Marine and Petroleum Geology 57 (2014) 652–670

Contents lists available at ScienceDirect

Marine and Petroleum Geology

journal homepage: www.elsevier.com/locate/marpetgeo

Research paper

Stratigraphic and provenance evolution of the Southern Apennines foreland basin system during the Middle Miocene to Pliocene (Irpinia-Sannio successions, Italy)

Fabio Matano [a, *], Salvatore Critelli [b], Mirko Barone [b], Francesco Muto [b], Silvio Di Nocera [c]

[a] Consiglio Nazionale delle Ricerche, Istituto per l'Ambiente Marino Costiero (CNR-IAMC), Napoli, Italy
[b] Università degli Studi della Calabria, Dipartimento di Biologia, Ecologia e Scienze della Terra, Rende, Cosenza, Italy
[c] Università degli Studi di Napoli Federico II, Napoli, Italy

ARTICLE INFO

Article history:
Received 17 April 2014
Received in revised form
9 July 2014
Accepted 14 July 2014
Available online 22 July 2014

Keywords:
Stratigraphy
Sandstone petrology
Foreland basin evolution
Southern Apennines
Italy

ABSTRACT

The paper deals with original stratigraphic, petrographic and structural data concerning the evolution of the southern Apennines chain (Italy). The main Langhian to Pliocene deposits cropping out in the northern sector of the southern Apennines foreland basin system (Sannio-Irpinia area) have been studied and correlated in order to document the effects of tectonic changes on the evolution of sandstone detrital modes and stratigraphic architecture. The studied sandstone units can be grouped in five key intervals: a) Numidian Flysch, mostly formed by Langhian mature quartzarenitic deposits and conformable Serravallian post-Numidian successions, formed by arkosic and calciclastic arenaceous-pelitic beds (foreland depozones); b) Langhian to Tortonian San Giorgio Fm., mostly composed of quartzofeldspatic sandstones (foredeep depozone); c) Tortonian to Early Messinian, quartz-feldspatic and partly sedimentary-carbonatoclastic petrofacies, thrust-top successions (Vallone Ponticello, Villanova del Battista and San Bartolomeo fms.); d) Late Messinian quartzolithic to quartzofeldspatic sandstones (Torrente Fiumarella, Anzano Molasse and Tufo-Altavilla unit), which can be referred to infilled thrust-top basins; e) unconformity-bounded Pliocene quartzofeldspatic sandstone strata (wedge-top depozones), characterized by synsedimentary tectonic activity.

Detrital modes of the Serravallian through Middle Pliocene sandstones of the southern Apennines foreland basin system testify clear provenance relations from the accreted terranes forming the southern Apennine thrust-belt. The studied clastics show almost the same blended (quartz-feldspatic) composition; this condition could be related to the tectonic transport over thrust ramp of source rocks, as suggested by the tectonic evolutionary model. This study, dealing with sedimentary provenance analysis and tectonostratigraphic evolution, provides an example of the close relations between clastic compositions and foreland basin system development in southern Apennines.

1. Introduction

Stratigraphic relations and compositional signatures of sandstones in foreland basin-fill are used to decipher the tectonostratigraphic evolution of orogenic and foreland basin systems (De Celles and Giles, 1996; Critelli, 1999). Although the sandstone detrital composition may vary among individual foreland basins from various settings, foreland basins sedimentary infill reveals the tectonic evolution of the fold-and-thrust belt that provides the detritus (e.g. Arribas et al., 2003; Reddad et al., 2009; Perri et al., 2012a, 2013).

The Miocene turbidite systems and the Pliocene deposits of the Southern Apennines (Bonardi et al., 2009) provide a good opportunity to constrain compositional variations with reference to temporal and spatial distribution of source rocks during tectonostratigraphic evolution of foreland basins.

In this paper we focus on the effects of tectonic changes on sandstone detrital modes and stratigraphic architecture along the northern sector (Sannio-Irpinia area) of the southern Apennines foreland basin (Fig. 1) and their paleogeographic implications.

Miocene to Pliocene units within the study area have largely been studied in terms of stratigraphy and facies analysis (Boiano,

* Corresponding author. Consiglio Nazionale delle Ricerche, Istituto per l'Ambiente Marino Costiero (CNR-IAMC), Napoli, Italy. Tel.: +39 0815423834.
E-mail address: fabio.matano@cnr.it (F. Matano).

http://dx.doi.org/10.1016/j.marpetgeo.2014.07.012
0264-8172/

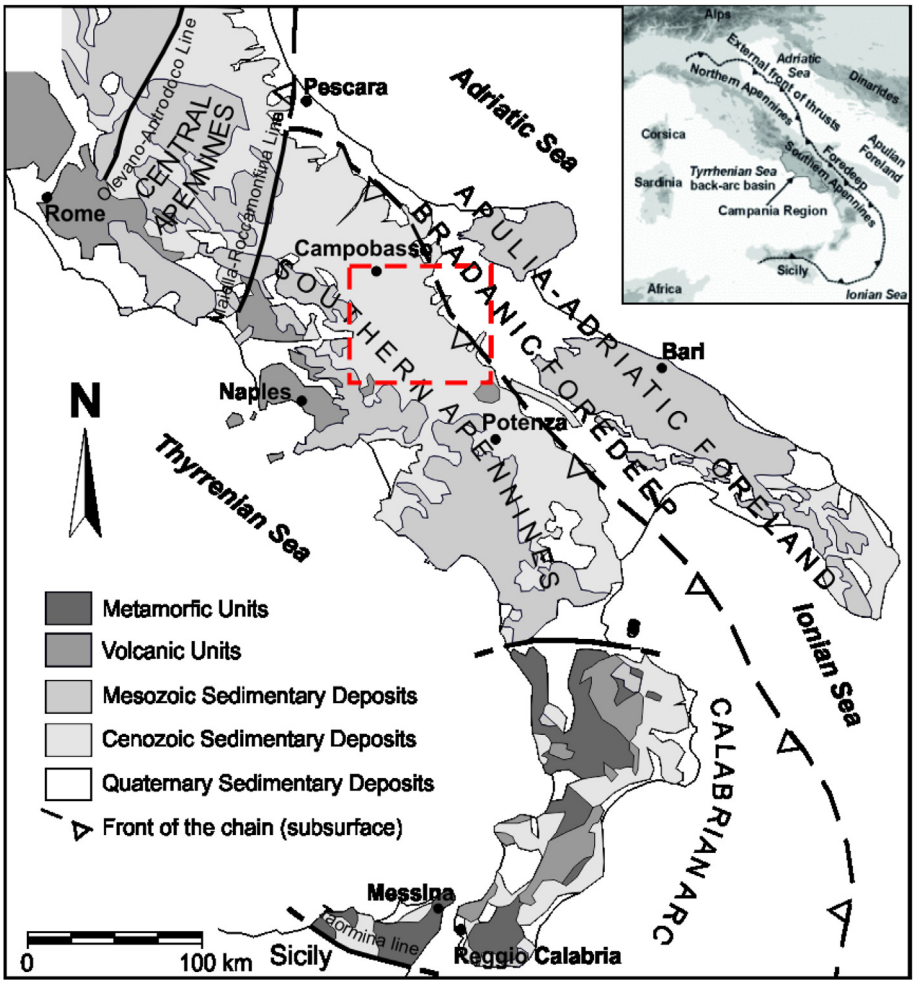

Figure 1. Geological sketch-map of the Southern Apennines and study area location (modified by Bonadi et al., 2009). The red box shows location of study area.

2000; Ciarcia et al., 2003; Di Nocera et al., 2011; Matano, 2002; Matano et al., 2005). Conversely, petrographic studies on the composition of arenites cropping out in Irpinia and Sannio Mts. is poorly documented in literature (Critelli, 1999; Critelli et al., 2011, 2013), with the exception of Messinian deposits (Barone et al., 2006; Chiocchini et al., 2003).

The present paper focus on the general stratigraphy and the provenance of Miocene and Pliocene arenite successions of the Southern Apennines foreland basin, which crop out in the Irpinia and Sannio sectors, and takes advantage of a dense sampling of key successions (Fig. 2), integration of petrological data with geochemical analyses of volcaniclastic layers and Sr isotopic analyses on selected samples, using as framework a significant recent update on the tectono-stratigraphic architecture of the sector (Bonardi et al., 2009).

2. Geological setting

The southern Apennines thrust-belt is part of the Africa-verging Apennine-Maghrebides orogenic structure developing between the back-arc Tyrrhenian basin and the Apulia and Iblean platforms foreland (Fig. 1). The Apennine chain comprises a stack of Adria-verging rootless thrust sheets, which over-thrusted a buried mainly carbonate foreland thrust belt, known as Apulian thrust system or “internal” Apulian Platform (Mostardini and Merlini, 1986; Lentini et al., 1990; Roure et al., 1991).

During the pre-orogenic times, the Apulia continental margin was characterized by carbonate platforms and pelagic basins, spanning from the Triassic to Early Miocene (D'Argenio et al., 1975). The platform-basin system was gradually covered since the Miocene up to the Early Pleistocene by fluvio-deltaic to deep-marine foreland clastic wedges related to the progressive flexuring of lithosphere beneath the advancing Apenninic thrust belt (Patacca et al., 1990).

Middle Miocene history of the southern Apennines foreland region is the result of collisional processes occurred since early Miocene, when the Meso-Mediterranean microplate collided with Adriatic portions of the Africa plate and Lucanian remnant-ocean basin was definitively closed (Guerrera et al., 1993; Critelli, 1999; Critelli et al., 2008; Perri et al., 2013). In the southern Apennines the onset of continental collision is dated as early Miocene, and accretionary processes continued with high slip and uplift rates since early Tortonian (Patacca et al., 1990; Sgrosso, 1998). A significant shift of the foreland basin system depozones toward E-NE occurred starting from the Late Tortonian, after the beginning of rifting in the back-arc region of the Tyrrhenian area (Patacca et al., 1990, 1993).