

Palaeotemperature and latitudinal temperature gradient implications for the Late Jurassic of the Ouarsenis Mountains (north-western Algeria) based on stable isotope values of well-preserved belemnites

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The Late Jurassic is considered as greenhouse period. Most palaeoclimatic data, however, have been derived from European basins, and these data show an increase of the palaeotemperature from the Oxfordian to the Tithonian. In the present study we for the first time present such data from the Ouarsenis Mountains, northwest of Algeria (southern margin of the Tethyan Ocean). For this purpose, brachiopods, aptychi and belemnites have been studied under cathodoluminescence and scanning electron microscopy. Subsequently, only 55 belemnites have been taken for the isotopic analysis after eliminating the diagenetically altered specimens.

Their $\delta^{18}\text{O}$ values range from -0.35‰ to -3.88‰ . To translate these values to temperatures, $\delta^{18}\text{O}$ values of 0‰ for the ambient sea-water have been used. In summary, warm and stable temperature conditions in the course of the Late Jurassic have been recorded. The average temperature in the Transversarium Zone (Middle Oxfordian) is 27.8 °C , in the Bimmamatum Zone 27.0 °C , in the Planula Zone (Late Oxfordian) 27.5 °C , in the Early Kimmeridgian 26.2 °C , and in the Hybonotum Zone (Early Tithonian) 27.3 °C .

In order to estimate the latitudinal temperature gradient, the obtained data from the Ouarsenis Mountains (NW-Algeria), which were situated at tropical palaeolatitude of about 20 °N during the Late Jurassic, have been compared with coeval belemnites from higher latitudes (up to 50 °N) (Poland, Scotland and Russia). The results show parallel gradient to today during the Late Jurassic. However, some anomalies that could be linked either to changes in oceanic circulation patterns affecting temperature conditions in European study areas or regional changes in $\delta^{18}\text{O}$ values within European basins have been observed. Thereby, the results point to comparatively stable temperature conditions throughout the Late Jurassic and challenge the earlier proposal of a global warming in this time interval.

Key words : stable isotopes, belemnites, palaeotemperature, Late Jurassic, Latitudinal temperature gradient, Ouarsenis Mountains, Algeria.