Early Archaean crust in the Ukrainian Shield – Evidence from clastic zircons in Late Archaean Greenstone belts

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Zircons from clastic sediments carry the memory of the source rocks, and can provide information about ages of previously exposed rocks. Examples include Hadean zircons from the Jack Hills, Western Australia.

The oldest dated zircons (3.6-3.7 Ga) from the Ukrainian Shield come from two localities, in suture zones between the Middle Dniepr and Azov domains in the east and between the Podolian and Kirovograd domains in the west [1, 2]. The Late Archaean Middle Dnepr Domain is a classical granite-greenstone terrane, with greenstone belts surrounded by up to 3.25 Ga [3] basement rocks of the Auli series. The upper Belozerka suite in the Verkhovtsevo greenstone belt is represented by sediments metamorphosed in greenschists facies. Studied zircons from three conglomerate samples show magmatic zonation and are slightly rounded. The U-Pb ages of zircons, determined on the NORDSIM ion microprobe, are 3.15-3.00 Ga with a few grains of 3.25 Ga. Sm-Nd T(DM) of these rocks are 3.1-3.3 Ga. These results indicate that zircons were mainly from local derivation with a small contribution from surrounding basement rocks.

In the Azov Domain, the Soroki greenstone belt appears as a tectonic fragment inside the high grade West Azov basement series. We have studied zircon from four metasediment samples collected in the upper Krutobalka suite of the Soroki belt. These zircons are rounded and have complex internal structures with both zoned and unzoned cores, and high-grade metamorphic overgrowths. Most cores are 3.6 Ga, with a few as old as 3.8 Ga. The ages of the overgrowths are in the range 3.4-3.2 Ga. The time of sedimentation is estimated at around 3.0 Ga. Sm-Nd T(DM) are 3.3-3.4 Ga. These results indicate various sources for the clastic material, including a considerable 3.6 Ga component and even older material.

Our new data are in accordance with previous results for the Middle Dnepr Domain, and indicate a wide development of Early Archaean crust in Azov Domain previously unknown. In many respects the Ukrainian Shield resembles the Pilbara Craton.

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Influence of the analytical errors in geochemical modeling programs

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The most widely used geochemical modeling programs consist of a computer code and a related database containing thermodynamic and kinetic parameters. The code uses the thermodynamic and kinetic parameters in the database and concentrations or other constraints as input and produces results able to describe a geochemical model of a natural system. In this framework the analytical error affecting source data also influence the obtained model. Most of the data used as input are compositional in nature and the correct sample space in which they show their variability is the constrained simplex [1]. In this space the Euclidean geometry is not applicable if a new concept of distance is not adopted, as well as new mathematical operations. Geochemical modeling programs are able to manage compositional data in the Real space and no studies about the effect of this choice have been considered up to now. The aim of the present work is to investigate the influence of the errors affecting the mineralogical composition of different rock types related to an off-shore well in central Tyrrenian Sea [2]. The bulk mineralogical composition used as source data was obtained by XRD Rietveld analytical method (quantitative mineral assemblage analysis). In geochemical modeling mineralogical data were used as follows: 1) without considering the analytical error; 2) computing the effect of the error in the Real space; 3) computing the error influence in the simplex. The differences in the main chemical composition of waters supposed in thermodynamic equilibrium with the previous mineralogical compositions (computation performed by PHREEQC software v. 2.15 [3]) were evaluated. A preliminary comparison among the outputs indicates that the correct choice of the sample space is important and geochemical modeling would be implemented by considering this aspect.

[1] Pawlowsky-Glahn & Egozcue (2006) *Geol. Soc. Lond. Spec. Publ.* **264**, *1-10.* [2] Montegrossi *et al*. (2008) *Boll. Geof. Teor. App.* **49**, 408-410. [3] Cantucci *et al*. (2008, in press) *Chem. Geol*., doi: 10.1016/j.chemgeo.2008.12.029.