EGU2012-6195: **Plutonic ultramafic-mafic complexes of the Vel'may terrane, eastern Chukotka (Russia): first petrological results and preliminary geodynamic interpretations**

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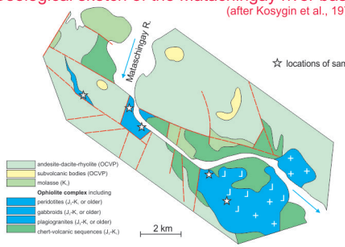
Geological position of the objects studied

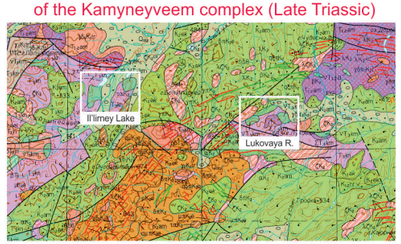
Locations of the plutonic complexes studied:
1 - Matachingay R.
2 - Lukovaya R.
3 - Il'lirney Lake

Geological sketch of the Matachingay river basin

(after Kosygin et al., 1974)

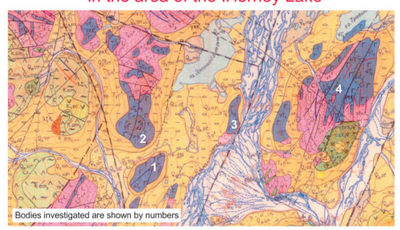


Geological setting of ultramafic-mafic complexes of the Kamyneyveem complex (Late Triassic)



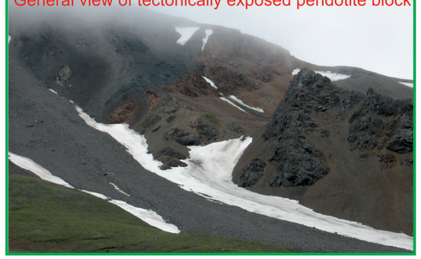
Typical exposure of ultramafic-mafic rocks in the basin of the Lukovaya River

Gabbroic complex of in the area of the Il'lerney Lake



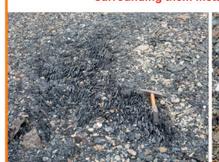
Gabbroic complex composes numerous hills. Their contacts with the country rocks are mainly not exposed.

General view of tectonically exposed peridotite block



In the Matachingay river basin, ultramafic-mafic plutonic rocks compose tectonic nappes spatially associated with basaltic lava-chert and chert-carbonate deposits (J_3-K_1). Plutonic rocks studied are represented by residual mantle peridotites (spinel harzburgites and minor dunites), ultramafic vein cumulates (Pl lherzolites and websterites) in residue peridotites; Hbl and Bi-Hbl gabbro. Compositional variations in bulk rocks (major and trace elements) and minerals (major elements) suggest that all plutonic rocks studied can be fragments of a disintegrated single ophiolite assemblage (except for Bi-Hbl gabbro). They exhibit features typical of rocks originated in subduction setting. Crystallization of cumulates including those of veins took place at low pressure that suggest their formation in a marginal basin environment.

In the basin of the Lukovaya River, ultramafic and mafic rocks compose tectonic slices. Contacts of the latter are marked by melanges with boudins of both intensively metamorphosed ultramafic, mafic rocks and surrounding them metamorphic rocks (T3)



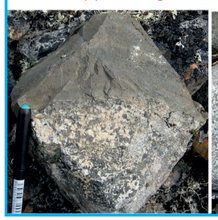
Shared serpentinites marking the tectonic contact

The small boudin of metamorphic rock in serpentinites of the near contact melange

In the basin of the Lukovaya River, tectonic slices associated with T_3 metamorphic rocks are comprised of Cpx-bearing dunites, wehrlites, Hbl-Ol clinopyroxenites and Hbl gabbros.

Compositional variations of bulk rocks (major and trace elements) and minerals (major elements) indicate their crystallization from the H_2O-rich magma in a subduction setting at moderate to high pressure. This is consistent with existence of a mature arc or an active continental margin characterized by thick crust/lithosphere, presumably, of continental type.

Contact relationships of gabbroids with deposits of the chert-volcanic-terrigenous complex (T3, norian) can be observed only in boulders. Hbl gabbro are unconformably overlain by basaltic lavas (A) and basic tuffs (B). No chilling contacts were found in gabbro.



In the area of Lake Il'lereney, plutonic rocks spatially associated with siliceous-volcanic-terrigenous sequences (T3, Norian) are represented by Hbl gabbros.

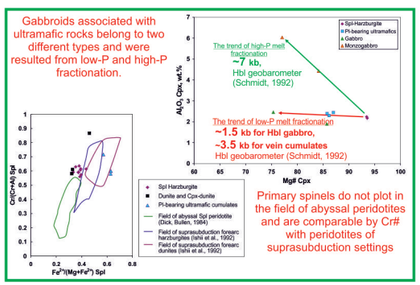
Major element variations in minerals suggest that these rocks crystallized from of magma with dual characteristics typical of subduction-derived and within-plate melts. The magma resulted in crystallization of Lake Il'lerney Hbl gabbros was differentiated and rich in H_2O. The rock crystallization took place at high-pressure. The data available up to now do not allow an unambiguous distinguishing between two possible geodynamic settings. Nevertheless, Hbl gabbros were, in any case, related to an environment characterized by thick crust and lithosphere.

In the basin of the Matachingay River, ultramafic-mafic rocks compose several small tectonic nappes. Tectonic contacts are markes by metasomatically reworked mantle peridotites. Pebbles of such peridotites are described in conclomerates (K1?).

Metasomatically reworked peridotites confined to the block tectonic contact.

Pebbles of peridotites in conclomerates of the lower Cretaceous age overlaing blocks of ultramafic-mafic rocks

Gabbroids associated with ultramafic rocks belong to two different types and were resulted from low-P and high-P fractionation.



Primary spinels do not plot in the field of abyssal peridotites and are comparable by Cr# with peridotites of suprasubduction settings

In inner part of the tectonic slice, dunites and peridotites are partially serpentinized. Hbl gabbro locally exhibit migmatitic textures probably indicative of their partial melting

Serpentinized dunites

Migmatized gabbro

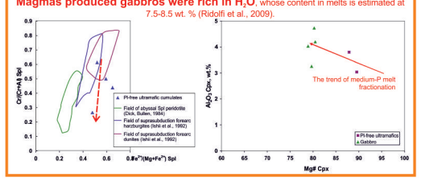
Primary spinel compositions in rocks exposed in the basin of the Lukovaya River indicate their crystallization from the subduction-derived mantle melt at moderate to high pressure.

Max Cr# Spl = 0.612, spinel plot in the field of suprasubduction forearc dunites.
Cr#Spl decreases as rocks fractionate (red arrow).

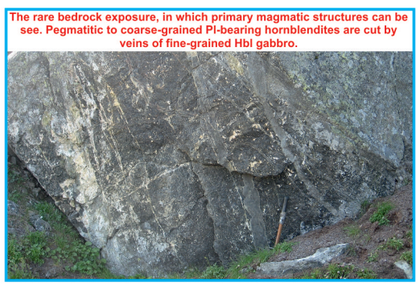
Cpx and Hbl compositions supports this conclusion.

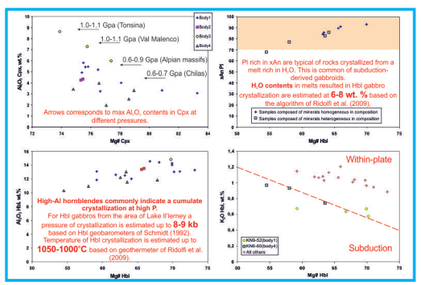
Pressure of Hbl crystallization is estimated at about 8 kbar based on the geobarometer Schmidt (1992) and 4-6 kbars based on the geobarometer of Ridolfi et al. (2009).

Magmas produced gabbros were rich in H_2O, whose content in melts is estimated at 7.5-8.5 wt. % (Ridolfi et al., 2009).



The rare bedrock exposure, in which primary magmatic structures can be see. Pegmatitic to coarse-grained Pl-bearing hornblendites are cut by veins of fine-grained Hbl gabbro.





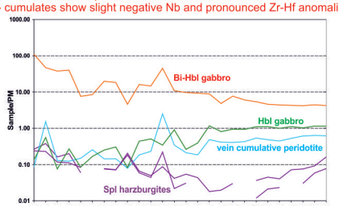
Primary relationships between different rock types are preserved in central parts of tectonic nappes. Nonetheless, the relationships between mantle peridotites and gabbroic rocks are not clear.

Thin dikes of cumulative plagioclase lherzolites and websterites cutting serpentinized residual spinel harzburgites. Rocks containing primary mineral are preserved in central parts of blocks.

The boudin of plagiclasite in serpentines. Note, undeformed dikes of plagioclasites cutting serpentinized residue spinel peridoties are preserved in central part of blocks.

Trace element variations in ultramafic-mafic rocks of the Matachingay river basin indicate their formation in the suprasubduction geodynamic setting:

- residue mantle peridotites are enriched in LILE relative to HFSE,
- cumulates show slight negative Nb and pronounced Zr-Hf anomalies.

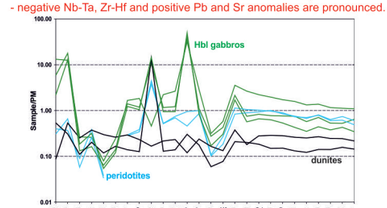


A. Angular fragments of peridotites in dunites
B. Irregular intercalation of dunites and peridotites
C. A debris of layered Hbl gabbro; the layering is expressed in intercalation of coarse-grained mesocratic and medium-grained melanocratic varieties of Hbl gabbro.

Primary igneous textures are preserved only in central part of the tectonic slice

Trace element variations in ultramafic-mafic rocks of the Lukovaya river basin indicate their formation in the subduction geodynamic setting:

- rocks are enriched in LILE relative to HFSE,
- negative Nb-Ta, Zr-Hf and positive Pb and Sr anomalies are pronounced.



Hbl gabbro, which are dominated in the massif, are represented by fine-grained to coarse-grained varieties. They commonly reveal sharp contact and cut each other. Taxitic rocks are widespread.

Fine-grained Hbl gabbro at sharp magmatic contact with coarse-grained Hbl gabbro.

Taxitic Hbl gabbro

The varieties that differ in grain sizes, however, are characterized by the same mineral assemblages and very similar compositions of minerals.

Conclusion

The plutonic complexes of the Vel'may terrane belong to different types. Two of three complexes studied are certainly originated in supra-subduction setting. However, ultramafic-mafic rocks associated to, J_3-K_1 basaltic lavas and sediments are shown to be formed in a marginal basin setting (the Matachingay river valley), while ultramafic-mafic rocks associated with T_3 deposits are recognized to be related to a mature arc or an active continental margin (the Lukovaya river basin). One of the complexes investigated (the area of Lake Il'lerney) exhibit dual affinity to subduction-related and within-plate plutonic rocks, and its geodynamic setting is disputable so far.

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