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U-Pb geochronology of detrital zircons from a metaconglomerate of the Formation of São Domingos (Group of Douro), Desejosa/Castanheiro do Sul, Northern Portugal

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The Desejosa/Castanheiro do Sul area (Northern Portugal) is characterized by a predominance of Ediacaran to Cambrian metasediments, forming a thick and relatively monotonous sequence of phyllites, metagraywackes and metaconglomerates. This area is located within the autochthonous of the Central Iberian Zone, which is one of the largest crustal segments of the Variscides. Lithostratigraphically, these metasediments are included in the Super Group Dúrico-Beirão that consists of two groups: Group of Douro and Group of Beiras. The metaconglomerate sampled for the present study belongs to the Formation of São Domingos, which forms part of the Group of Douro. Reliable biostratigraphical data are lacking from all these metasedimentary units. Presumably, the Formation of São Domingos corresponds to the top of a sequence of four formations and, thus, the U-Pb geochronological data obtained in its detrital zircons by Laser Ablation-Quadrupole-Inductively Coupled Plasma Mass Spectrometry (LA-Q-ICPMS) will help to constrain the maximum depositional age of the metaconglomerate. Furthermore, recent studies concerning the determination of U-Pb ages of detrital zircons from metasedimentary rocks show that they could reflect the age distribution patterns of the sources, helping to constrain the paleogeographic solutions.

The LA-Q-ICPMS U-Pb data set (88 detrital zircons with 92–110% concordant ages) is dominated by Neoproterozoic ages (88.7 %), with a main cluster in the Cryogenian – Ediacaran (ca. 647 – 552 Ma). A few Cambrian (1.1 %), Mesoproterozoic (3.4 %), Paleoproterozoic (5.7 %) and Neoarchean (1.1 %) ages are also present. The detrital zircon population from the metaconglomerate of the Formation of São Domingos records the existence of a major long-lived Neoproterozoic magmatic episode at ca. 705 – 552 Ma, probably located near or at the northern Gondwana margin. On the other hand, the Neoarchean (2790 Ma) and Paleoproterozoic (2403 – 1773 Ma) ages of some detrital zircons from the metaconglomerate of the Formation of São Domingos, combined with recent paleogeographic reconstructions, also indicate that the main source could be located in the West African Craton. However, the contribution of another sources containing Mesoproterozoic (1570 – 1048 Ma) and Tonian (964 – 912 Ma) zircons should be considered. Two hypothesis should be discussed: 1) the presence of Mesoproterozoic and Tonian detrital zircons in the metaconglomerate argues in favour of a peri-Amazonian location of the Neoproterozoic/Early Paleozoic depositional basin, close to West Avalonia; 2) the West African Craton provenance could be consistent with the obtained U-Pb isotope data if a long distance transportation of Mesoproterozoic and Tonian zircons from Amazonian Craton or Arabian–Nubian Shield is admitted. The drifting of sediments along the northern Gondwana was possibly due to the action of rivers, like it has been demonstrated by investigations carried out on present day river systems. The new U-Pb age data for detrital zircons from the metaconglomerate of the Formation of São Domingos suggest that the maximum depositional age is 524 $\pm$ 20 Ma (Cambrian), which corresponds to the $^{206}Pb/^{238}U$ age of the youngest concordant zircon (101 %).