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Evidence for changes in intermediate-water currents in the Alpine Tethys during the Late Jurassic.

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Global temperature and precipitation distribution is strongly influenced by ocean circulation patterns. Variations in these patterns induce changes in climate organization, weathering, and sedimentation. Evidence for intense current activity during the Middle-Late Jurassic transition has been identified in the Northern Tethyan margin .(Gehring, 1986; .Felber, 1984). We are using sediment distributions as proxies for reconstructing the intensity of current activity during this period. Strong current activity causes either hiatuses or the formation of hardgrounds. Moderate currents produce condensed lithologies such as glauconitic sandstones or nodular limestone. Shales, marls, and micritic limestones are formed during periods of quiescence.

Based on these concepts, several sections were collected and studied. To get a precise idea of the deposition conditions prevailing at that time, we chose sections from the Jura Mountains and the Helvetic realm representing different paleoenvironments and paleodepths.

A large part of the Callovian (last stage of the Middle Jurassic) as well as the beginning of the Late Jurassic (Early Oxfordian) is missing or strongly condensed. Sediment starvation occurs in all the sections including the deepest ones. This period covering several millions of years is reduced to a few centimeters to one meter of sediment. These hardgrounds are characterized by high iron concentrations (matrix and ooids), high fossil content (mainly cephalopods), and microbial incrustations. After this sediment-starved phase, current activity decreased gradually which enabled the deposition of condensed nodular limestones (Middle Oxfordian.) followed by non-condensed marls and limestones (Late Oxfordian).

We used bio- and carbon isotope stratigraphy to correlate the evolution of current intensity across the studied areas. Stable carbon isotopes provide a very good tool for correlation, however, measurements on condensed sediments have to be taken with caution and require analyses of specific sediment components. The large amplitude δ^{13}C-shift in carbonates observed during the Oxfordian – from 1‰ to 3‰ (VPDB) ..(Louis, in prep) - enable an exceptionally good correlation. Hardgrounds cover the entire Early Oxfordian with characteristic light δ^{13}C. The decrease of current activity appears to be synchronous in all the sections. It corresponds to a δ^{13}C-peak of 3‰ dated as Middle Oxfordian (Transversarium zone). The exact age of the onset of undisturbed sedimentation is uncertain, perhaps diachronous, but occurs in the Middle or Late Oxfordian.

The reasons for these changes in current activity are still under investigation. The Middle-Late Jurassic transition is definitely a time of reorganisation of ocean and climate. Carbonate deposition decreases dramatically in the Callovian followed by a rapid expansion of carbonate producing organisms into pelagic environments in the Late Jurassic. At the same time, 87/86 Sr ratios reach the lowest values of the Mesozoic .(Jenkyns et al. 2002) while Neodymium isotopes display a decoupling of the Pacific and Tethyan values .(Stille et al. 1996). Considering the importance of tectonic activity for this period, it is tempting to link these events with the opening of the Atlantic, creating a new gateway for shallow and intermediate waters through the Hispanic corridor.

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