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Petrology and geochronology of detritus from the foreland basins of SE France: geodynamic and structural implications for the Tertiary evolution of the Western Alps

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The Tertiary basins of SE France are considered the foreland basins of the Western Alpine orogen and their detrital content is expected to record the lithologies exhumed and exposed at the surface of the evolving orogen. The aim of our work was to expand the existing data about the detrital content of these basins through the application of single-crystal, laser fusion $^{40}Ar/^{39}Ar$ geochronology of detrital white mica grains and advanced petrologicl study of metamorphic pebbles.

Our study reveals the predominance of detrital white micas characterized by low Si content, less than 6.5 a.p.f.u, and pre-Alpine ages, 150-360 Ma, throughout the Tertiary sequence. Thus, foreland basins were mainly fed from a more external source rather than from the internal high-grade metamorphic domain of the Western Alps. This conclusion is generally in agreement with previous studies that favoured the Variscan basement of the External Massifs as the main provenance area for these basins. However, the spread of pre-Alpine ages and particularly the presence of the 150-260 Ma age group, not uniquely compatible with derivation from the Variscan basement of the European plate, suggest that some reworking of older Alpine flysch units should also be considered.

Geothermobarometric investigation of rare blueschist pebbles, collected from the

Clumanc conglomerate unit of the Barrême Oligocene basin, suggests their equilibration at relatively high pressure conditions of 11-12 kbar and temperatures of 460±25 ºC. Five Si-rich micas separated from one of these pebbles recorded distinctively Alpine mean age of 34±3 Ma.

Although rare, the presence of Alpine age blueschist pebbles in the foreland basin of Barrême bears great significance, as they provide unequivocal evidence for the exposure of high-pressure metamorphic rock units of the inner Alpine orogen by early Oligocene time.

The relatively short time lag, up to ∼7 m.y., between the metamorphic event recorded by the blueschist pebble and the deposition age of their host conglomerate, at 30-32 Ma, corresponds to high exhumation rate, no less than 4.5 mm/year for the blueschist-facies belt of the Western Alps in the Eocene-Oligocene boundary.

The scanty amount of high-pressure detritus in the early Oligocene western foreland basins may indicate that the inner metamorphic units of the Western Alps were then blanketed to the west by a thick lid of sediments and lower-grade metamorphic rocks. This proposed paleo-structure bears much resemblance to the present day structure of the orogen, whereby the eclogitic and UHP rock units of the most internal part are almost completely isolated from the western foreland basins. This resemblance suggests that the internal Western Alps structure was shaped during a short intensive exhumation event in the Eocene-Oligocene boundary and had not changed much since.