Paper Number: 1841

Preliminary multi-tool (LA-ICP-MS, EMPA and XRD) investigation on heavy minerals from selected Holocene peat bog deposits from southern Poland

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Peat bog deposits provide a very important record of past environmental conditions, preserving biotic and abiotic processes that occurred during the peat bog evolution. In this study, we studied heavy mineral suites of three peat bog profiles from: Kietrz, Mizerów and Strumień, southern Poland. Detrital minerals were separated from ~10 cm thick sand-rich layers. The most common identified minerals are monazite, apatite, zircon, titanite, biotite, perovskite, garnet, pyroxene, amphibole, hematite, Al_2SiO_5 polymorphs, tourmaline, epidote, allanite, staurolite, topaz, ilmenite, goethite, pyrite, and rutile. More than 50% of the studied grain population are automorphic. Next ~35% is xenomorphic (cracked or chemically weathered), while the rest of the population is well-rounded.

Chemistry of some minerals, especially silicates indicate mostly their igneous provenance. In case of electron microprobe monazite CHIME age determinations two weighted mean ages 387 Ma and 372 Ma are visible. LA-ICP-MS U-Pb dating as well as trace elements distribution in apatite reveal three populations differing in age and REE patterns populations. The first gives a Lower Cretaceous age (~126 Ma). Their chondrite (C1)-normalized REE patterns are dominated by very strong LREE fractionation (La_N/Yb_N=58—72, minor positive Eu anomalies (~1.0). The second type of apatite is Variscan in age (~340 Ma). In this case, the REEs show moderate fractionation (Ce_N/Yb_N = 20.8–24.2) and a weakly negative Eu anomaly (Eu/Eu* = 0.9). The last apatite type reveals reset age, but the REEs distribution is anomalous according to the previous two types, with low degree of REE fractionation and negative Eu anomalies (Eu/Eu* = 0.35–0.8).

The mineral suites, their chemistry and obtained ages indicate at least two supply areas for detrital minerals during peat bog formation: (i) Variscan crystalline rocks (the Tatra Massif and/or the Bohemian Massif) [1, 2]; (ii) ultramafic magmatic rocks (teschenite-picrite association present in the Silesian Unit) [3]. Moreover, the minerals related to the ultramafic rocks dominate over the other types. Above mentioned facts point out that intensity of weathering of Cretaceous igneous rocks fingerprinted strongly during Holocene. This may be used for new paleo-reconstructions of that area in the Upper Quaternary.

Acknowledgements: This study was supported by the Centre for Polar Studies, University of Silesia, Poland -The Leading National Research Centre (KNOW) in Earth Sciences 2014-2018.

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