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A fossil Ocean–Continent Transition of the Mesozoic Tethys preserved in the Schistes Lustrés nappe of northern Corsica

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ABSTRACT

The analysis of field relationships between allochthonous crystalline slivers, ultramafic units and associated sedimentary cover in the high-pressure Schistes Lustrés units of northern Corsica allows reconstruction of the pre-orogenic architecture of a fossil Mesozoic Ocean–Continent Transition (OCT) of the Tethys basin. The studied area, encompassing the Serra di Pigno and Col de Téghime areas (Cap Corse) is composed of an assemblage of prealpine basement sheets made up of serpentinized mantle rocks, Permian gabbros and gneisses, locally associated with Paleozoic metabasites and micaschists. The sedimentary cover includes numerous intervals of calc-schists, marbles, quartzites, micaschists and dolomitic metabreccias yielding a great variety of lithostratigraphical successions. The metasedimentary sequences do not show affinities with the typical cover series of the Prépiémontais margin domains. This implies an origin from a more internal domain (oceanward) for the studied units. In addition, the sedimentary cover of the ultramafic basement units do not display the characters of the classical Alpine ophiolites but bear lithological features showing affinities with both continental and oceanic environments. We assume that the high variability of the sedimentary successions as well as the presence of a basement composed of continental and upper-mantle rocks is consistent with an origin at an OCT. The acidic basement slivers are regarded as former extensional allochthons of continental crust abandoned during breakup on a newly exhumed seafloor of peridotite composition. Such extensional allochthons, will then logically constitute the most internal continental slices buried at great depth during Alpine subduction. This work shows that a lot has to be expected from a revision of the Schistes Lustrés lithostratigraphy in the light of the new concepts of the evolution of the OCT domains.

1. Introduction

Despite recent improvements in offshore technologies, direct access to key-regions of the current continental margins remains extremely difficult. As a result, our knowledge of the geology and architecture of the distal portions of passive margins has long been limited to restricted sets of marine data. However, since two decades, geological, petrological and geochemical approaches conducted on paleo-margins in orogens yield considerable increase in our understanding of the evolution of passive margins. Crucial information on the mechanism of rifting, involving thinning of continental crust and mantle exhumation at distal margins have been obtained from the analysis of onland analogs trapped in mountain belts. Of particular interest has been the interpretation of poorly known units of the internal Alpine belt, now regarded as analogs of the buried regions of the current Ocean–Continent Transition (OCT) in very distal deep-sea margins (Beltrando et al., 2010; Florineth and Froitzheim, 1994; Hermann et al., 1997; Manatschal and Nievergelt, 1997; Marroni and Pandolfi, 2007; Marroni et al., 1998, 2001; Müntener and Hermann, 2001; Mohn et al., 2010; Molli, 1996; Vitale Brovarone et al., 2011a). Such interpretations are based on the discovery of subcontinental mantle in direct contact with marginal sequences in the Swiss Alps, Western Alps, Northern Apennines and Alpine Corsica. Further studies in some ophiolite-bearing units originating from the Piemonte–Ligurian oceanic domain have revealed additional features typical of former OCTs. These features include: (1) the existence of pre-rift contacts between subcontinental mantle and continental crust, (2) the association of top-basement detachment faults with continental extensional allochthons and (3) ultramafic-bearing tectono-sedimentary breccias overlying exhumed subcontinental mantle (e.g., Manatschal and Müntener, 2009). These observations do not preclude that classical ophiolitic units in the internal Alpine belt still represent remnants of the basement of the more internal Piemonte–Ligurian slow-spreading ocean (Lagabrielle and Cannat, 1990; Lagabrielle and Lemoine, 1997; Manatschal et al., 2010).

In this article we focus on the geology and lithostratigraphy of metamorphic units originating from the Piemonte–Ligurian ocean, now belonging to the ophiolite-bearing Schistes Lustrés nappe of northern Corsica. We have studied the Serra di Pigno-Col de Teghime

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area, between Bastia and St Florent, where both ultramafics and continental basement slices occur and preserve remnants of their own primary (ante-alpine rift-related) sedimentary covers. These units do not display the characters of the classical Alpine ophiolites but bear primary stratigraphic features inherited from deposition within continental and oceanic environments. We describe the lithostratigraphy of selected sections from this region and we discuss how they might relate to a former OCT of the closed Piemonte–Ligurian ocean.

2. Geological setting

Northern Corsica is part of the Alpine orogen. It consists mainly of ocean-derived Mesozoic formations, some of them transitional between an extended continental margin (to the west) and more typical ophiolitic units that underwent *HP/LT* metamorphism, tectonically overlying the crystalline basement of the European continental margin (e.g. Molli, 2008). This margin together with its sedimentary cover has been involved into an eastward dipping continental subduction during the Eocene convergence (e.g. Faure and Malavieille, 1981; Malavieille et al., 1998; Molli and Malavieille, 2010). Alpine Corsica is classically subdivided into four major domains (Fig. 1). (1) The "external" European autochthonous continental basement. To the West, it is composed of variably deformed crystalline rocks and preserves evidence of Variscan deformation and Carboniferous to Permian magmatic events. To the East, the external continental units (Annunciata-Volparone/Popolasca/Corte/Razzo Bianco/Santa, Lucia/Caporalino slices) consist of crystalline basement rocks overlain by Permian to Eocene sediments (Lahondère, 1996) that underwent Alpine deformation under low grade blueschist- (Bezert and Caby, 1989; Garfagnoli et al., 2009; Malasoma and Marroni, 2007; Malasoma et al., 2006; Netelbeek, 1951) to subgreenschist-facies metamorphic conditions (Libourel, 1988; Libourel in Rossi et al., 1994; Zibra, 2006; Zibra et al., 2010). (2) The "Internal" Continental units. They include the Tenda Massif (e.g. Durand-Delga, 1984; Molli et al., 2006) and the more internal Centuri/Serra di Pigno/Farinole/ San Petrone/Campitello units, which are interlayered within the Schistes Lustrés complex. These continental units were interpreted as Alpine tectonics slices (Caron and Delcey, 1979; Faure and Malavieille, 1981; Fournier et al., 1991; Jolivet et al., 1990; Lahondère et al., 1999; Malavieille, 1983; Mattauer et al., 1981) or as Tethyan rift-related continental extensional allochthons characteristics of ocean–Continent transitions zones (e.g. Lahondère, 1996; Vitale Brovarone et al., 2011a). These allochthonous units experienced blueschist- to lawsonite-eclogite- facies peak metamorphic conditions, followed by a widespread greenschist-facies re-

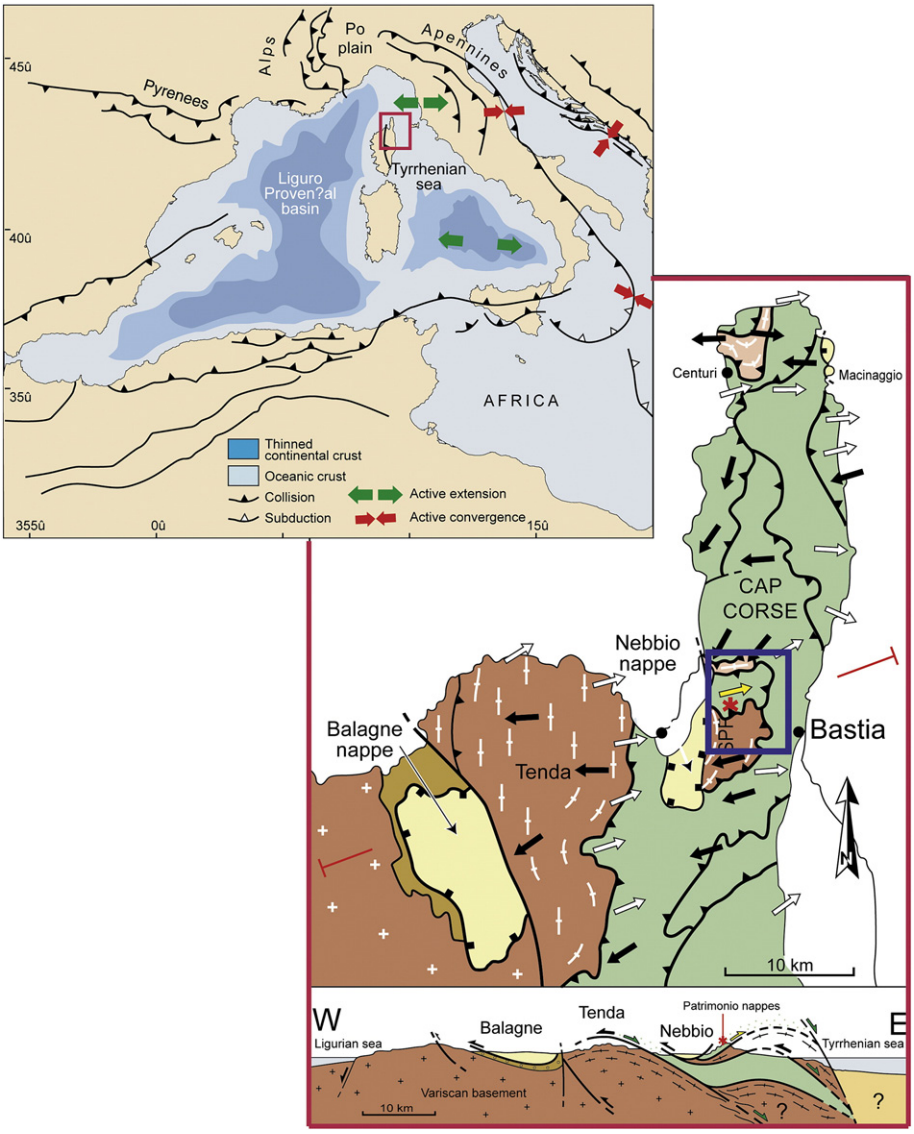

Fig. 1. Geological setting of Corsica within the frame of the Alpine orogeny. The blue square corresponds to the studied area.