Stratigraphy, structural setting and burial history of the Messinian Laga basin in the context of Apennine foreland basin system


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ABSTRACT - An integrated approach to the study of the Central Apennines thrust system has been conducted, combining together new field, geophysical, organic matter maturity and mineralogical datasets. The area comprises one of the most studied basins of the Central Apennines: the Laga basin. It developed during the Messinian time and represents the link between the internal, uplifted, Lower Miocene fold-and-thrust belt to the west, and the external, more recent part of the basin, buried below a thick pile of synorogenic, Plio-Pleistocene clastic deposits of the Periadriatic basin to the east. The Laga basin is filled by several facies, largely studied in the past and mostly included into the Laga Formation, classically considered the fill of a deep marine foredeep basin connected to the flexure of the subducted Adriatic lithosphere under the Apennines. Our results clearly suggest that during Messinian, the main factor controlling depositional system architectures was thrusts activity, which governed the localization of the main depocenter in the basin and its preferential space-time migration. The occurrence of thrust activity during deposition of most of the Laga basin sedimentary succession suggests that it can be described as an internally deformed but not migrating sedimentary wedge, having features recording the transition from foredeep to wedge top depozone.

Key Words: foredeep, wedge top basin, fold-and-thrust belt, basin analysis, sequence stratigraphy, Central Apennines

INTRODUCTION

Foreland basins form on the continental crust at the front of active thrust systems, and, as a consequence, constitute sectors characterized by high tectonic mobility. In the foreland, basin sedimentation is controlled by two opposite mechanisms: uplift, due to forward propagation of the orogenic wedge, and flexural subsidence, under the orogenic wedge and/or subsurface loading (Beaumont, 1981; Karner and Watts, 1983; Ori and Friend, 1984; Royden and Karner, 1984; Allen and Homewood, 1986; Ricci Lucchi, 1986; Fleming and Jordan, 1990; De Celles and Giles, 1996; Ford, 2004). Most of the accommodation space is the result of flexural subsidence and is strictly correlated to the curvature of the subducted plate and to the position of the orogenic wedge with respect to the hinge of subduction (Doglioni et al., 2006 and references therein). This tectonic model provides the coexistence of different depozones that from the orogenic wedge to the foreland are (Fig. 1): 1) a wedge top depozone where sedimentation is strongly controlled by thrust activity, 2) a foredeep depozone, further subdivided into inner, axial and outer foredeep (Artoni et al., 2000; Mutti et al., 2003), characterized by shallow and/or deep marine sedimentation depending on the evolution of the foreland system, and 3) an outer ramp marking the passage from foredeep to foreland depozone, where most of the foredeep turbidite system onlapped (Fig. 1). The vertical passage between these sectors occurs through the progressive deformation and migration of the entire foreland basin system, and is marked by a vertical change of depositional systems: deep-water turbidite systems should characterise the lower portion of the sedimentary succession (foredeep depozone), passing upward to mixed turbidite and deltaic depositional systems (wedge top depozone), and finally to continental deposits, testifying an overall progradational trend toward the foreland (see Mutti et al., 2003 and references therein). It is clear that depending on the sector of the foreland basin, the vertical change from foredeep to wedge top sedimentation is often difficult to be recognised in the field, and it is evident that such a change occurs within a time lapse varying from basin to basin. Reasonably, the change from foredeep to wedge top depozone inevitably implies a size reduction of the foredeep basin and its internal structuring through the growing of the internal and more external thrusts, leading to a modification of the basin morphology, that in turn influences the direction of the turbidite flows and the resulting facies.