Mercury enrichments in lower Aptian sediments support the link between Ontong Java LIP activity and OAE 1a

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Materials and methods: further details

Three hemipelagic sections situated in different basins were investigated in the western Tethyan Ocean. The Glaise section (SE France, near Gap) is located in the Vocontian Basin, which represents an area of hemipelagic sedimentation characterized by a palaeodepth of a few hundred meters and which is surrounded by three carbonate platforms (Masse, 1993). Discrete dark laminated layers corresponding to the Goguel Level were recognized (Bréhéret, 1997). The temporal framework is well defined by ammonoïd zonation (Bréhéret, 1997). The La Bédoule section (SE France, southeast of Marseille) is considered as the historical stratotype of the Bedoulian (Moullade et al., 1998), and is situated in the South Provencal Basin. The sediments were deposited in an intra-shelf basin, which was separated from the Vocontian Basin by the North Provence Platform (Masse et al., 1999). A marly succession lacking organic-rich layers represents the equivalent to the Goguel Level. The sedimentary succession is well dated by ammonoïds, calcareous nannofossils, and planktonic foraminifera (Moullade et al., 1998). The Roter Sattel section is situated in the "Préalpes Médianes Plastiques" (Préalpes Romandes, Switzerland) and represents the Briançonnais domain - a micro-continent forming a structural high within the former Tethyan Ocean (Stampfli, 1993). The time equivalent of the Selli Level represents an expanded interval including organic-rich layers (Strasser et al., 2001). The temporal biostratigraphic framework is based on the recognition of planktonic foraminiferal assemblages (Strasser et al., 2001).

Precise chemostratigraphic correlations were established using the complex structures of the $\delta^{13}C_{carb}$ curves, which are defined as isotope segments C2 to C7 (Menegatti et al., 1998) (Fig. DR1). These $\delta^{13}C_{carb}$ records well comparable to those in other parts of the Tethys (Kuhnt et al., 1998; Menegatti et al., 1998; Erba et al., 1999; Stein et al., 2012; Westermann et al., 2013). At the onset of the anoxic event 1a, a negative shift is observed in the $\delta^{13}C_{carb}$ records (segment C3). It is followed by a long positive excursion (2‰) decomposed in three segments: an abrupt step-like positive excursion (segment C4), an subsequent plateau (segment C5), and a second increase (segment C6) to the plateau C7 (Fig. DR1).

Results and discussion

The relationship between Hg contents and TOC enrichments was investigated using the correlation coefficient R^2 (Fig. DR2). Moderate correlation ($R^2 = 0.41$) with the generally moderate TOC (1-2%) values is recorded at Roter Sattel during the C2-C3 segments. At Glaise and La Bédoule a correlation is lacking between TOC values and Hg contents ($R^2 = 0.12$ and 0.16, respectively).

During the positive carbon isotope excursion (segments C4 to C6), at Roter Sattel and Glaise the overall correlation coefficient is moderately low ($R^2 = 0.48$ and 0.32 respectively; Fig. DR2), indicating that this relationship is not consistently linear. The generally high Hg values at Roter Sattel and Glaise are partly correlated with the high to moderate TOC values, especially in the lower part of segment C4 and C6, and the higher part of segment C5. During this time interval no correlation exist between these parameters at La Bédoule ($R^2 = 0.15$) (Fig. DR2).

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Supplementary figures

Fig. DR1: Correlation of the stratigraphic $\delta^{13}C$ records from Roter Sattel (Menegatti et al., 1998), La Bédoule (Kuhnt et al., 1998, 2011), and Glaise (Westermann et al., 2013).

Fig. DR2: Hg (ppb) versus TOC (%) diagram for segments C2-C3 and C4-C6.

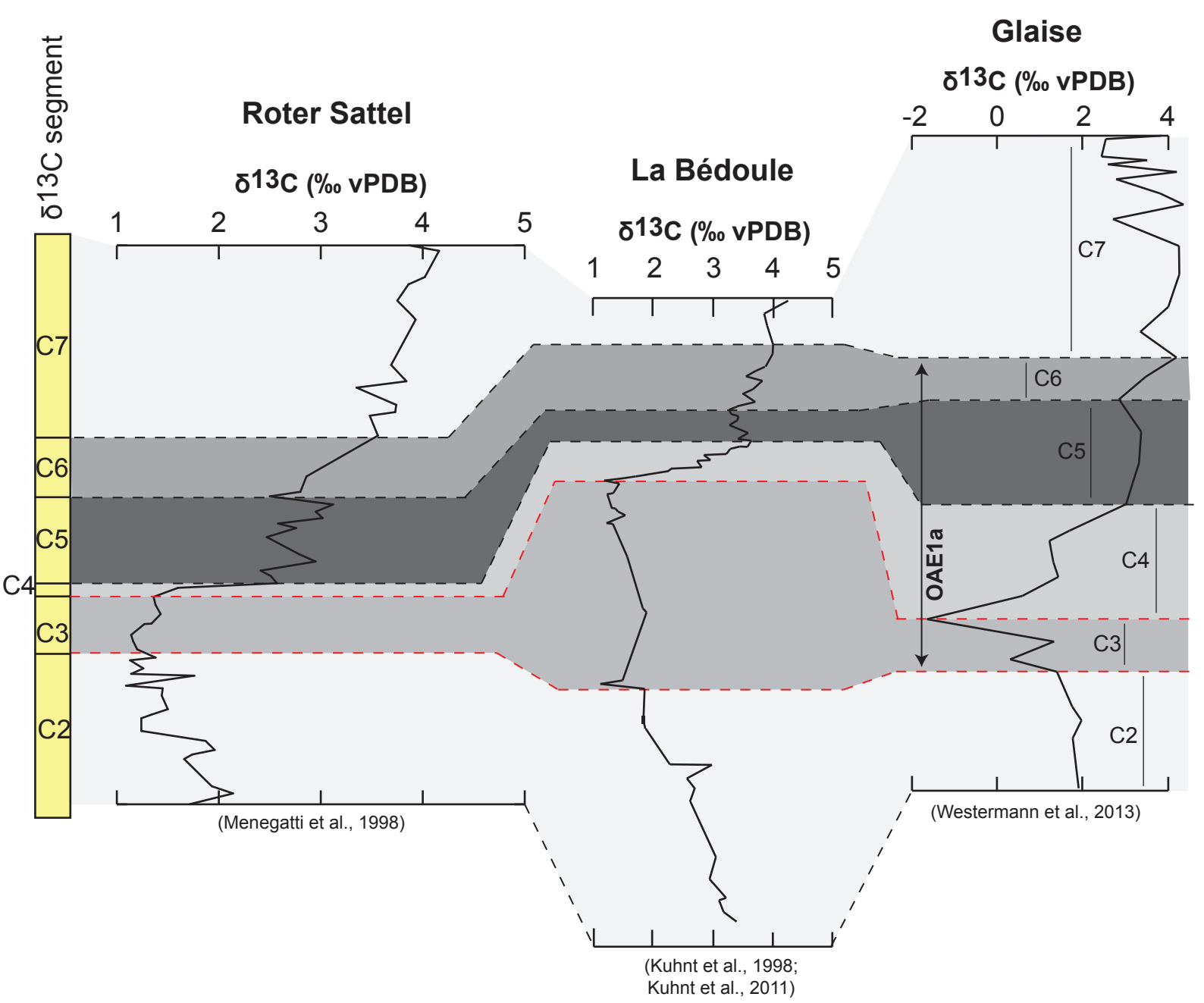
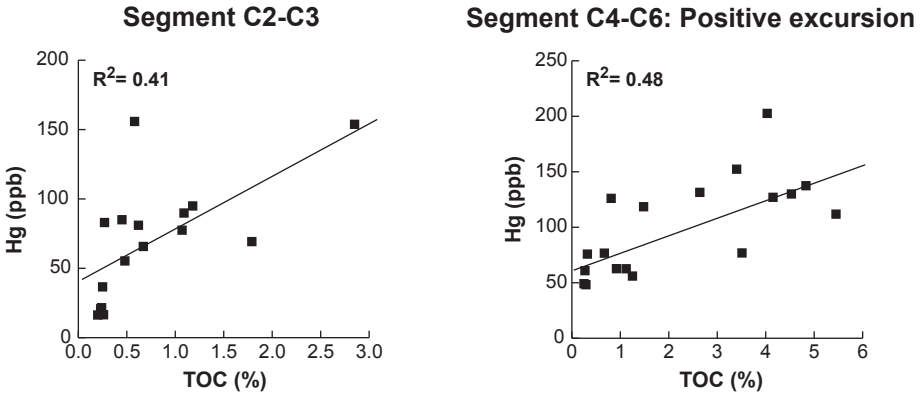
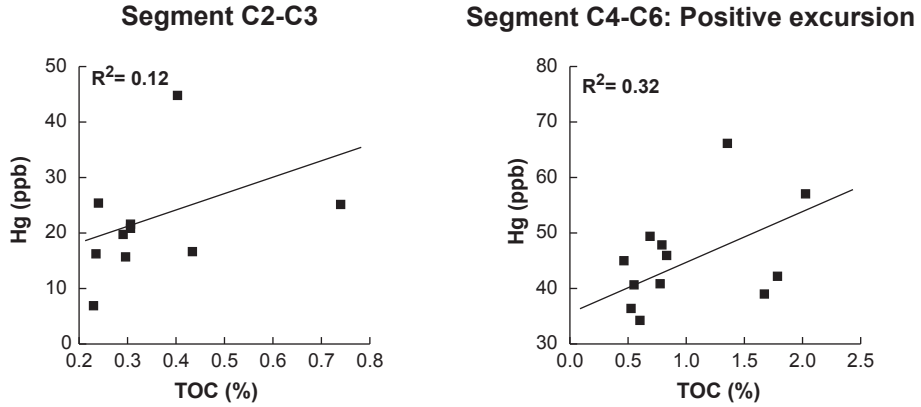

δ13C segment
Roter Sattel
δ13C (‰ vPDB)
1 2 3 4 5
La Bédoule
δ13C (‰ vPDB)
1 2 3 4 5
Glaise
δ13C (‰ vPDB)
-2 0 2 4
C7
C6
C5
C4
C3
C2
OAE1a
(Menegatti et al., 1998)
(Kuhnt et al., 1998;
Kuhnt et al., 2011)
(Westermann et al., 2013)

Figure DR1

Roter Sattel (Briançonnais Domain)



Glaise (Vocontian Basin)



La Bédoule (South Provencal Basin)

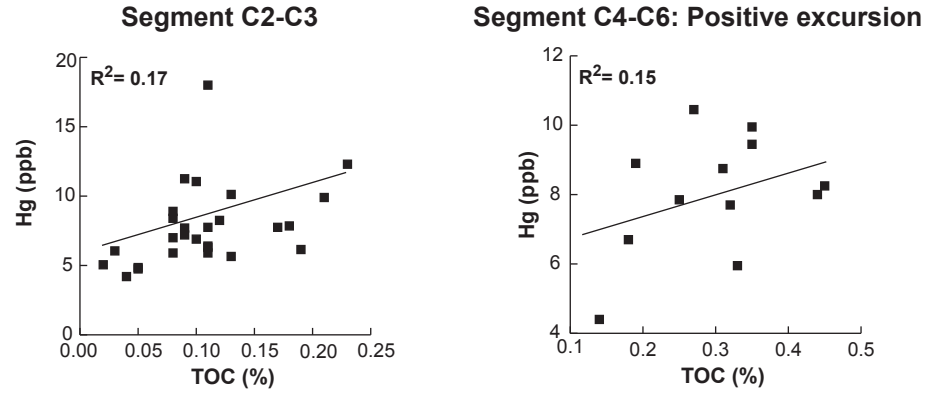


Figure DR2