

Kazakhstanian greenstone belt as typical epicontinental mobile structure of Early Proterozoic

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1. Kazakhstanian Early Proterozoic greenstone belt (KEPGB) stretches archedly through western part of Central Kazakhstan over 700 km and exposes in the central parts of Caledonian anticolinorium. KEPGB consists of volcanogenic and sedimentary rocks, metamorphized in green schist facies, overlies with unconformity Archean(?) crystalline rocks. The lowest Balazhdinskaya Series is narrow spread (South Ulutau), consists of metabasalts (800m) and then metakeratophyres (200m) at the bottom and of metatrachybasalt-terigenous rocks with highly initially sandy-clay matter in the upper part (2900m). The main sequence consists of Aralbaykayskaya (4500-6800m) and Karsakpayskaya (4000m) Series that are bed conformably and attend in the region one another. Aralbaykayskaya Series has metabasalt-keratophyre content, varies by character of main middle-acid volcanites from volcanic to volcanic-sedimentary. Series includes three levels of metabasalts (20%) with the thickness increasing in the upper part. In Karsakpayskaya Series in the lower half metabasaltic and quartzite-phyllic layers combine macrocrystally twice; and in the upper half the same way metabasalts with metarhyolites and acid metavolcanomitic and polymictic rocks, including conglomerates. All three Series are iron-bearing, especially Karsakpayskaya, in connection with basalt volcanism (S.B. Rozanov). The age of the sequence is rejuvenated, but the cover metamorphic orogenic complex is characterized by isotopic U-Pb method as 1800-1860 Ma (S.I. Zykov, N.I. Stupnikova).

2. Volcanic complex of the KEPGB is bimodal. Acid rocks mainly have crust origin. Metabasalts belong to the line tholeiites - subalkal basalts. Volcanites are usually sodium, basalts with high TiO₂. Karsakpayskaya Series also includes in the lower part genetically independent K-Na-metatrachybasalts. The main in the region Bolbraunskoe iron deposit is connected proposedly with this rocks. The features of basalts are the result of the difficult outlet of basalt magma and partly of the different depth of the magma generation. It is evidently stipulate by the development of the belt paleostructure at the consolidated basement. The tectonic regime was relatively inert even at its the most active stage.

3. KEPGB was asymmetric riftogenetic paleostructure with clear west and east near slopes that was of the marginal position. The east framing massif more consolidated than the west one is fragment of protocontinent. About 2000 Ma ago the inversion, folding and plagiogrinitization were taken place. Structure formation role of the plagiogrinitization resulted in the structural plan close to the Archean Greenstone belts, but more linear.

4. KEPGB can be examine in the lateral line of destructive epicontinental structure with different extent of mobility.

THE PROTEROZOIC PLATE TECTONISM AND COLLISIONAL OROGENIC KINEMATICS IN THE JIANGNAN REGION, SOUTH CHINA

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The arcuate Jiangnan orogenic belt is composed of a series of Proterozoic metamorphic-deformed volcanic rocks and flysches. The oldest petrotextonic assemblages are continentally-derived coarse sediments of 1930±162 Ma (North Jiangxi). There are two ophiolitic melange zones with the ages of 1667±247 Ma (Guangxi) and 1035±33 Ma (NE Jiangxi), two CA-type volcanic zones of 1515±241 Ma (Jiulingshan) and 916-825 Ma (Huaiyushan), two granite zones with the ages of 960 Ma (Xiunin) and 766 Ma (Shiershan). The glaucophane-jadeite-bearing blueschist of 866±14 Ma occurred in the NE Jiangxi suture zone.

Studies suggest that the Jiangnan belt underwent 4 stages of tectonic evolution as follows: (1) The early Proterozoic passive margins, outcropping in the North Guangxi, West Hunan and North Jiangxi; (2) The middle Proterozoic active continental margins of trench, volcanic arc and back-arc basin, occurring in the Jiuwandashan, Fanjingshan, Wulingshan and Jiulingshan; (3) The late Proterozoic active margins and terrane group that developed in the North Guangxi, SE Guizhou, Wulingshan-Mufushan, Jiangxi-Anhui-Zhejiang frontier areas and East Zhejiang; (4) A closure of oceanic basin, arc to land or terrane to terrane collision during the time space of 860-760 Ma, taking place along the SE boundaries of the Jiangnan arc.

The late Proterozoic collision along the SE boundaries of the Jiangnan was marked by these structures: (1) HP metamorphic glaucophane schist relics, (2) two ophiolitic melange zones in the NE Jiangxi fault and the Jiang-Shao fault, (3) regional greenschist facies metamorphic rocks, (4) large scale fold zones and thrust ductile shear zones with a sense toward SE. There are also a plenty of post-collision structures, mainly (1) S-type cordierite-bearing granites, (2) a sinistral strike-slip ductile shear mylonites, (3) locally, decollement and extension with a sense of shear from NW to SE, (4) a united early Sinian red colour molassic cover, distributing on the whole Jiangnan orogenic belt.

CRUSTAL EVOLUTION OF THE AMAZONIAN CRATON BETWEEN 1.8 Ga TO 1.5 Ga: BASED ON ISOTOPIC EVIDENCES

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The Amazonian craton is composed by an ancient cratonic domain (Central Amazonian Province-CAP), which is surrounded by early to middle proterozoic mobile belts (Maroni Itacaiunas, 2.2Ga - 1.9Ga; Rio Negro-Juruena RNJP-, 1.8Ga-1.55Ga, Rondonian-San Ignacio, 1.5Ga-1.3 Ga and Sunás, 1.25Ga-1.0Ga). The Sr, Pb and Nd isotopic data shows that the development of the mobile belts did involve new crust formations as well as reworking of older crustal materials.

The RNJP occupies large portion of the western part of the Amazonian craton, and is a zone of complex granitisation and migmatitisation. It is composed mainly of gneisses, migmatites, amphibolites, granodiorites and tonalites as well as syn- and post-tectonic anatectic granites. Regional metamorphism generally took place in the RNJP in the upper amphibolite facies. The granites and gneisses of the RNJP yield Rb-Sr and Pb-Pb whole rock isochron dates in the range 1.75 Ga to 1.55 Ga., with initial ⁸⁷Sr/⁸⁶Sr ratios around 0.703 and a single-stage model μ_1 value about 8.15. These results were interpreted as indicating the time of original rock-formation from mantle-derived magmas.

In order to improve the geochronological control, SHRIMP U-Pb zircon and conventional U-Pb zircon ages have been undertaken on six samples of granitoids and gneisses from the Papuri-Uaupés and Guaviare-Crinoco rivers areas (northern part of RNJP) and Jamarí-Machado rivers area (southern part of RNJP). The granitoids from the northern part yielded conventional U-Pb zircon ages of 1709 ± 17 Ma and 1521 ± 31 Ma, and SHRIMP U-Pb concordant zircon results on two metatolalitic samples of 1800 ± 18 Ma. Samples from a foliated metadiorite and a blastomylonitic granitoid from the southern part of RNJP yielded SHRIMP U-Pb concordant ages of 1750 ± 17 Ma. and 1570 ± 17 Ma.. These new U-Pb results confirm the previous Rb-Sr and Pb-Pb geochronological evidence, that the main magmatic episodes within the RNJP took place mainly between 1750 Ma and 1550 Ma.

In the area of the RNJP and CAP there are several anorogenic rapakivi type granite plutons, mainly subalkaline, and exhibiting characteristics of A-type and within-plate granites. These late to post-tectonic and anorogenic granites were emplaced in three different time periods as follows: 1.6 - 1.5 Ga.; 1.4 - 1.2 Ga. and 1.1 - 1.0 Ga. In addition, within the CAP there are several undeformed within-plate bi-modal volcanic and sedimentary covers deposited on rift environments, which their histories are dated since 1.9Ga. to 1.5Ga..

The geochronological pattern of the RNJP together with the few Sm-Nd T_{DM} model ages of about 2.0 Ga, obtained on basement rocks, suggest that this crustal province constitute a segment of continental crust newly added to the Amazonian craton at the early and middle Proterozoic. Produced through the development of at least two magmatic arcs, although its precise geographical boundaries remain uncertain.

TECTONIC EVOLUTION OF SOUTHERN BRAZIL DURING THE BRASILIANO CYCLE, BASED ON U/Pb AND Sm/Nd GEOCHRONOLOGY

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The Neoproterozoic Brasiliano cycle in southern Brazil is represented by two tectonic units, the Dom Feliciano Belt (DFB), situated along the eastern coast, and the São Gabriel Block (SGB) westward from the DFB. The São Gabriel block is an extension of the Ribeira Belt in southern Brazil, from which it is separated by a Phanerozoic cover.

The DFB is comprised mainly by granites, gneisses and migmatites that occur along a 800 km long and 100 to 200 km wide belt. The SGB is made up of a volcano-sedimentary sequence metamorphosed at greenschist to lower amphibolite facies (Vacacaí Supergroup). This unit was thrust over gneissic rocks of the Cambai Complex which are granodioritic to tonalitic in composition and formed under amphibolite facies condition.

Two main orogenic events affected these areas during the Brasiliano - Pan African cycle: the Sao Gabriel event (700 - 750 Ma) and the Dom Feliciano event (ca. 600 Ma) (Chemale Jr. et al., 1994). In order to characterize these events, 5 zircon samples were dated by conventional U/Pb methods and 27 whole-rock samples were analysed by Sm/Nd method.

U/Pb ages determined on granites and gneisses of DFB allowed us to define two structural events in this region. The first one, which occurred between 610 and 620 Ma, is characterized by the tangential tectonics, with westward overthrusting, and generation of granites, gneisses and migmatites. The second deformation is defined by a transcurrent tectonics, dated at 595 ± 5 Ma. Sm/Nd data obtained for 16 samples from the DFB can be divided in two groups. The first group consists of Brasiliano granitoids with Nd T_{DM} ages between 1.3 to 1.7 Ga. The second group includes gneissic rocks with Nd T_{DM} ages of ca. 2.0 Ga and older. Both groups have negative $\epsilon_{DM}(t)$, where $t = 600$ Ma, although the values for the second group are more negative. These data show that rocks from both groups represent involvement of older crust during the 600 Ma orogeny. Rocks from the first group (younger T_{DM}) suggest a mixture between older material (2.1 Ga Transamazonian basement) and younger material (Brasiliano juvenile magma?), since no 1.3 to 1.7 Ga crust has been recognized in the area. We have not determined any T_{DM} ages younger than 1.0 Ga in the DFB, with respective positive $\epsilon_{DM}(t)$, which could suggest the presence of juvenile material formed during the 600 Ma event.

Zircon U/Pb ages from the SGB indicate orogenesis between 700 and 750 Ma. The age of 700 Ma is from a tonalitic gneiss (this work) and the age of 750 Ma was determined on metarhyolites from the Campeste Formation (Machado et al., 1990). Sm/Nd data on 11 samples from the SGB show few Nd model ages (T_{DM}) as old as 2.0 Ga, most of them are younger than 1.0 Ga, with positive $\epsilon_{DM}(t)$, (where $t = 700$ Ma). These data indicate generation of juvenile magma during the São Gabriel Orogeny in the Brasiliano - Pan African cycle, suggesting accretion of juvenile terranes in this area, in contrast to the situation observed in the DFB. Since there is an interval of ca. 100 Ma between the two orogens, it is suggested that the São Gabriel block (Vila Nova terrane) occupied a hinterland position during the Dom Feliciano orogeny (600 Ma).

References:

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