Elbrus region - Caucasus pre-Alpine geodynamics study a key object

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Abstract. The northern Elbrus region is the Greater Caucasus most thoroughly studied sector. Here, in the Bolshoi Zelenchuk Baksan interfluve, the Caucasus pre-Alpine basement, represented by a granite-metamorphic layer, is visible. The interdisciplinary research information support is considered, which covers the Caucasus pre-Alpine development two competing concepts theoretical and methodological foundations - geosynclinals and new global tectonics. The article authors have identified geological objects that disprove a large thrust structures number presence. It is shown that the Russia Petrographic Code terminology, published in 1995, is not consistent with the Stratigraphic Code terminology (1977, 1992, 2006). This led to the synonyms and homonyms emergence. Following the PK-95 requirements in the explanatory note to the K-38-1 tablet map led to the SC logically justified and consistent with the instructions' destruction, metamorphic formations stratigraphic schemes developed over 50 years.

1. Introduction

The second half of the 20th century and the beginning of the 21st century were the most active stages in the Caucasus geology study. These stages results are reflected in numerous monographs, articles, textbooks and on various scales maps.

A relatively recent studies number have considered the plate tectonics main provisions in relation to the Caucasus. I P Gamkrelidze and D M Shengelia \[1\] the paleo-oceanic basins location problem in the Neoproterozoic and Paleozoic within the Caucasus region is considered. E A Rogozhin and A N Ovsyuchenko \[2\] carried out studies that made it possible to determine the strong paleoearthquakes recurrence period and energy in the axial part and on the Northwestern Caucasus southern slope. Based on the kinematic fracturing structural-par genetic analysis method A V Marinyn \[3, 4\] revealed the tectodynamic conditions features for the Late Alpine structure formation for Northwest Caucasus different segments. As a detailed geodetic measurements result carried out by A A Lukk, V I Shevchenko \[5\] on the Greater Caucasus territory, GPS points displacements were revealed, which is explained by an active increase in the Greater Caucasus layered rocks volume (and, in particular, the area) and a rocks' separation environment emergence as an additional mineral material supply result introduced by the ascending deep fluid flows.
1.1. This work purpose
This work purpose is: to assess the stratigraphic schemes and ideas factual material validity about the Greater Caucasus pre-Mesozoic development main stages. It should be emphasized the authors team uniqueness and the study task. In 1934 in the city of Essentuki in the North Caucasus is creating a production and research and production organizations system, which was especially active in 1955-2010. Geologists G A Mikheev and Yu Ya Potapenko [6] participated in the state geological survey as the Caucasus summary map co-authors. After 2010, the geological center in the city of Essentuki was disbanded. The Karachay-Cherkess Republic creation in 1990 contributed to the Karachayevsk city transformation into a historical, ethnic and social information center. The natural-geographical faculty in Karachaevsk, created in 1992, became the historical ties and a connecting link custodian.

1.2. The study object
The study object is the metamorphic and magmatic complexes that form the Greater Caucasus pre-Mesozoic folded basement and form three sublatitudinal structural-formational zones (SFZ) within the Karachay-Cherkess Republic. From south to north, there are SFZs: Main ridge, Peredovoy ridge and Karachay-Cherkessk.

1.3. The study subject
The study subject determined the age and metamorphic complexes internal structure within the SFZ. Within the republic, the main morphostructures are inherited and repeat the lithogenic base spatial image. Morphostructures (MFS) follow from south to north: Main ridge, Foremost ridge, North Jurassic depression, monoclinal ridges - Skalisty and Pastbishnyj.

2. Materials and methods
The geological problems field was studied using a interdisciplinary research set. From the beginning of the twentieth century to 1990, the territory was studied by qualified specialists from the Russia and the USSR leading institutes, and since 1934 - by regional geological organizations - by a variety of methods - stratigraphic, mineralogical, petrographic, paleontological, structural, geophysical, geochemical, paleogeographic.

3. Results
Interdisciplinary regional studies have been actively developed since the twentieth century beginning. In these works, three stages can be distinguished:

1) the knowledge foundations development about the geological structure;
2) geological survey and prospecting works, and the development geosynclinal hypothesis substantiation;
3) ideas revision under the plate tectonics influence.

The first stage of consisted in the Greater Caucasus study by the intersections method. In 1882, the Geological Committee (Geolkom) was organized in Russia, which task was regional geological research. In 1908-1940, the Caucasian Section of the Geological Committee determined the Caucasus geological structure main features. On the Greater Karachay territory (now the Karachay-Cherkess Republic), the Precambrian crystalline shales were identified, the Paleozoic deposits presence (Cambrian, Silurian, Devonian, Carboniferous, Permian) was established, and the Sudeten tectonic phase was identified by analogy with Central Europe. It appeared at the lower and middle carboniferous boundary and consisted in the marine sedimentation replacement by the folding, magmatism manifestation and the continental molasses accumulation.

The second stage covers 20 years from 1955 to 1975, when the Greater Caucasus and, first, pre-Mesozoic metamorphic and magmatic formations were covered by the state geological survey on a scale of 1: 50,000. For this purpose, the Central Geological Survey Expedition (CGSE) was organized in Yessentuki. To help it, the Moscow State University Caucasian Expedition was created at the
Moscow State University. This research stages main results are presented in the USSR Geology IX volume second edition (1968) [7]. In the Caucasus pre-Mesozoic history, the Baikal and Hercynian tectonic cycles were confidently distinguished. The Middle Paleozoic (Devonian, Early Carboniferous) Volcanogenic strata, which contain copper pyrite ores industrial deposits, were dissected in particular detail. In the Early Carboniferous most detailed diagram, S M Kropachev [8] from bottom to top follow: The Kyrkol Formation, carbonate-terrigenous, Kasaevskaya volcanogenic, Teberda shale and Karabek basaltic lavas with pillow separation. In general, after the detailed mapping stage, the Greater Caucasus, according to V V Belousov [9], retained a compact tectonic laboratory role, where new tectonic concepts were tested. The Caucasus notions as a geosynclinal tectonotype were reflected on the Caucasus map, compiled in 1976 at the VSEGEI (Editor-in-Chief, Academician D V Nalivkin), the map editor-in-chief – V I Yarkin [10], repeatedly visited the Karachay-Cherkessia territory, where G A Mikheev and Yu Ya Potapenko introduced him to geological objects that had an ambiguous interpretation. V I Yarkin is the highest category stratigrapher, the the SK-92 compilers one. Communication with him contributed to the many geological bodies objective diagnostic, which, following the fashion, were called tectonic plates in the 1970s, and their boundaries, previously considered unconditionally concordant, stratigraphic, were transferred to the tectonites rank. Thus, it was possible to preserve the North Caucasus Middle Paleozoic sections main stratotypes.

The third stage began in 1974 when the Marukhsk tectonic cover was isolated in the Forward Ridge Paleozoic. Its justification looked quite convincing, although only three years later, olistostromes detailed studies in Harz (Germany) received a more convincing explanation without invoking the thrust hypothesis [12]. Other tectonic covers, including the most theoretically important ophiolite one, were distinguished not in the field, but in offices, in the new global tectonics mental space. All these covers were concentrated in the Laba-Marukh interfluve [13]. After the Natural Geography Faculty opening, the article authors had the opportunity to assess these structures' reliability for more than 25 years, conducting field practice [14-17].

In this article, from among the many controversial problems in geology, we have identified two problems, which are solved mainly in the logical-linguistic sphere.

3.1. The cover problem

In 1974, several tectonic covers were discovered at once, and in 1976 an ophiolite cover was identified [18], after which the ophiolites were equated to the oceanic crust. It is useful to consider precisely this a new concept birth initial moment. The article authors cite their field observations and very carefully assume that gabbro’s and hyperbasites can be overturned and then their composite section resembles the Europe Alpine troughs classical ophiolites section. However, this assumption must be categorically rejected. The ophiolite cover authors kept silent about an Arkhyz gabbro massif detailed petrographic map presence (figure 1), according to which the gabbro crystallized in situ and was not overturned. That is, there was no reason either for the ophiolite complex isolation, or for the overturned ophiolite cover. Accordingly, all other constructions in the plate tectonics spirit, described in article [18], and their like-minded people hang in the air. The authors, keeping silent about Khiltov's monograph [19], made a logically incorrect conclusions' series. Here it is necessary to emphasize the fundamental differences in the ophiolites’ interpretation by Western European geologists and their Caucasian colleagues. The term ophiolites authors one [20], categorically opposed the classical ophiolites' identification with oceanic crust.

Two books contributed to the cover tectonics ideas popularization among North Caucasian geologists: The Greater Caucasus Geology edited by G D Azhgireya [21] and North Caucasus Foremost Ridge Ophiolites and Hercynian cover structure E V Khain (Khain junior) [13]. In the first book, the North Caucasian geologist G I Baranov was invited as a co-author on the Paleozoic. Outlining his ideas on the stratigraphy, magmatism, and the pre-Upper Paleozoic strata tectonics, he identified many new thrusts and covers that were absent on the Central Geological Sector and the Moscow State University recently compiled maps. The collection editor is G D Azhgirey, in his introductory article, accepted the G I Baranov' views. He regarded the gentle disruptions' presence in
the Main Ridge crystalline strata and covers in the Paleozoic Peredovoi Ridge as fundamentally new, radically changing our Caucasus tectonic structure and development understanding in the Precambrian and Paleozoic [21, p 18].

Figure 1. The Arkhyz gabbro massif petrographic map (according to Yu N Khiltov [19], with simplifications). 1 - Quaternary deposits; 2 - Paleozoic metamorphic schists; 3 - fine-grained gabbro; 4-6 - medium-grained gabbro: 4 – leucocratic; 5 – mesocratic; 6 – melanocratic; 7 - xenolith of hyperbasites; 8 - faults, bedding elements.

The map clearly proves that the gabbro crystallization took place in situ and the gravity vector had a normal orientation.

After the collection publication, V E Khain to personally verify the Urlesh cover presence, which radically changed the Caucasus Paleozoic history initial stage idea. Dedicated as a guide, Yu Potapenko showed V E Khain, Urlesh Formation basal conglomerates several outcrops, with erosion occurring on the Khasaut Group rocks. However, the map with conglomerates all the known outputs was included in the I S Krasivskaya dissertation [22].

In 1969-1975, the Stratigraphic Party (headed by Yu Ya Potapenko) functioned at the TsGSE. It compiled a unified legend for a 1: 50,000 scale map and a North Caucasus consolidated geological map 1: 200,000 scale [23]. The latter was linked with the Georgian and Azerbaijan SSR maps, since it served as the basis for the Caucasus geological map 1: 500,000 scale, compiled in the VSEGEI. From the North Caucasian geologists, the author's group included Yu Ya Potapenko, G A Mikheev (Central and Western Caucasus) and L V Wheat (Eastern Caucasus). The map responsible editor V I Yarkin, who visited the North Caucasus three times. In the field routes G A Mikheev and Yu Ya Potapenko showed him objects that had an ambiguous interpretation. First, these were the dumb shale strata and basalt strata contacts (Karabek Formation) of the ophiolite cover with the paleontologically characterized Middle Paleozoic of the Peredovoy Ridge (for example, the Teberdin Formation shales overlapping the Lower Carboniferous limestones, the Kasayevskaya strata basalts with underlying limestones (figure 2)).

Figure 2. The Kyrkol Formation limestones xenoliths (C1) in the Kasaev Formation basalts. Dividing ridge between the Zelenchuk and Marukha rivers, the Maly Karabek mountain western slope. 1 – basalts; 2 - limestones.
No tectonites (dynamoclastites, mylonites) were found at the contacts. These data were partially published in the meeting materials on geodynamics [24], but were ignored by the cover tectonics proponents. In 1976, the Caucasus a geological map was published on a scale of 1: 500,000 (editor Academician D V Nalivkin, executive editor V IYarkin. The map includes the detailed surveys results. Since the map was compiled according to the traditional method, confirming the geosynclinal concept, its content corresponded to the descriptions in the Moscow State University works and North Caucasus State University and in the USSR Geology jointly published IX volume [7].

3.2. The stratigraphic and petrographic codes provisions terminological agreement problem
The Petrographic Code [25] proposed its own metamorphic rocks taxonomy version. It is proposed to distinguish (Art. 11.11) metamorphic and metamorphosed rocks. Metamorphic androcks are rocks formed as a deep metamorphic transformations result. Metamorphosed rocks are partially transformed rocks, which, to one degree or another, have retained their original naturesigns.

To analyze terminological problems, a professional linguist was involved in the team of authors [26]. Weakly metamorphosed rocks allocation into a special group, turned out to be logically, linguistically and semantically vulnerable. But when constructing stratigraphic schemes, this term contributed to the simplified tectonic-stratigraphic schemes introduction. For example, the Bechasyn complex ancient strata stratigraphy scheme [27], compiled by geologists three generations [28], was mercilessly destroyed by geologists who are not specialists in the ancient strata stratigraphy, in the so-called tectono-stratigraphic scheme favour [29].

4. Conclusions
North Elbrus is the territory where the Greater Caucasus pre-Mesozoic basement geological reference sections are located. Currently, the region coexists pre-Alpine development two different concepts - geosynclinals and plate tectonics. The article identifies geological objects; which survey will help to choose the most reliable model. Factual data are presented, proving the tectonic cover structures identifying a number erroneousness in the Karachay-Cherkessia territory.

An cartographic products expert assessment compiled by local geological organizations in accordance with the Petrographic Code requirements (1995) revealed inconsistency in the PC and the UK terminology. Its consequences were the stratigraphic schemes homonyms and the distortion appearance, drawn up earlier in accordance with the UK requirements and the International Stratigraphic Handbook. It is proposed to refine the terminology proposed for metamorphic rocks.

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