

Significance of Detrital Zircon U-Pb Age Peaks Inferred from Pb Isotopes in Detrital Feldspar and Tourmaline

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The proportions of detrital zircon U-Pb age peaks in clastic sedimentary rocks are sometimes used in provenance studies as a proxy for the relative contributions of terranes that were sediment sources. In crustal evolution research, sizes of detrital zircon U-Pb age peaks are often attributed to crustal growth or preservation rates. It is recognized however that zircon fertility varies significantly between different terranes and thus U-Pb zircon ages alone may provide misleading conclusions about provenance or crustal growth. Common-Pb isotopic compositions of feldspar and tourmaline may be used in conjunction with U-Pb age peaks of zircon in order to understand the significance of the ages.

Detrital zircon, orthoclase, plagioclase and tourmaline were separated from Lower Cretaceous sandstone from the Erris Basin, offshore western Ireland. Using a NWR193 ArF excimer laser ablation (LA) system (8 Hz, 3 J/cm²), zircon was measured for U-Pb ages on 20- μ m spots whereas feldspar and tourmaline were measured for Pb isotopes on 25 to 75- μ m spots (depending on Pb concentration). The LA system was coupled to a Nu AttoM sector field (SF) ICP-MS for U-Pb ages and a Nu Plasma2 multiple ion-counter collector SF-ICP-MS for Pb-isotopes.

Near concordant (-15% to +5%) U-Pb ages (108 grains) of detrital zircon exhibit four major peaks on a kernel density estimation (KDE) plot: *ca.* 1.0 Ga (33%), 1.8 Ga (29%), 0.5 Ga (27%) and 2.7 Ga (11%). Pb isotopic compositions of detrital feldspar and tourmaline plot along the evolution line for Stacey-Kramers (SK) average crust from *ca.* 3.0 Ga to 250 Ma but not with the same model Pb age distribution as zircon U-Pb ages. Orthoclase (67 grains) has SK Pb isotope compositions consistent with model ages of *ca.* 2.0-1.5 Ga (36%), 0.3-0.5 Ga (30%), 3.0-2.5 Ga (18%) and 1.0 Ga (16%). Rarer plagioclase (12 grains) is dominated by Pb isotope compositions with SK model Pb ages of *ca.* 2.3-1.6 Ga (85%). Detrital tourmaline (11 grains) mostly has SK model age Pb of *ca.* 0.5-0.3 Ga (73%). Because comparably few feldspar and tourmaline record SK model age Pb of *ca.* 1 Ga, detrital zircon U-Pb ages probably significantly overestimate the proportion of 1 Ga sources, perhaps due to their high zircon fertility.