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Denudation of SW Iberia during Pangea´s break-up: geochemical and detrital zircon geochronology characterization of Triassic basins

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This provenance study is mainly based on new whole-rock geochemistry data but also involves detrital zircon geochronology. More specifically, this study investigates the Early Mesozoic denudation of a Late Paleozoic mountain range, and the coeval development of basins during Pangea break-up in SW Iberia. The relations with past dynamic Earth events in Western Europe also include the amalgamation of Pangea and the development of the Carboniferous basins.

U-Pb LA-ICP-MS geochronology on detrital zircons complemented by geochemical data of siliciclastic sediments is a powerful tool for the study of the sediments' provenance, particularly in constraining the paleogeography, the tectonic reconstructions, and the crustal evolution. The use of zircon geochronology can be a balancing tool useful for the elucidation of the uplift rates and the establishment of the behaviour of different crustal blocks related to intra-continental tectonics.

The objects of this study are the siliciclastic sediments that define one of the most profound unconformities of the Early Mesozoic: the basal unconformity where late Triassic strata overlie late Carboniferous basement previously deformed and metamorphosed. This important stratigraphic boundary records the transition from the timely stages of Pangea´s amalgamation to the early stages of its break-up. In SW Iberia the record of Pangea formation and break-up is associated to significant siliciclastic sedimentation arising from mountain building, rifting and up-lift processes. During the Triassic sedimentation in the different blocks of Pangea was dominated by a series of coalescing, alluvial-deltaic wedges and axial braided rivers that filled the foreland basins. As the foreland basins were filled, the excess detritus was transported across the craton by fluvial and aeolian processes. This sedimentation formed a complex of inter-fingered basins related to the continental break-up and coeval with the infill of other basins associated to the subduction of the Paleotethys and, the birth of the Neotethys sea.

In SW Iberia, the late Carboniferous greywackes are characterized by an increase of the maturity towards the top of the succession demonstrated by the decrease of Al2O3/SiO2 and Al2O3/(CaO+Na2O) ratios and Fe2O3(T)+MgO. These variations reflect the quartz enrichment and the decomposition of feldspar, biotite, amphibole and pyroxene. These chemical differences are also imprinted on the late Triassic sandstones. The chondrite-normalized REE-patterns show a strong enrichment of the LREE relative to the HREE, and have a characteristic negative Eu-anomaly typical of the erosional products of felsic igneous rocks.

Late Carboniferous greywackes and late Triassic sandstones show a continental arc signature and a felsic provenance. The only exception is the oldest greywacke with high Ni content indicative of a mafic provenance.

Cathodoluminescence imaging of the zircons show euhedral to subhedral simple grains with oscillatory growth zoning consistent with a precipitation from the melt phase of felsic to intermediate magmas, and also simple, needle-shaped, acicular, medium to large zircons that can derived from mafic and/or peralkaline magmas.The younger siliciclastic sediments also include a significant amount of complex zircons, composed of a core surrounded by generally concentric zoned or unzoned (low or high luminescent) overgrowths.

The results indicate that weathering and sorting of the reworked siliciclastic sediments were more intense in the late Carboniferous sediments and less efficient in late Triassic. The continental arc signature of these greywackes and sandstones is probably inherited from the sedimentary sources that include continental arc igneous rocks, dominated by felsic magmas, and related recycled sediments. The significant presence of complex zircons in the younger sediments and their scarcity in the older sediments suggest that the cratonic sources were mainly uplifted

and underwent intense denudation at c. 305-205 Ma. Ongoing U-Pb LA-ICP-MS detrital zircon dating will help to test this preliminary interpretation.