

The Jurassic Succession of the Inner Northern Apennines (Italy) and Rif Belt (Morocco): Records of the Pangea Break-Up in the Mediterranean Area

Andrea Brogi¹, Alessio Cerboneschi¹, Ahmed Chalouan², Lorenzo Fabbrini¹, Khalil El Kadiri³, Antonio Lazzarotto¹, Domenico Liotta⁴, Marco Meccheri¹, André Michard⁵, and Federico Oloriz⁶

¹ University of Siena, Department of Earth Sciences, Via Laterina 8, 35100 Siena, Italy

² University Mohammed V-Agdal, Faculty of Sciences, Department of Geology, BP 1014, Rabat, Morocco

³ University Abdelmalek Essaadi, Faculty of Sciences, Department of Geology, BP 2121, 93003 Tetuan, Morocco

⁴ University of Bari, Department of Geology and Geophysics, Via Orabona 4, 70125 Bari, Italy

⁵ 10 rue des Jeûneurs, 75002 Paris, France

⁶ Facultad de Ciencias de Granada, Depto de Paleontología, Av. Fuentenueva, 1802 Granada, Spain

The Jurassic succession of the inner Northern Apennines is mainly composed of, from bottom to top: a) white massive limestones (Hettangian-Early Sinemurian); b) red nodular ammonites-bearing limestones (Sinemurian-Pliensbachian); c) grey cherty-limestones (Pliensbachian-Toarcian); d) red and grey marls and limestones (Dogger); e) radiolarites (Dogger-Malm). In the Colline Metallifere and in the southern part of the Mt. Amiata geothermal area, the Jurassic succession shows widespread syn-sedimentary extensional structures (i.e., synsedimentary normal faults and Neptunian dykes) and sedimentary records (slumps, debris flows) indicating tectonic instability of the substratum. These features characterise the Lias-Dogger succession, particularly. Furthermore, a syn- sedimentary mafic volcanic episode was documented within the succession of the nodular ammonites-bearing limestones.

A similar Jurassic succession crops out in the Dorsale Calcaire of the internal Rif belt: a) white massive limestones (Earliest Liassic); b) red nodular ammonites-bearing limestones (Late Sinemurian in the External Dorsale, ED; Middle Domerian-Middle Toarcian in the Internal Dorsale, ID); c) grey cherty limestones, accompanied in many places by basal coarse grained debris flows (rock faults) and olistostromes (Middle Domerian, mainly); d) marly and nodular limestones (Middle-Late Toarcian); e) Radiolarites (Dogger-Malm, ED; Early Tithonian, ID). This succession is widespread exposed with a significant tectonically-controlled diachronism in the onset (from external to internal Dorsale units) of the three key facies: rosso-ammonitico, cherty limestones and radiolarites. As in the inner Northern Apennines, syn-sedimentary extensional features, mainly represented by normal faults and sedimentary records (slumps, debris flows), characterise the Liassic succession. This suggests that both regions might share an overall similar evolution during the Pangea break-up. New investigations are required to account for the differences between these successions (e.g. possible emersions in the Dorsale vs submarine hiatuses in the Apennines).

Key words: Jurassic succession, syn-sedimentary extension, Pangea break-up, Northern Apennines, Rif Belt