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NEW DATA ON AGE AND NATURE OF CARBONIZATION WITHIN SOUTHERN FLANK OF THE BAIKAL LEDGE OF THE SIBERIAN CRATON BASEMENT

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The Baikal ledge rock formations in the Siberian craton structure are included in the Akitkan mobile belt which is considered as the Late Paleoproterozoic independent island arc system moved up to the ancient basement during the terrains amalgamation 1.91–2.00 Ga ago (Fig. 1) [*Rosen, 2003; Gladkochub et al., 2009; Didenko et al., 2013*].

The rocks of the terraine basement are covered by terrigenous and volcanogenic-sedimentary formations of the Akitkan Group (PR_1) and intruded by granitoids dated at 1.85–1.88 Ga [*Neymark et al., 1998; Larin et al., 2003; Donskaya et al., 2008*].

The Ilikta formation of the Sarma Group PR_1 represented by metaeffusives of basic and intermediate composition, phyllites and sericite±chlorite-quartz schists containing carbonaceous material (CM), limestones, sandstones, tuff sandstones is developed within the Baikal ledge of southern flank (Fig. 1, *b*). The block of underlying the Khulurtui formation composed of gneisses, migmatites, amphibolites, carbonate rocks interbedded quartzites is distinguished among them. Rocks of both formations are intruded by plagiogranites, granites and pegmatites of Kocherikova (2.02–2.07 Ga [*Neymark et al., 1998*]) and Primorsky (1.91–1.93 Ga [*Bibikova et al., 1981; Savelyeva et al., 2009*]) complexes and dikes of diabases as well as dikes of carbonatites aged of about 1 Ga [*Savelyeva et al., 2016*].

The authors studied occurrences of carbonization in metamorphized rocks of the Khulurtui and Ilikta formations which are located within the schist forma-

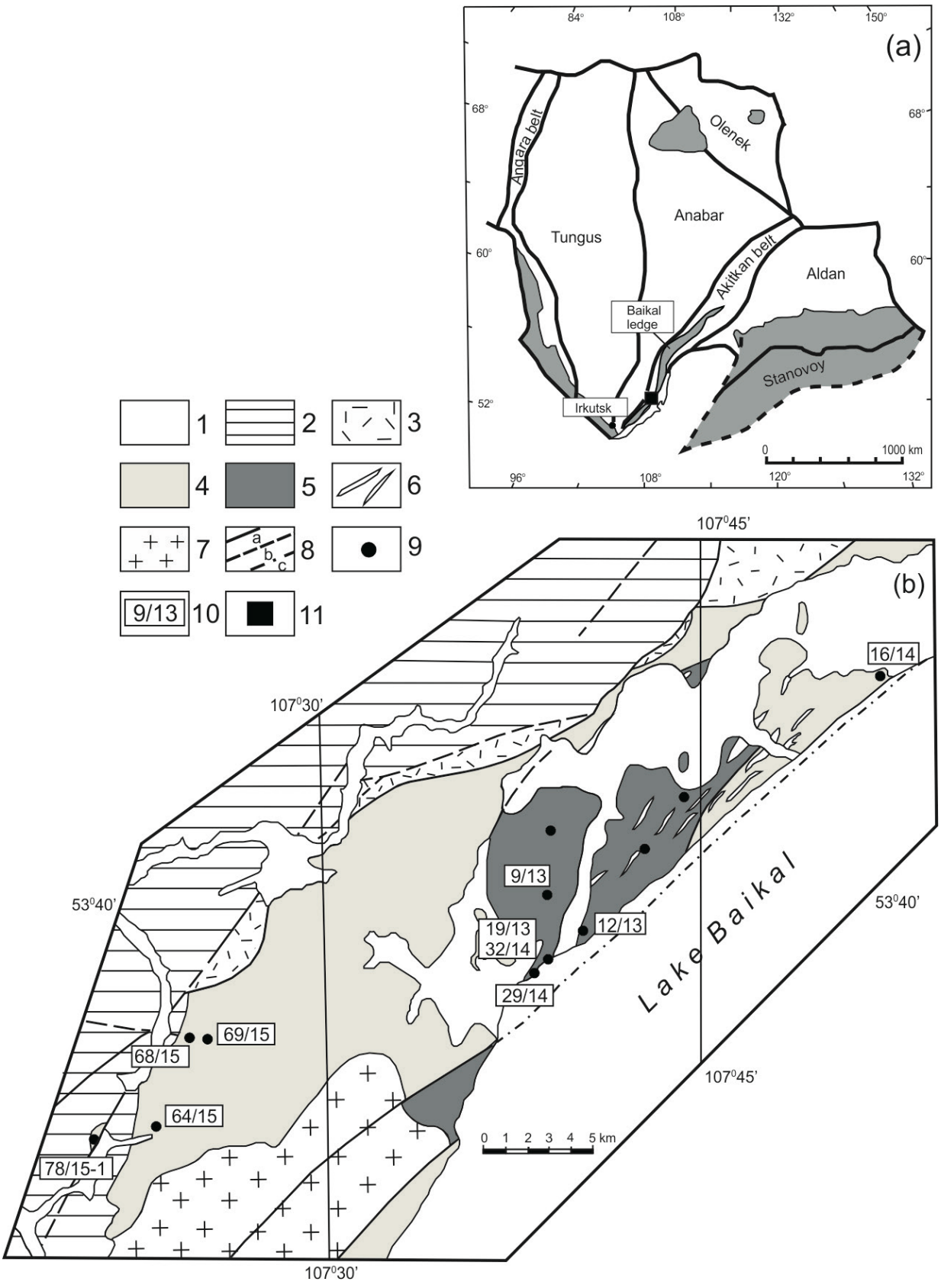

Fig. 1. Tectonic zoning of the Siberian craton [*Rosen, 2003*] (*a*) and sketch-map of geological structure of the area of work (*b*).

1 – Cenozoic deposits; *2* – carbonate-terrigenous deposits of the Baikal series R; *3* – terrigenous and volcanogenic formations of the Akitkan Group PR_1; *4–5* – Sarma Group PR_1: *4* – Ilikta formation, *5* – Khulurtui formation; *6* – granites of Kocherikova Complex PR_1; *8* – faults: a – observed, b – inferred, c – overlain by Lake Baikal water; *9* – occurrences of carbonization; *10* – sampling points for isotopic and geochemical studies; *11* – the area of work on tectonic sketch-map. Dikes of diabases and carbonatites are not shown in Fig. b for simplicity.

tion zones at the Baikal ledge southern flank (Western Baikal Area).

These steep-grade schist formation and intensive carbonization zones with thickness from several cm up to 6 m and a trend azimuth from 340–350° up to 15° were recognized within the block southern parts of the Lake Baikal precipices in broken down, muscovitized and chloritized gneisses and migmatites and schistose chloritized and muscovitized diabase. Carbonization of dinamoschists is observed in other areas of Khulurtui block.

Sampling from the Khulurtui block and also carbonized schists of Iliktinskaya formation was made with the aim of comparison. Carbonized dynamoschists are composed of quartz and muscovite with admixture of chlorite, chloritized biotite, albite, accessory tourmaline and CM. Dynamoschists are characterized by increased contents of Si, Al and K and rare elements (Ba, Rb, Y and Nb) and decreased contents of Ca, Na, Mg, Fe (the later is redeposed in the form of oxides on single areas). Evacuation of Sr, Co, Ni, Cu and Zn is observed. The carbon content (C_{el}) in dynamoschists amounts to 10–16 wt % significantly exceeding that in the rocks of Iliktinskaya formation (less than 3 wt %).

Carbonaceous material closely intergrown with muscovite is predominantly distributed along schistosity. Microinclusions of native Ni with admixture of Fe and Sn, zincous Cu, intermetallic compounds of Fe-Ni composition, as well as sulphides of copper, rutile, monacite, circon are found among graphite.

Compositional and structural analysis of CM of the Khulurtui block dynamoschists indicates its primary disperse state. Planar particles with unit cell parameters proper to high-ordered hexagonal graphite are lesser in a quantitative sense. Raman spectra characterizing a matter as a well-ordered graphite and microcrystalline graphite with residual hydrocarbon radicals are obtained for CM of dynamoschists. The study is carried out at the Center for Collective Use «Geoscience» at IG of the Komi SC UrB RAS, Syktyvkar city using scanning electron microscope TESCAN VEGA3 (Czechia) with energodispersing attachment Oxford Instruments X-Max, Raman spectrometer HR800, Horiba Jobin Yvon (France), electron microscope Tesla BS-500 (Czechoslovakia) and X-ray diffractometer XRD-6000, Shimadzu (Japan).

Carbonaceous material in the Iliktinskaya formation schists is in general characterized by dispersed X-ray amorphous state. Well-ordered graphite was not registered on Raman spectra. CM spectra are accompanied by strong luminescence and they are graphite-like matter containing bitumen-forming components. Graphite lines whose height and location indicate the high degree of defect structure and small size of crystallites are developed simultaneously with luminescence on Raman spectra of fine-grained aggregates of CM. Peculiarities of some spectra demonstrate a close intergrowth of mica with carbon material.

Isotope carbon composition $\delta^{13}C$ (PDB, ‰) from quartz-muscovite dynamoschists fit in the range from –29.19 ‰ up to –31.58 ‰. Isotope carbon composition from schistose carbonized diabase sampled near of carbonized dynamoschist after migmatite is harder: $\delta^{13}C$ = –24.93 ‰.

In order to judge about the carbonization age a muscovite was picked out from the dynamoschist samples of the Khulurtui block. ^{40}Ar-^{39}Ar muscovite dating was performed at the Center for Collective Use «Geodynamics and geochronology» at IEC SB RAS, Irkutsk city. Isotopic measurements were made using mass-spectrometer ARGUS VI. Dating of muscovite which is syngenetic to carbonaceous material fits with age of 1947±7.8 Ma.

The findings allow revealing of superposed dynamometamorphic zones accompanied by hydrothermal change and deposits of carbon matter within high-metamorphized formations of the Siberian Craton Baikal ledge. Isotope carbon composition from dynamoschists and carbonaceous material composition with residual hydrocarbon radicals point to its deposition from fluid enriched in hydrocarbons. Accessory phases in intergrowths with CM indicate a transport of Fe, Ti, Ni, Cu, Zn, Sn, REE and Zr by hydrocarbon fluid and native metal composition typical of basite-hyperbasite magmas point to possible deep-seated source of fluid. ^{40}Ar-^{39}Ar muscovite dating (1947±7.8 Ma) allows to relate the Baikal ledge dynamo-metamorphism to accretion of the Akitkan folded system with the ancient Craton complexes.

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