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U-Pb zircon geochronology of gneisses of the Betic Cordillera, Spain: Evidences of recycled Variscan crust during the Alpine orogeny

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Gneisses crop out in widespread locations and different lithostratigraphic positions through the Nevado-Filábride metamorphic Complex (Betic Cordillera, southern Spain). Their abundance offers the opportunity to date the ages of acid magmatism and its host rocks in this complex - metamorphosed and deformed during the Alpine orogeny - and to establish its origin after comparison with variscan rocks. The investigated gneisses are strongly peraluminous leucogranites with a rather restricted compositional variation. This indicates a common source, compatible with a low degree of partial melting of biotite-rich, moscovite-plagioclase bearing metapelitic materials, at relatively low temperatures (<830ºC). They strongly resemble peraluminous, post-collisional, granitic bodies from elsewhere in the Variscan Orogen. Small variations in Rb-Sr-Ba may be explained by differing degrees of melting, source heterogeneity or minor feldspar fractionation. Variations in REE and positive correlation of Th, Y, and LREE are compatible with zircon and monazite fractionation. U-Pb SHRIMP dating of magmatic zircons in eight samples yielded ages of the range between $\sim$ 280 and 300 Ma. The U-Pb SHRIMP ages and the geochemical homogeneity of the resulting magmas suggest that a single magmatic pulse was responsible for the formation of the protoliths of all the studied gneisses.

Zircons in host pelitic metasediments provide older ages ranging from $\sim$336 to 2050 Ma. They testify to the recycling of Early Carboniferous granites mainly found in the Ossa-Morena and Central Iberian zones of the Iberian Massif. 2050 Ma old zircons can be correlated with the estimated ages for magmatism intruding the West African Craton and the basement of the Peri-Gondwana European Variscan Orogen.

The new geochronological data combined with detailed field observations allow drafting a new chronostratigraphy of the Nevado-Filábride Complex. Traditionally proposed Triassic ages for the upper series of the complex are not consistent with the ages reported here, which suggests that the entire complex may consist of Palaeozoic or older rocks. This conclusion has profound implications on the validity of the tectonic subdivisions proposed so far.

Rare metamorphic zircon rims in the gneisses and the pelitic metasediment yield ages in line with those previously proposed (15-17 Ma) for the high-pressure metamorphic peak in the Nevado-Filábride Complex. The new radiometric data attest for independent metamorphic and tectonic evolutions for the Nevado-Filábride and the Alpujárride complexes of the Betic Cordillera: while the former complex was undergoing high-pressure metamorphism the overlying Alpujárride Complex was already exhumed and cooled.