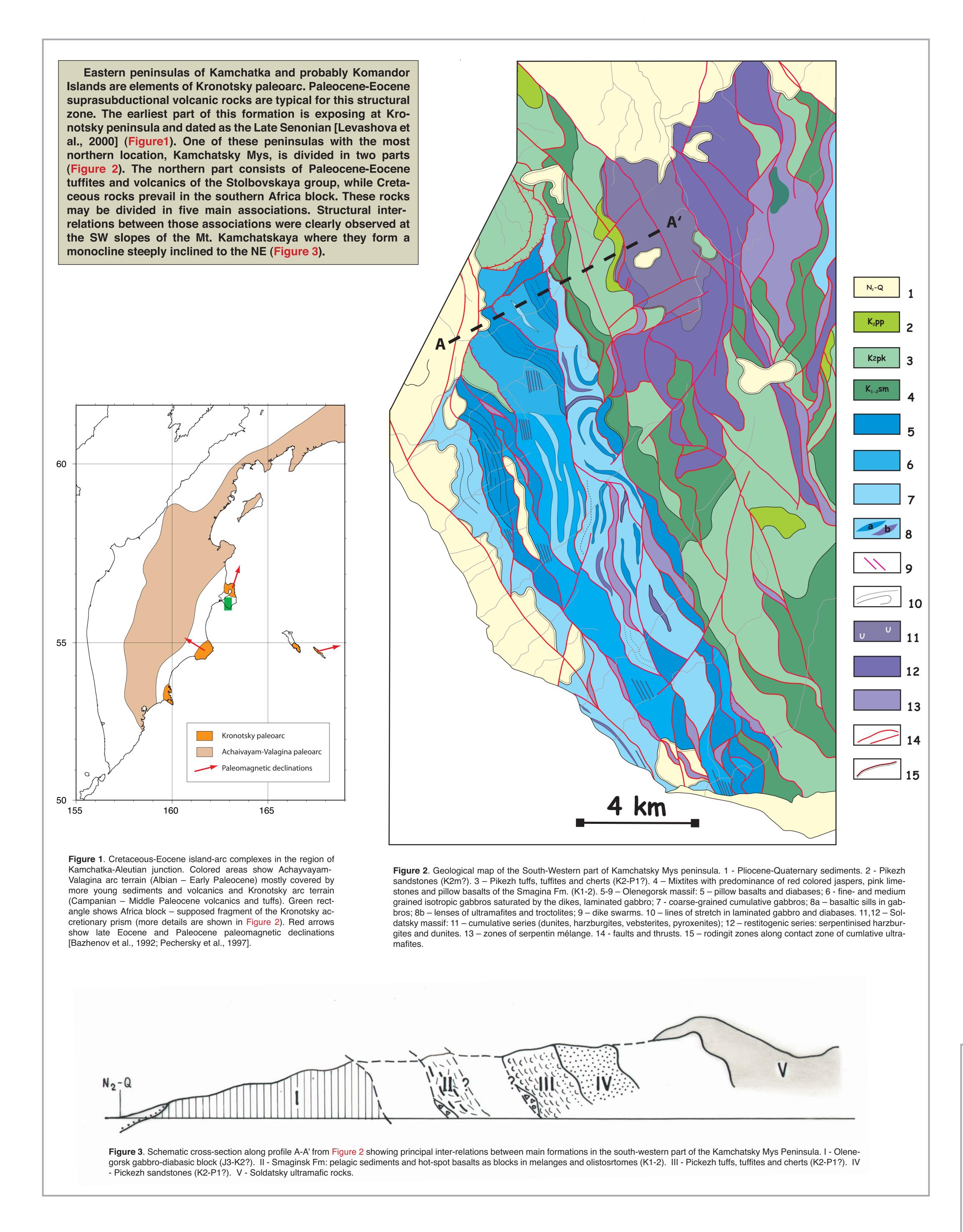
## Overview

We present hypotheses about formation of the Africa block in the Kamchatka Mys peninsula (Eastern Kamchatka). Cretaceous rocks of this block are considered as a part of the accretionary prism of the Kronotsky paleoarc (Figures 1-3). Paleomagnetic data (Figure 8) from the remnants of this arc combined with the information about the structure, the composition, and the age of main geological complexes forming the Africa block (Figures 4-7) allows us to reconstruct some important tectonic events during the evolution of the North Pacific region (Figires 9-10).

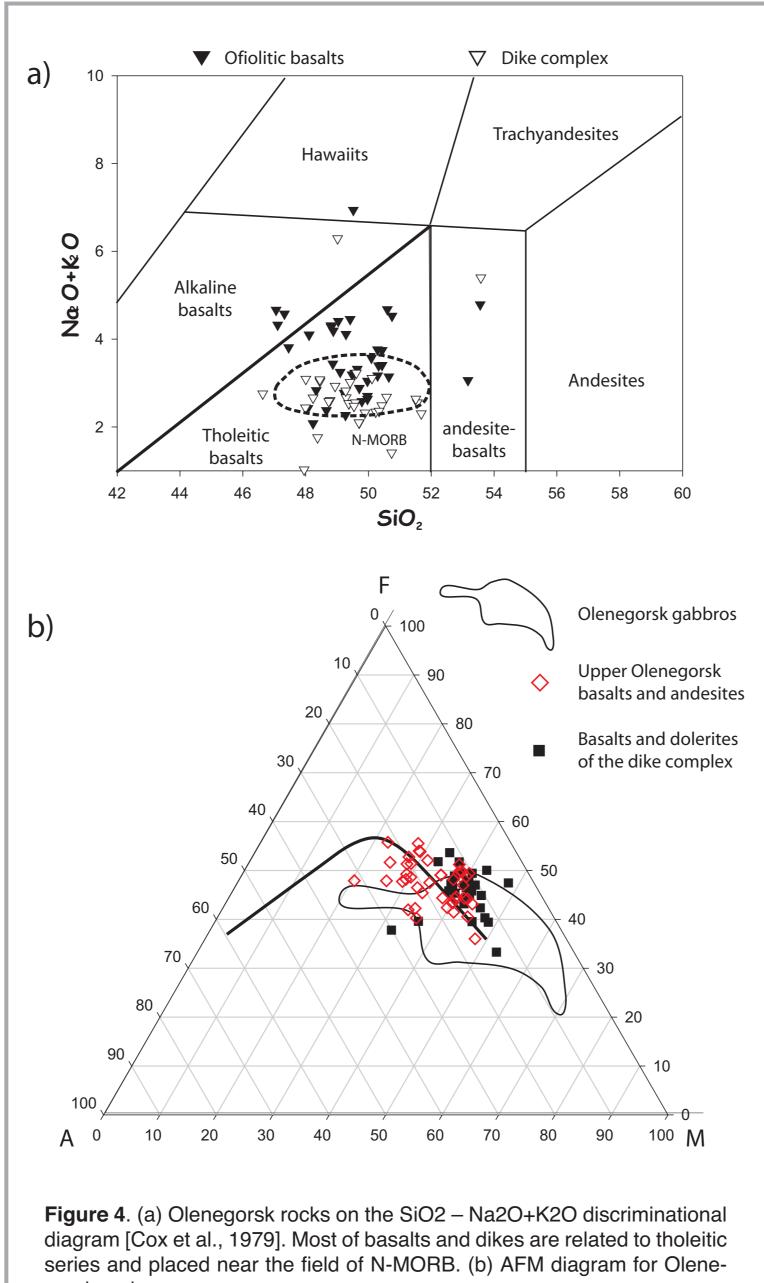
## LATE CRETACEOUS – EOCENE EVOLUTION OF THE KRONOTSKY ISLAND ARC

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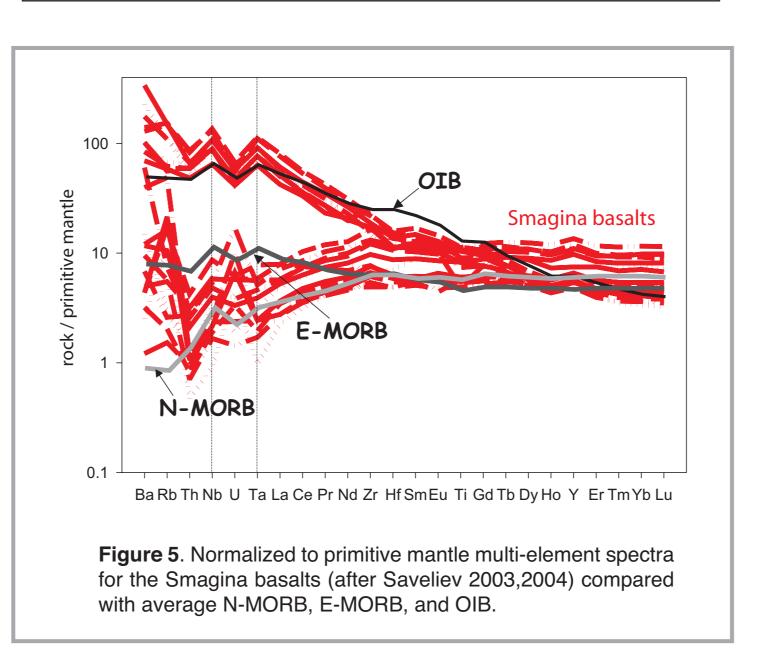
Five main complexes composing the Africa block were formed at different ages and in different geodynamic settings. The most probable tectonic realm, where such different complexes can be united is a suprasubductional accretionary prism. Our basic hypothesis is that this was a prism of the Kronotsky arc. Eocen paleomagnetic declinations of the Kamchstsky Mys peninsula indicate that this prism was placed south of the volcanic arc. At the end of the Cretaceous and during the Paleocene, the Kronotsky arc had a southern polarity (subduction toward the North).

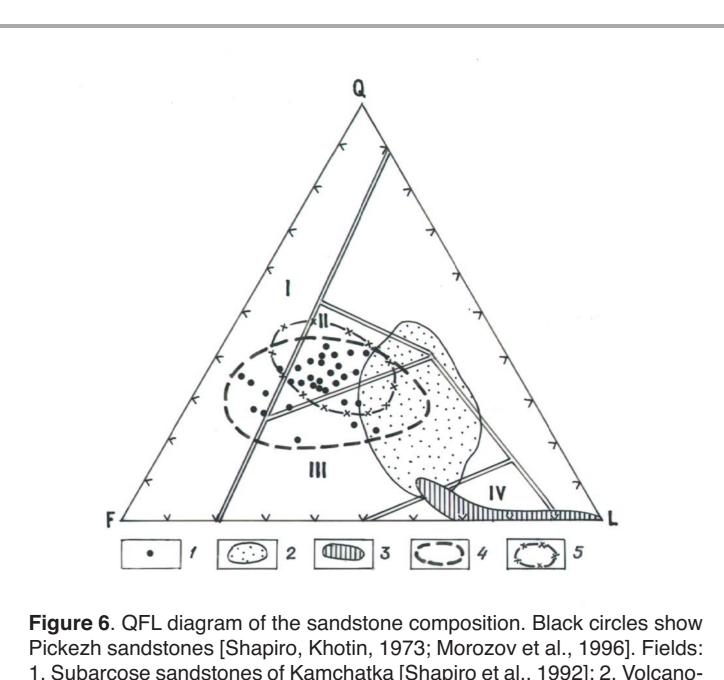


Here, the lowest structural position is occupied by the layered gabbro-diabasic Olenegorsk massif with ultramafic rocks at the base and pillow-basaltes at the roof. The composition of the predominant basic igneous rocks corresponds to the MORB basalts and gabbros (Figure 4). The massif was dated as Jurassic-Cretaceous on the basis of several K/Ar determinations [Fedorchuk et al., 1991].

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The next level is occupied by the Smagina Fm. composed of Albian–Senomanian pink jaspers and pelitic limestone containing lenses of pillow-basalts and red mudstones. All these rocks are preserved only as more-or-less large blocks in the sage-green tuffaceous matrix that resembles tuffites of the Pickezh Fm. that is lying above. Therefore, the Smagina Fm. as a whole is considered to be a tectonic mélange. The composition of the Smagina basalts is compared with the composition of intraplate vocanic rocks in Figure 5.





clastic sandstones of Kamchatka [Shapiro et al., 1992]; 3. Torless sand-

stones (N.Z.) [McKinnon, 1983]; Sandstones of the Aleuthian abissal plain

[Steward R.J., 1976]. Types of provenance [Dickinson et al. 1983]: I - con-

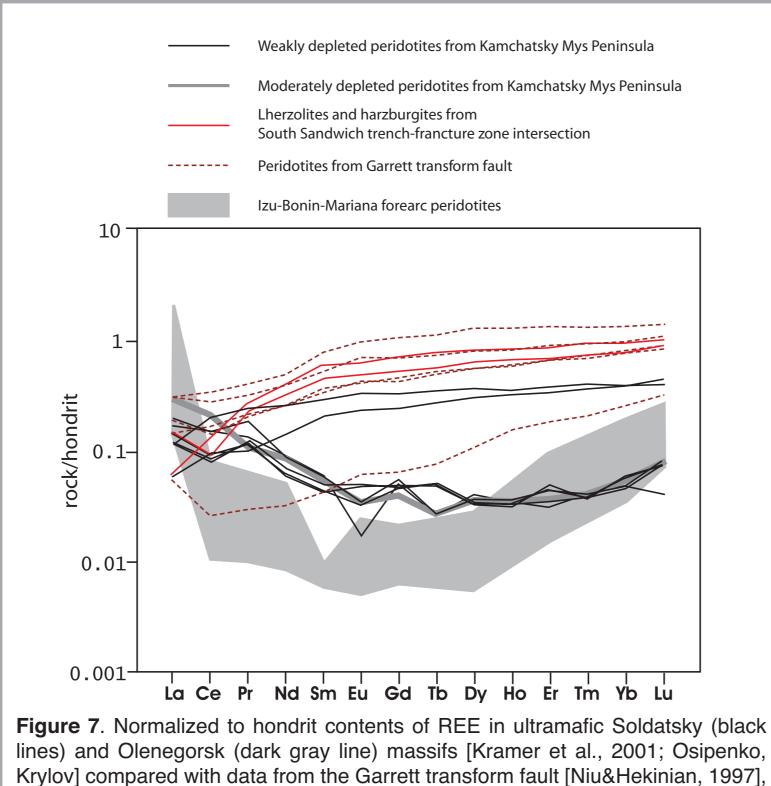
tinental blocks; II - strongly dissected magmatic arcs; III - moderately dis-

sected magmatic arcs; IV - undissected magmatic arcs.

The Pickezh tuffaceous association composed of gray and greenish ash tuffs, tuffites, tefroides, and cherts is the most common rock complex of the Africa block. The main part of these rocks related to the upper part of the Late Cretaceous but it is known that some of them contains radiolaria of Paleocene [Vysotsky, 1986; Fedorchuk et al. 1989]. Abundance of ash tuffs with the light volcanic glass is a forcible argument for the island arc provenance of Pickezh pyroclastics.

The Pickezh sandstones lie structurally higher

than pyroclastic series. They are massif, almost nonbedded rocks (feldspar-quartz graywacks) (Figure 6) whose main components include quartz, feldspar (including microcline), shales and cherts, variable altered volcanics, shists, black and white mica. The sandstones are enriched by zircone and others accessories with high natural radioactivity. Undoubtedly, these rocks are of a continental provenance. The Pickezh sandstones are conventionally related to Maastrichtian.



from the South Sandwich arc [Pearce et al., 2000], and from the Izu-Bonin forearc.

The ultramafites of the Soldatsky massif occupy the highest structural position in the observed intersection. Most of these ultramafites can be compared with mantle restites formed in middle oceanic ridges, but some of them are comparable with rocks of cumulative series. The latter are enriched by rear elements (Figure 7). Reevaluation of the Sm/Nd age [Landa et al., 2002] permits to estimate the age of the cumulative rocks as ~90 Ma (synchronous to Smagina basalts). It must be accentuated, at present, Soldatsky ultramafites form a large and complex protrusion that arose in the Middle Eocene and remains active till now. The origin of these ultramafites is much deeper than the structure exposed now at the surface.

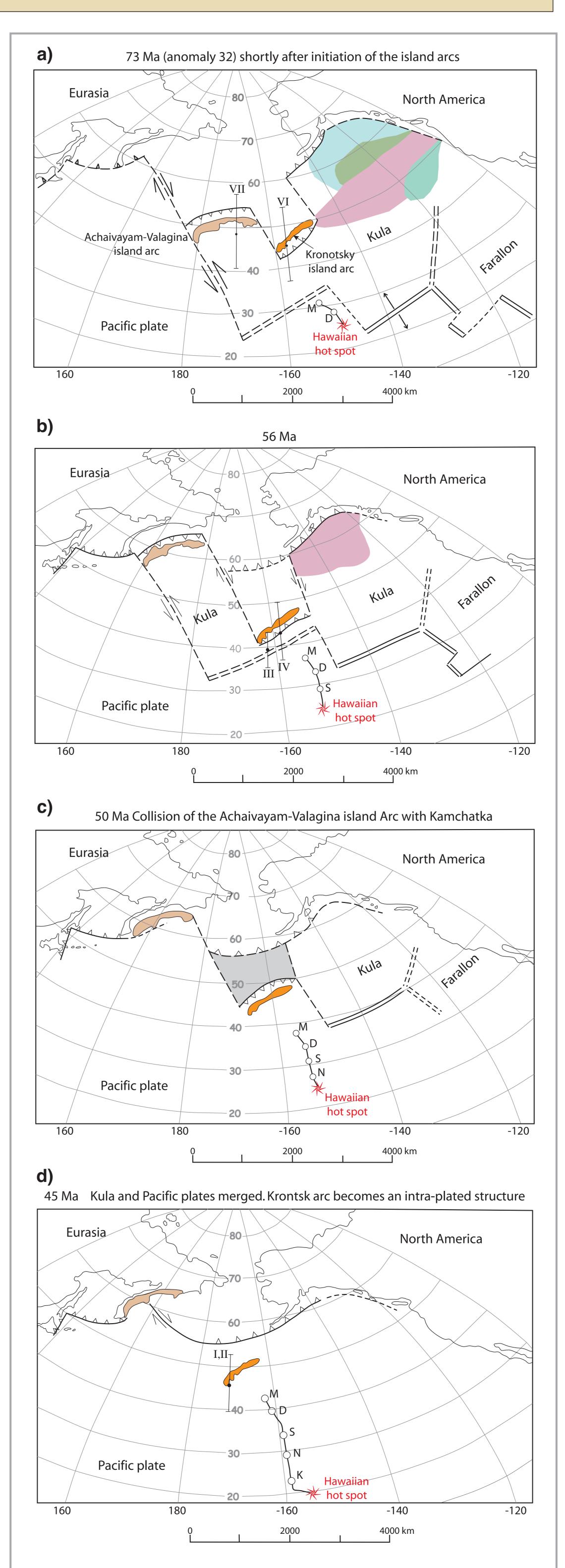


Figure 9. Kinematic reconstructions of the North Pacific region. (a) 73 Ma (anomaly 32), shortly after the Kro-

notsky arc origin. (b) 56 Ma (anomaly 24), shortly before the collision of the Kronotsky arc and the Kula-Pacific

ridge. (c) 50 Ma, shortly after change of the Kronotsky arc polarity and shortly before the collision of AVIA with Ka-

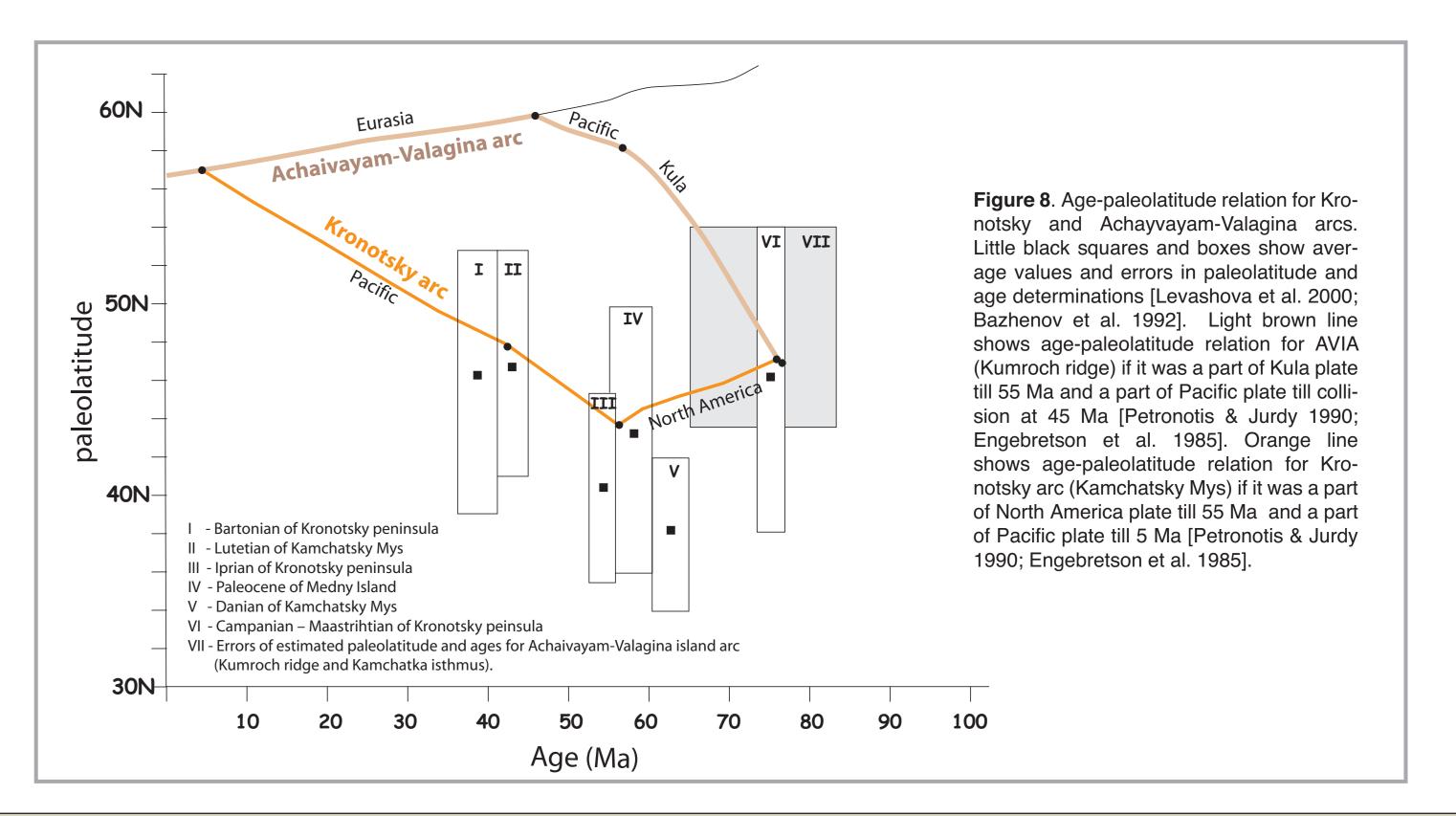
mchatka. (d) 40-35 Ma, shortly after the junction of Pacific and Kula plates. Light gray area in (c) indicates sup-

posed little plate between the Kronotsky and the Aleutian arcs. White circles (M, D, S, N, K) indicate mountains

of Imperator ridge - Meijy, Detroit, Sujko, Nintoku, Koko. Little black circles with vertical bars show paleomag-

netic latitudes and their uncertianties from Figure 8. Colored areas show supposed submarine fans. Eurasia –

North America boundary remains unknown and, therefore, is not shown.

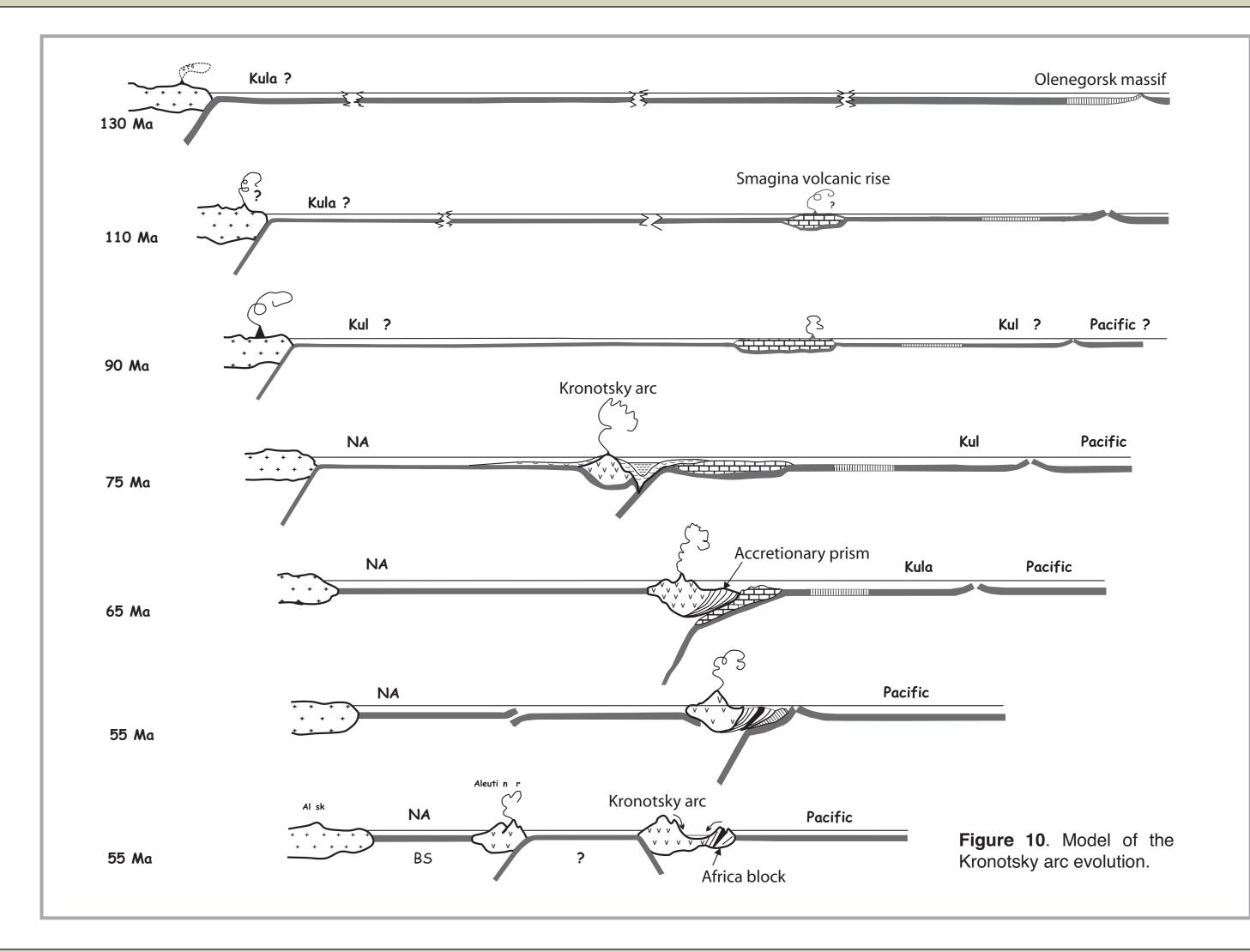


The Cretaceous–Eocene kinematics of the Kronotsky arc is ambiguous. It is difficult to adjust its low paleolatitudes during the Paleocene (38°) and the Early Eocene (40°) with relatively high paleolatitudes at the Maastrichtian and at the Middle Eocene (46-48°) (Figure 8). According to these estimations, the arc was moving to the South at the end of the Cretaceous at the beginning of the Paleogene and then shifted to the North. Moreover, the Kronotsky arc motion has to be coordinated with the motion of the Achayvayam-Valagina island arc (AVIA), which arose at the end of the Cretaceous simultaneously with the Kronotsky arc and approximately at similar paleolatitudes, but at 45 Ma collided with the continent [Shapire et al., 2002]

An additional ambiguity of pre-Middle Eocene kinematics of the oceanic plates (Pacific and Kula) is caused by the mobility of the Hawaiian hot spot before 43 Ma. Therefore, we use kinematic models based on global plates circuit relative to the Africa hot spot system [Engebretson et al., 1984; Petronotis & Jurdy, 1990; Norton, 1995]. The high velocity of the northern drift of AVIA could be only reached with the Kula plate. The southern motion of Kronotsky arc could be only possible together with the North America plate (or with a small plate kinematically resembling the NA plate). This implies that, near the end of the Cretaceous, a large part of the northern Pacific was occupied by the North America plate with the Kula plate to the east and to the and the Pacific plate to the west. Two island arcs (the AVIA with a northern polarity and the Kronotsky arc with a southern polarity) were formed along the E-W border between North America and Kula plates. Such configuration could be only possible only if the AVIA was placed to west of the Kronotsky arc. Only the model of Petronotis & Jurdy [1995] satisfies this requirement. Therefore, the reconstruction (Figure 9) is based on the model of Petronotis and Jurdy [1995] before 43 Ma and the model of Engebretson et al. [1984] after 43 Ma. Motion of Eurasia and North America is after Kraus and Scotese [1994].

At the end of the Cretaceous, the Kronotsky arc was situated north of Kula-Pacific Ridge while the Obruchev (Meji) rise was placed south of this ridge. At the end of the Cretaceous and at the beginning of the Paleogene, the ridge was slowly moving to the north approaching the Kronotsky arc that drifted southward. As a result of this counter movement, at 55-56 Ma, the Kula-Pacific ridge blocked the Kronotsky subduction zone, and the western part of Kula plate joined the Pacific plate. This was the cause of the considerable deceleration of the northward drift of the AVIA between 55 and 45 Ma. In the Early and the Middle Eocene, the suprasubductional volcanism in the Kronotsky arc took place simultaneously with its fast northward drift indicating the change of the arc polarity and the formation of a new trench north from the arc.

Interpretation of the Kronotsky arc kinematics after 43 Ma is practically unambiguous. Almost during all this time it was a part of the Pacific plate. The arc activity stopped near 35 Ma and it collided with NE Asia about 5 Ma. Paleomagnetic data from the Bartonian of the Kronotsky peninsula and the Lutetian of the Kamchatsky Mys are in good agreement with this kinematics.



We try to reconstruct the sequence of events that formed the Kronotsky accretionary prism exposed in the Africa lock (Figure 10).

In the very beginning of the Cretaceous (130 Ma), the oceanic plates drifted toward NW and the oceanic lithosphere was consuming in subduction zones near Eurasia (Uda-Murgal arc and its analogs). Most likely, in the northern part of the Pacific the Kula plate, was separated from the Pacific plate by an active ridge. The crust formed at this ridge was partly preserved as the Olenegorsky massif.

In the Middle Cretaceous (110 Ma), a part of Kula plate overrode a hot spot resulting in formation of the Smagina volcanic rise. T cumulative ultramafites of the Soldatsky block were probably formed simultaneously with this event.

At the end of Cretaceous (75 Ma), the Achaivayam-Valagina and the Kronotsky arcs were formed. The letter was palced closer to North America than to Asia. Initially, the Kronotsky arc accretionary prism was mostly built of arcs pyroclastic (Pikezh tuffites). This tephra apron partly reached the trench and locally oceanic plain of Kula plate. The upper parts of Smagina plato mixed with the tephra also became a part of the accretionary prism. These intraoceanic events occurred simultaneously with the orogenesis in the Northern Cordilleras. Several submarine fans were created along its western margin. It is quite possible that Pickezh sandstones are a part of some of these fans incorporated in the Kronotsky accretionary prices.

porated in the Kronotsky accretionary prism.

During the Cretaceous-Paleogene boundary (65 Ma), the formation of the Kronotsky accretionary prism wa almost completed, after the accretion of a large block of lower oceanic crust (Olenegorsk massif).

At the end of Paleocene (~60-55 Ma), the Kronotsky arc collided with the Kula-Pacific ridge. This is the most probable cause of the supplementary deformation of the accretionary prism and of the uplift of a nonvolcanic rise supplying the Stolbovskaya group by the ofiolitoclastic material [Shapiro et al., 1997]. This is the first evidence of the appearence of ultramafites on the surface.

Continuation of the Kronotsky volcanism trough the second half of Eocene (55 – 40 Ma) after the collision with Kula-Pacific ridge is probably related to the new subduction zone arising north of the Kronotsky arc. Extinction of this second subduction zone at the end of Eocene was probably connected with arc compression and ultramafic protrusion.