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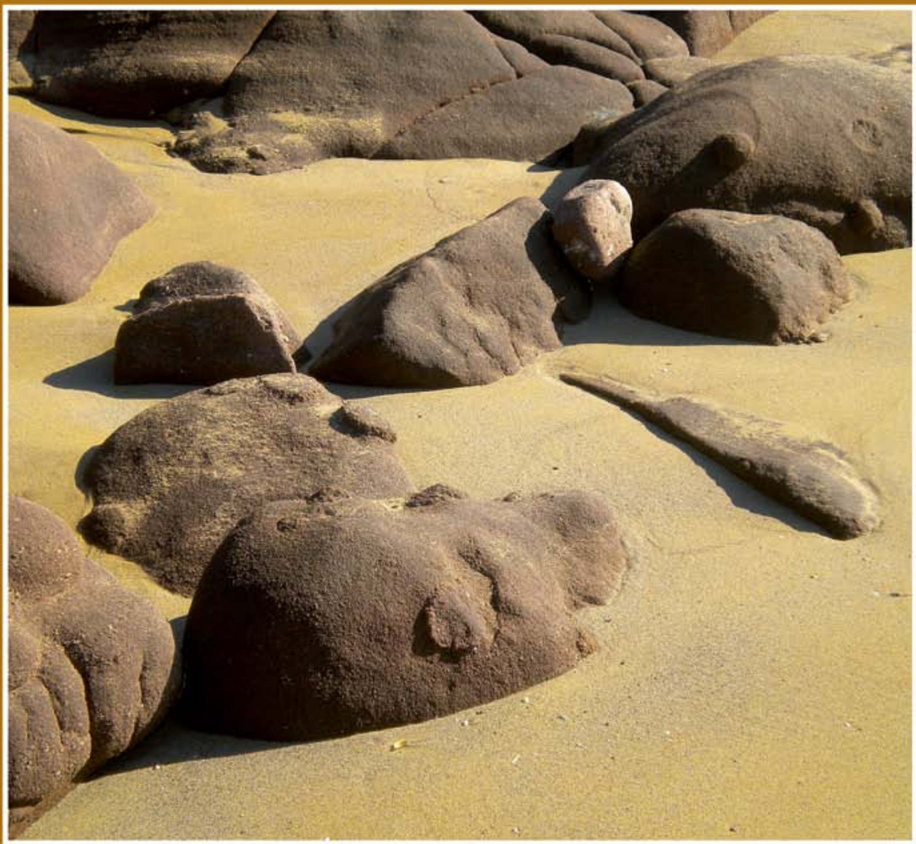

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IAS POST GRADUATE GRANT SCHEME REPORT – 2ND SESSION 2015

The role of Jurassic inherited structures on the post-rift Early Cretaceous extensional faults. Comparison between the "Mt. Cosce Breccia" and the "Ballino Breccia"

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Introduction

The tectono-stratigraphic evolution of Mesozoic sedimentary successions in the Alpine Tethys was influenced by Early Jurassic rift-related extension. Evidence for this normal faulting are in the Alps and in the Apennines, where huge Hettangian carbonate platforms (Calcari Grigi Fm. and Calcare Massiccio Fm., respectively) were dismembered into fault-bounded blocks causing a characteristic horst-and-graben/semigraben setting (e.g. Castellarin 1972; Bertotti et al. 1993; Santantonio 1993,

1994). This is highlighted by facies and thickness variations in the syn- and post-rift Jurassic pelagites. While the occurrence and the effects of the Early Jurassic rifting stage is a well-known theme, evidence for an Early Cretaceous extensional tectonic phase is far more sparse. Direct and indirect evidence for this phase is described for several paleogeographic domains, and includes i) the back-stepping of carbonate platform- and pelagic carbonate platform- (PCP sensu Santantonio

1994) margins, ii) the areal reduction or –locally- drowning of carbonate platforms (e.g. Bièvre & Quesne 2004; Santantonio et al. 2013), iii) the deposition of clastic bodies (e.g. Castellarin 1972; Cipriani 2016; Fabbi et al. 2016), iv) the occurrence of neptunian dykes (e.g. Bertok et al. 2012), v) the development of angular unconformities (e.g. Menichetti 2016).

In the Narni-Amelia Ridge (central Apennines), a Cretaceous megaclastic deposit, called the "Mt. Cosce Breccia" (Cipriani, 2016), was recently identified during a geological mapping project. Due to the stratigraphic, sedimentological and paleotectonic similarities with the "Ballino Breccia" outcropping in the Southern Alps (Castellarin 1972), the two sectors were compared. The aim of this work is to

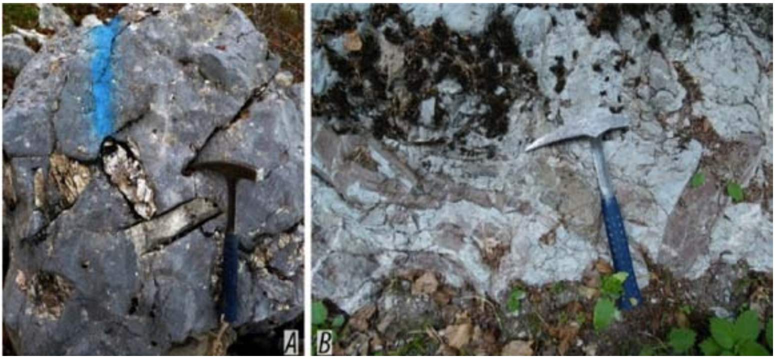

Figure 1: field view of the Lower Cretaceous clastic deposits. A) "Mt. Cosce Breccia"; B) "Ballino Breccia".

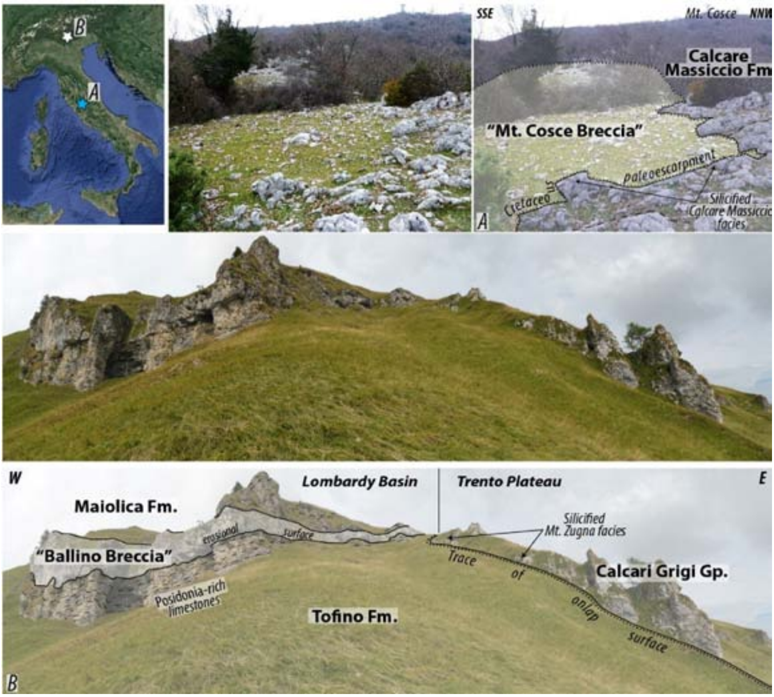

Figure 2: A) panoramic view of the "Mt. Cosce Breccia" unconformably resting on the Calcare Massiccio; B) outcrop visualization of the "Ballino Breccia", resting through an erosional surface on Middle Jurassic pelagites and onlapping the western margin of the Trento Plateau.

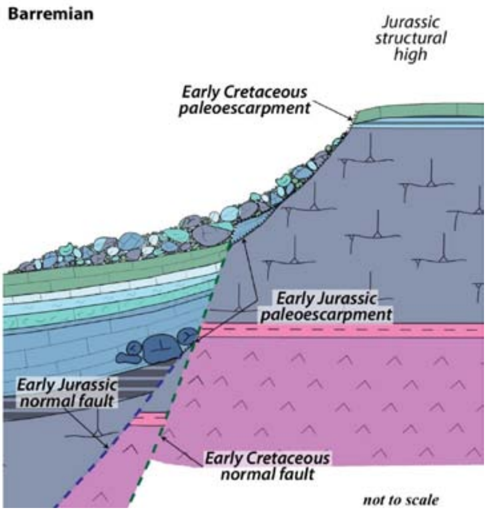

Figure 3: attempted reconstruction of the relationship existing between Early Jurassic and Early Cretaceous structures in a PCP/basin system during post-rift extensions (modified from Cipriani, 2016).

understand the influence on inherited Jurassic structures on the development of Early Cretaceous extensional faults in two different paleogeographic domains of Italy, albeit with a comparable tectono-sedimentary evolution.

Methods

A field work based on a detailed geological mapping project (1:10.000 scale) was performed in the Ballino/Garda area (Southern Alps). Several stratigraphic sections were measured and correlated in order to describe facies and thickness variations of the "Ballino Breccia". Samples collection for the production of thin sections allowed for a microfacies comparison with the "Mt. Cosce Breccia".

Preliminary results

The "Mt. Cosce Breccia" is a polygenic breccia characterized by clasts of lithologies not younger than the Early Cretaceous, dispersed in a matrix of Maiolica-type facies (white Calpionellid-rich limestone) (fig. 1a). This deposit unconformably rests, through an erosional surface, on the horst- block Calcare Massiccio (Mt. Cosce structural high – Cipriani 2016) and, locally, on Lower Jurassic pelagites lapping onto it (fig. 2a). The arresting feature of the "Mt. Cosce Breccia" is the role played on the siting of Cretaceous faults by the inherited Jurassic structures. This deposit can be interpreted as related to the reactivation of an Early Jurassic normal fault during the Cretaceous, as faulting caused the exhumation of a Jurassic structural high and rejuvenation of an inherited tectonic margin (fig. 3).

Impressive similarities were recognized along the Jurassic western margin (Ballino escarpment) of the Trento Plateau, albeit with a larger scale. The Trento Plateau is a huge morpho-structural high formed during the Early Jurassic extensional stage. Polyphasic extension affected the Ballino paleoescarpment during the Mesozoic (mainly Early Jurassic, Early and Late Cretaceous), as testified by conspicuous megaclastic deposits embedded in the western basinal succession (Lombardy Basin - Castellarin 1972). The attention was focused on the "Ballino Breccia", a Lower Cretaceous polygenic breccia characterized by heterometric (sometimes >20 m in diameter) blocks made of shallow-water carbonates (Calcari Grigi Group), chert-rich basinal deposits (Lombardy Basin succession) and horst block-top condensed facies (Venetian Succession). The clasts are associated with pebbles of Maiolica-type facies (with and without calpionellids), and the matrix of the ruditic deposit is a nannomicritic mudstone (Maiolica Fm.) (fig. 1b). The ruditic deposit rests, through an erosive base, on several Jurassic units of the Lombardy succession and, locally, directly on the Calcari Grigi facies, and is sealed by the top of the Maiolica Fm (fig. 2b).

As well as for the "Mt. Cosce Breccia", the "Ballino Breccia" was interpreted as a syn-tectonic deposit related to an Early Cretaceous extensional phase that caused (fig. 3): i) back-stepping and rejuvenation of an Early Jurassic submarine paleoescarpment (Ballino escarpment); ii) formation of neptunian dykes made of Maiolica-type deposits; iii) formation of erosional scars in the footwall-block, due to rock-falls, draped by the clastic deposits or the younger pelagites; iii) silicification of the footwall-block shallow-water carbonates related to the unconformable contact with cherty pelagites. This peculiar diagenetic feature is commonly used in the Apennines to describe PCP/basin systems (Santantonio et al. 1996), but has never been previously described in the Southern Alps.

Budget justification

The € 972,00 of the IAS Grants awarded to me were spent to cover: a) the cost of travel and of accommodation during the field work; b) the cost of the laboratory for the production of thin sections.

Predicted expenses	€ 220,00 travel	€ 602,00 accommodation	€ 150,00 thin sections
Actual costs	€ 194,10 travel	€ 652,00 accommodation	€ 183,00 thin sections

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