cretaceous Omgon belt is similar in age, structure and tectonic position to Shimanto belt in southwest Japan (Fig. 1 C).

GEOLOGICAL OVERVIEW

The oldest unmetamorphosed sedimentary sequence in Kamchatka is exposed on the eastern coast of the Sea of Okhotsk in the Omgon Range. The Omgon Range is made up of southeast-verging imbricated tectonic units (Fig. 1d). The imbricated sequences are dominated by sandstones, mudstones, conglomerates < flysch complex), as well as a number of slices and blocks of pillow and massive basalts with radiolarian cherts (volcanogenic-siliceous complex). The Omgon Flysch is mainly highly deformed turbidites, with macrofossils and flora indicating an Albian-Coniacian (c. 113 to 87 Ma) age (Geologiya USSR, 1964). Sandstones are uniform in composition and the sediment is inferred to have been derived from a continental arc. The slices and blocks have the oceanic affinity based on their geochemistry (Soloviev et al., 2000). Radiolarian assemblages and Buchias ranging in age from Jurassic to Early Cretaceous are reported from volcanogenic-siliceous slices and blocks (Vishnevskaya et al., 1999). Available paleomagnetic data indicate that complexes of Omgon Range are located in more-or-less their modern position definitely since the beginning of Paleocene and probably since Cretaceous (Chernov and Kovalenko, 2001).

Detrital fission-track (FT) thermochronology. Detrital FT thermochronology involves using FT ages of single grains for stratigraphic correlation, provenance analysis, dating unfossiliferous sediments, and exhumation studies (e.g. Garver et al., 1999). Detritus shed off an active arc tends to retain a good record of the timing of volcanic and high-level intrusive events. In this case, a population of detrital grains is derived from contemporaneous volcanics and therefore the age of the young population can serve as a proxy for depositional age, or a limiting age on the timing of deposition. Detritus from contemporaneous volcanic sources is transported very quickly into adjacent flanking basins.

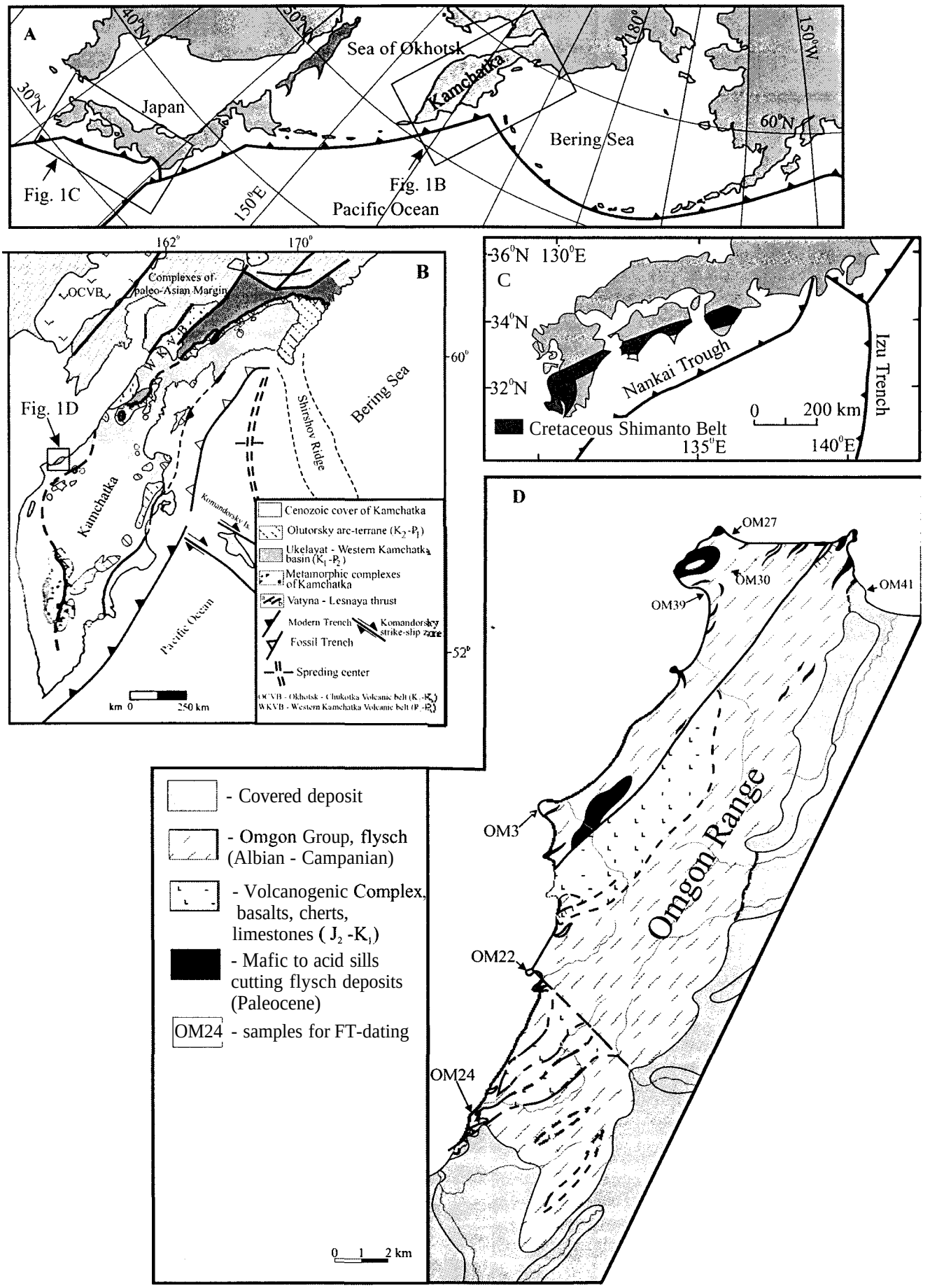

Fig. 1. (A) Regional setting of the western margin of the Pacific Ocean. (B) General geological setting of Kamchatka. (C) Distribution of the Shimanto Belt in Japan. (D) Simplified geological map of the Omgon accretionary complex.

Table 1: Summary of detrital zircon fission-track data from Omgon accretionary complex

No sample	Nt	Age of zircon population		
		P1 (Ma)	P2 (Ma)	P3 (Ma)
OM3	75	80.0±4.1 (95%)	175.7150.5 (5%)	-
OM39	74	85.3±4.2 (95%)	167.8±33.6 (5%)	-
OM30	46	90.6±9.0 (53%)	151.3+17.3 (47%)	-
OM27	75	99.8±5.8 (83%)	187.0127.9 (17%)	-
OM24	75	102.0±18.9 (19%)	142.2±12.0 (68%)	248.2+28.8 (13%)
OM22	60	114.5±7.2(70%)	-	237.1+25.3 (30%)

Note: Nt = number of grains; percentage of grains calculated in a specific peak; uncertainties cited at ±1 se. Zircons were dated using standard methods for FT dating using an external detector. Mounts were etched in a NaOH-KOH at 228°C for 15 and 30 hr and then irradiated at Oregon State with a fluence of 2 x 10" n/cm^2, along with zircon standards and dosimeter CN-5. Tracks were counted on an Olympus BX60 at 1600x, and a ζ-factor of 348.2±11.02 was used.

Sandstones from Omgon Flysch have a population of colorless, euhedral zircons, ascribed to active magmatism in the source. This young population can be used to constrain the maximum age of the units. Populations of fission-track ages of unreset detrital zircon grains from 6 sandstone samples from Omgon Flysch are between 78 to 250 Ma and represent cooling ages in the source (see Table 1). The youngest population of grain ages may be ascribed to syn-depositional volcanic sources. The zircon FT minimum ages range from 114.5±7.2Ma to 80.0±4.1 Ma and may approximate depositional age of these rocks.

CONCLUSIONS.

The Omgon Range (Western Kamchatka) is made up of southeast-verging imbricated tectonic units that were likely imbricated in a subduction setting. Sandstones are uniform in composition and the sediment is inferred to have been derived from a continental arc, and the FT depositional ages of detrital zircons from the Omgon flysch are Albian-Campanian. It is likely that this arc was the contemporaneous Okhotsk-Chukotka volcanic belt (to the west, Fig. 1 B) as the main phase of volcanism and plutonism in this belt is mid Cretaceous. The younger flysch is clearly imbricated with older elements of oceanic rock. The basalts are tholeiites similar to those of spreading centers of oceanic and marginal basins. The overlying siliceous rocks are dated as the Middle Jurassic to Early Cretaceous. The Albian-Campanian continent-derived flysch with the exotic Middle Jurassic to Early Cretaceous ocean-derived blocks is a fragment of the accretionary wedge related to the Cretaceous subduction under the Eurasian margin. The Cretaceous Shimanto belt in Japan is similar to Omgon belt in age. structure and tectonic position. We are struck by the similarity of lithology and timing of these two units that occur in outboard positions. It is possible that the Omgon is essentially a northern continuation of the Shimanto. but the oceanic plates involved are not clear.

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