The Permo-Carboniferous basins of eastern Pangaea (France and Sardinia): paleoenvironmental implications of the latest U-Pb geochronology

Sylvie Bourquin*[1], Mathilde Mercuzot[1], Laurent Beccaletto[2], Camille Rossignol[3], Céline Ducassou[1], Pierre Pellenard[4], Jahandar Ramezani[5], Michel Lopez[6], and Marc Poujol[1]

[1]Géosciences Rennes 1, CNRS – UMR 6118 Université de Rennes 1, Campus de Beaulieu, 263 av. du Général Leclerc, Rennes 35042 Cedex – France

[2]Bureau de Recherches Géologiques et Minières – Bureau de Recherches Géologiques et Minières (BRGM) – France

[3]Università degli Studi di Cagliari = University of Cagliari = Université de Cagliari – Italie

[4]Biogéosciences [UMR 6282] – Université Bourgogne Europe – France

[5]Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology – États-Unis

[6]Géosciences Montpellier – Université de Montpellier – France

Résumé

The sedimentary record from the late Carboniferous to the early Permian is of major importance in documenting one of the most significant climatic upheavals of the Phanerozoic Eon: The Late Paleozoic Ice Age. This period also coincided with significant tectonic activity in Europe, marking the final stages of the Variscan Orogeny and extensive explosive volcanism. Continental upper Carboniferous- lower Permian basins of western Europe developed during the latest orogenic stages of the Variscan Mountain Belt in eastern Pangaea at equatorial palaeolatitudes. Their chronostratigraphic framework was traditionally founded on continental subdivisions (e.g., the Stephanian and Autunian stages), but has become the subject of dispute due to apparent lithofacies and biostratigraphic biases, as well as lateral diachroneity of their boundaries.

High-precision radioisotopic geochronology has greatly enhanced regional correlations, making it possible to elucidate the geologic evolution of the basins, their paleogeographies, depositional environments, and local versus regional climatic signals. We re-evaluated the depositional environment and the age of the Stephanian-Autunian formations from outcrops and core analyses of French basins located in the north (e.g., Autun, Aumance and Lucenay) and south (Saint-Affrique and Lodève) of the Massif Central, as well as from outcrops in Sardinia. The sedimentation is mainly lacustrine with deltaic influence. A significant quantity of volcanogenic material suitable for geochronology is interbedded with the siliciclastic basin-fill successions, in the form of either volcanic flows or altered ash-fall layers (i.e., tonsteins). The new and improved inter-basin correlations are based on U-Pb ages that range between 300 Ma and 278 Ma with 2σ internal uncertainties as low as 75 ky.

The combined sedimentological, geochronological, paleontological and whole rock geochemical analyses allow to discuss the present-day geographic extent of the basins (which must be considered as depocenter of larger basins), their hydrographic network and sedimentation rates, as well as climate evolution in the eastern Pangea.

*Intervenant

Mots-Clés: late Carboniferous, lower Permian, Massif Central bassins, Sardinia basins