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Metasediments of the Palaeoarchaean Dniester-Bug Suite of the South-Western Ukrainian Shield: composition, age, and sources

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Supracrustal rocks of the Dniester-Bug Suite are the oldest formation of the Ukrainian Shield (Esipchuk et al., 2008). They occur in the south-western shield as enclaves within enderbites. We have documented a W-E trending and subvertical enclave in the Odessa quarry (N 48°13'57", E 29°59'20") composed of mafic metavolcanics and very subordinate metasediments. SIMS zircon ages from a quartzite vary from 3.8 to 3.1 Ga, the majority of concordant values being 3.7-3.5 Ga (Bibikova et al., 2012). Younger metamorphic zircons are also present. In the south this enclave is bounded by a 3.1 Ga old enderbite which contains a xenolith of a metavolcanite identical to those alternating with metasediments (Lobach-Zhuchenko et al., 2012). So, the formation of supracrustals is constrained by the interval 3.4-3.2.Ga.

Sedimentary lithologies have been recognised as pure quartzites and garnet, garnet-magnetite, and magnetite quartzites. Metasediments form lenses of different length, and their thickness varies from a few centimetres to 2.5 m. All supracrustal rocks experienced multiple deformation coeval with two high-grade (up to granulite facies) metamorphic events accompanied by migmatization. The second deformation resulted in W-E trending lens-like and banded structures and penetrative steep to vertical mineral and aggregate lineation, which suggests widely developed ductile shearing.

Geochemically, the sediments are subdivided into quartzites, alumina-iron quartzites and iron quartzites (Algoma-type IF). High abundances in quartzites and alumina-iron quartzites of $Al2O_3$ (2-8 and 3-20 wt %), CaO (0.9-3.64 and 1.4-3.6 wt %), MgO (0.7-4.4 and 3.5-6.7 wt %), TiO_2 (0.07-0.23 and 0.56-1.28 wt %), respectively, and the ratio $Na2O/Al2O_3$ of 0.05-0.20 point to their terrigenic origin. According to Herron's classification of terrigenic rocks (Herron, 1988) predominant sediments are Fe-sandstones; some of rocks correspond to quartz arenites and Fe-Al shales; in addition, Fe quartzites (IF) are present. The high Sc content also suggests the clastic origin of these rocks. The chemical index of alteration (Nesbitt, Young, 1982; 42-48 in quartzites and 40-89 in IF) indicates a weak weathering grade. The Zr-Hf ratio of 30-40 suggests an input of continental component. The $K2O/Al2O_3$ ratio of 0.02-0.07 indicates an important role of plagioclase in an weathering area. Most samples have the concentration of LREE 10-50 times higher, and of HREE 1-9 times higher than in chondrites. The enrichment of LREE is thought to have been due to metamorphism. The IF displays a negative Eu anomaly, which also could have resulted from metamorphism (Fryer, 1983). In comparison with the average Algoma-type IF (Gross and McLeod, 1980) IF from the Odessa quarry have lower abundances of Co, Ni, Cr, Zn, and higher abundances of Cu and V; abundances of all transitional metals in the alumina-iron quartzites are higher. The Fe/Mn ratios are of 28-88 in quartzites and 420 in IF, and according to Rosen et al. (1994) these values suggest that sedimentation occurred in shallow basins. Thus, all geochemical features indicate the terrigenic origin of quartzites, Al-Fe quartzites and IF in contrast to most chemical sediments of Archaean Algoma-type IF.