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THE ARCHEAN-PROTEROZOIC BOUNDARY IN THE GEOLOGICAL HISTORY OF THE EARTH

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The Archean-Proterozoic historic-geological boundary is the unique one in its duration, because it seems to be commensurable with duration of formation of the stratons divided by it, as well as in variety in large mineral deposits timed to it. The boundary was signified by change of the global exogenic and endogenic events, which displayed in matter in concrete tectonic structures and in climatic belts of the Earth nonsimultaneously and in different ways, and included the time interval from 2.85 to 2.35 bill.years. At that time processes of continentalization of the Earth crust, denudation and weathering of paleosurface took place, these processes transformed the areas of finished foliation into peneplanated gneiss-granite-greenstone areas where eluvial and high-differentiated mature sediments displayed for the first time. The subsequent tectonic-magmatic activization and rifting were accompanied by intrusion of magmatic matter into the exosphere of the Earth, it caused heating and partial melting of the crust with formation of intrusions of the crustal and mixed mantle-crustal magmas. Interconnections and interconditionality of endo- and exogenesis were reflected in change of tendencies from general regression to transgression. At that time there was formed the first geodynamic profile "continent-ocean", which is possible to document confidently now. Time - space migration of the geodynamic situation led to heterogenity in development of the continents, and it promoted plurality in interpretation of the geological Archean-Proterozoic boundary. Change of conception on absolute age of this boundary reflects it too.

In case of continental situation on the crustal basement the boundary was displayed as a large "main" unconformity, which for the first time was taken for the Archean-Proterozoic boundary. Formation of this unconformity lasted for hundreds million years. In the marginal continental surroundings the boundary reflects continuous-interrupted transgressive overlaying of the crustal basement by rocks, the duration of breaks decreased in the basins of sedimentation and in case of volcanism. In the relicts of basins with "through" sedimentation there were preserved cross sections with a short break or uninterrupted. In the latter the Archean-Proterozoic boundary is of gradual character and reflects the turning point at the natural-historic boundary, fixed in layers marking the moment of change of regressive processes of sedimentation in development of basins by transgresive ones. The Bolshye Keivy cross section on the Baltic Shield can serve as a model of such a boundary.

8—6—2 00542 0016

Tectonic Position of Rapakivi Massifs of the East-European Platform

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Rapakivi massifs belong to the anorogenic anorthosite-rapakivi granite magmatic association, which is characterized by the following features:

(1) Rapakivi massifs are made up of two cogenetic rock groups: basic (anorthosites, gabbro-norites) and acid (quartz monzonite - ovoid biotite-hornblende granite - biotite granite - albite granite). The massifs are hypabyssal plate-like subisometric bodies with the older basic rocks underlying younger granitoids.

(2) The massifs are discordant relative to country rocks

(3) Rocks of the anorthosite-rapakivi granite association are Low Proterozoic in age (roughly, 1800 - 1000 Ma)

In the western part of the East-European Platform (EEP), rapakivi massifs occur in Lower Proterozoic metasedimentary rocks, whereas the eastern part of the EEP (the Volgo-Uralian region) is represented by Archean metamorphic rocks, where rapakivi massifs are unknown. Thus, rapakivi massifs are confined to the less rigid and more mature upper crust in the western part of the EEP. They form a system of differently oriented chains along large ancient (at least, Lower Proterozoic) lineaments inherited by Riphean aulacogens. A chain of Lower Proterozoic anorogenic intrusive massifs is traced along the Dneprovo-Donetsk aulacogen and Podlessk-Brest trough (from east to west): the Vostochno-Priazov massif of alkaline and subalkaline granites, Korsun'-Novomirgorod and Korosten' rapakivi massifs, Perga complex of alkaline granites and metasomatites in the Ukrainian shield and the Mazur and Suvalki rapakivi massifs in Poland. In Finland, Sweden, Norway, Karelia, and Baltic republics, rapakivi massifs are also traced along aulacogens. The thinner crust, presence of crust-mantle boundaries, evidences of mantle diapirism in the areas of the development of rapakivi and aulacogens comply with the concept of rift-controlling nature of rapakivi massifs.

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PRECAMBRIAN AND CALEDONIAN EVENTS IN SVALBARD, NORTHWESTERN EDGE OF EURASIAN PLATE

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Svalbard archipelago is situated at the northwestern corner of the Eurasian plate and is an important key area in considering the relationship between the Eurasian and Laurentian plates. The younger geological histories from Carboniferous to the Tertiary opening of Atlantic and Arctic Oceans are well established; however the older history is still under study.

Recent isotopic age determinations show two phases of tectonothermal event, Early Caledonian ca. 500-470 Ma and Late Caledonian 400-430 Ma, during Paleozoic. Several late Proterozoic ages of ca. 600-650 Ma have been obtained from igneous rocks, but their geological conformation has not been found. A tectonothermal event lasting from ca. 1,100 to 930 Ma has been established both by isotopic data and unconformities in the western and northeastern parts of the archipelago, but not yet confirmed in the middle-northern part. The isotopic ages of ca. 1,700 Ma have been obtained in the middle-northern part of the archipelago. Geological evidence correlatable with this event has not yet been fully established. 2.4 to 2.5 Ba U-Pb zircon upper intercept ages have been obtained from the southwest and northwest of the archipelago; however, their corresponding geological unit has not yet been identified. The oldest age so far obtained is 3.2 Ba from a metamorphosed porphyritic granite in the northwestern and central northern parts of the archipelago.

The archipelago can be divided into three or four, N-S trending geological units which may have different Precambrian tectonic history. By combining the isotopic and geological data, tectonic terranes which were juxtaposed at different times in the present configuration, will be established. Tectonic correlation between the Caledonian regions around western Arctic including northern Ellesmere Island and northern-eastern parts of Greenland will be presented. The zone of ca. 1.0 Ba old rocks and the Caledonian zone are roughly superposed along the whole length from Appalachia to the Arctic for about 7,000 km. This evidence presents a unique geological development in that one belt of such a length experienced orogenic events twice.

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NORTHWESTERN OVERTHRUSTING AND RELATED LATERAL ESCAPE DURING THE BRASILIANO OROGENY; NORTH OF THE PATOS LINEAMENT, BORBOREMA PROVINCE, NW-BRAZIL.

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Archean, Paleo-, Meso- and Neoproterozoic terranes across the Borborema Province, northwestern Brazil, are important elements for the correlation between South America and Africa. North of the Patos Lineament Archean to Mesoproterozoic blocks were reworked by the Brasiliano/Panafrican orogeny forming huge granitoids batholites; related collision processes overthrusted metasediments of the Seridó, Ceará and Martinópole/Ubajara groups onto basements units and São Luis/West Africa Craton on the northwestern. South of the Patos Lineament the basement and Sergipano Fold belt are overthrusted on the São Francisco Craton.

The use of U/Pb and Sm/Nd geochronology associated with tectonic and petrological criteria were the main tools for an efficient treatment and differentiation of the terranes. Parallel, subhorizontal foliations of different generations, with identical cinematic and metamorphic conditions , related to distinct orogenesis, represented the main problem for a fast identification and timing relation. After a careful geologic and geochronological mapping it was possible to separate basement and supracrustal tectonism.

The Sm/Nd values of metavolcanic and metasediments of the supracrustal units as Seridó, Ceará and Martinópole shows values not older than 1.4 Ga, probably age of the protolithes. The U/Pb method in zircon gave volcanism age of 0.8 Ga or less.

North of the Patos Lineament subhorizontal Brasiliano (0.6 Ga) shears overprint all the units, with NW and also a NE/SW transport sense. The regional S_1, S_2 and S_3 are well preserved. In horizontal S_2 foliation it is possible to recognize related L_2 and L_3, the first with NW thrusting and the second NE/SW stretching. The transport sense are given by sedimentary and metamorphic markers showing stretching and rotation. The rotation of primary structures, folding and refolding of foliation and quartz veins, all in same metamorphic condition, indicate a systematic progressive deformation in all rocks. The horizontal S_2 foliation change to vertical S_3 foliation in a bland or sharp way. The horizontal or vertical NE/SW escape gave their tectonic a transpressive character. The recognition of similar mineral assemblage (biotite/garnet) in the S_2 and S_3 foliation, across the Seridó, Ceará and Martinópole groups is a strong argument for the working of progressive overprinting and different deformation styles in similar PT conditions.

Based on the cinematic reconstruction, it is characterized a main NW thrusting with related transpressional and transtensional movements with material escape in NE and SW, both related to collisional process during the Brasiliano orogeny. The NE/SW transcurrent shearzones are related to collision normal escape. The Patois shearzone represent a final vertical shearing amalgamating terranes of different histories north and south of that.

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ABSTRACTS

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