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Alpine tectonics in the Calabrian–Peloritan belt (southern Italy): New $^{40}Ar/^{39}Ar$ data in the Aspromonte Massif area

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ABSTRACT

This study provides new $^{40}Ar/^{39}Ar$ geochronological constraints on the age of the Alpine tectonics in the Aspromonte Massif (southern part of the Calabrian–Peloritan belt). This massif exposes the upper units of the Calabride Complex which originated from the European continental margin. The Calabride Complex was incorporated in the Alpine orogenic wedge and then integrated into the Apennines and Maghrebides fold-and-thrust belts. Throughout the Calabride Complex there is evidence for a two stage tectonic history, which remains however rather poorly dated: Alpine nappe stacking is followed by extensional reworking along the former thrust contacts or along new detachment surfaces. Our new ages suggest that exhumation of the uppermost units, which accompanied nappe stacking, probably started at 45 Ma and that the deepest units were almost completely exhumed at 33 Ma. This kinematics probably corresponds to syn-orogenic extension while the end of exhumation is clearly related to the extensional tectonics dated at 28.6 Ma along detachment structures.

Our geochronological data reveal a very short lag time between accretional and extensional processes in this part of the Mediterranean Alpine orogenic belt. The direction of extension, when the units are restored to their initial position (i.e. before the opening of the Western Mediterranean basins and the bending of the arc) is NNE–SSW. Such a direction does not fit with the eastward slab-retreat model generally put forward to explain extension in the Western Mediterranean. In contrast, we provide evidence for roughly N–S middle Oligocene extension in the accretionary prism, not previously described in this part of the Mediterranean domain.

1. Introduction

In the Western Mediterranean, thinned continental crust or oceanic basins are surrounded by an almost continuous Alpine orogenic belt. Several basins can be distinguished: the Ligurian–Provençal Basin between the south-European margin and the Corsica–Sardinia block, the North-Algerian Basin and the adjacent Alboran Sea, which are connected eastward through the Sardinia Channel with the Tyrrhenian Basin (Fig. 1). The opening of these extensional basins occurred within the European Plate, i.e. in a back-arc position with respect to the Tethyan northwest-directed subduction zone (e.g. Rehault et al., 1984; Vigliotti and Langenheim, 1995). Due to the fragmentation of the Alpine orogenic belt constructed during the convergence of the African, Apulian and Eurasian plates, the timing, initial location and kinematic direction of the extension, as well as the opening mechanisms are still poorly constrained. According to Alvarez (1976), Bouillin (1986), Stampfli et al. (1998) or Schettino and Turco (2006), the Calabrian–Peloritan Arc, the Kabylian massifs, the Moroccan Rif and the Betic Cordilleras are segments of the southern-European paleomargin (block AlKaPeCa), adjoining the Corsica–Sardinia block and were transported to their present position during opening of the Western Mediterranean basins.

Progressive eastward slab retreat is classically put forward to explain this extension (e.g. Malinverno and Ryan, 1986; Royden, 1993; Lonergan and White, 1997; Doglioni et al., 1997; Brunet et al., 2000; Jolivet and Faccenna, 2000; Mascle et al., 2001, Faccenna et al., 2004; Rosenbaum and Lister, 2004) in a geodynamic context controlled since the Upper Eocene by bulk N–S directed Africa–Eurasia convergence (e.g. Dewey et al., 1989; Rosenbaum et al., 2002). In the Tyrrhenian Sea area, this model is supported by the progressive eastward younging of sedimentary basins and volcanics (Jolivet et al., 1998; Brunet et al., 2000). In addition, in the two lateral ends of the

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