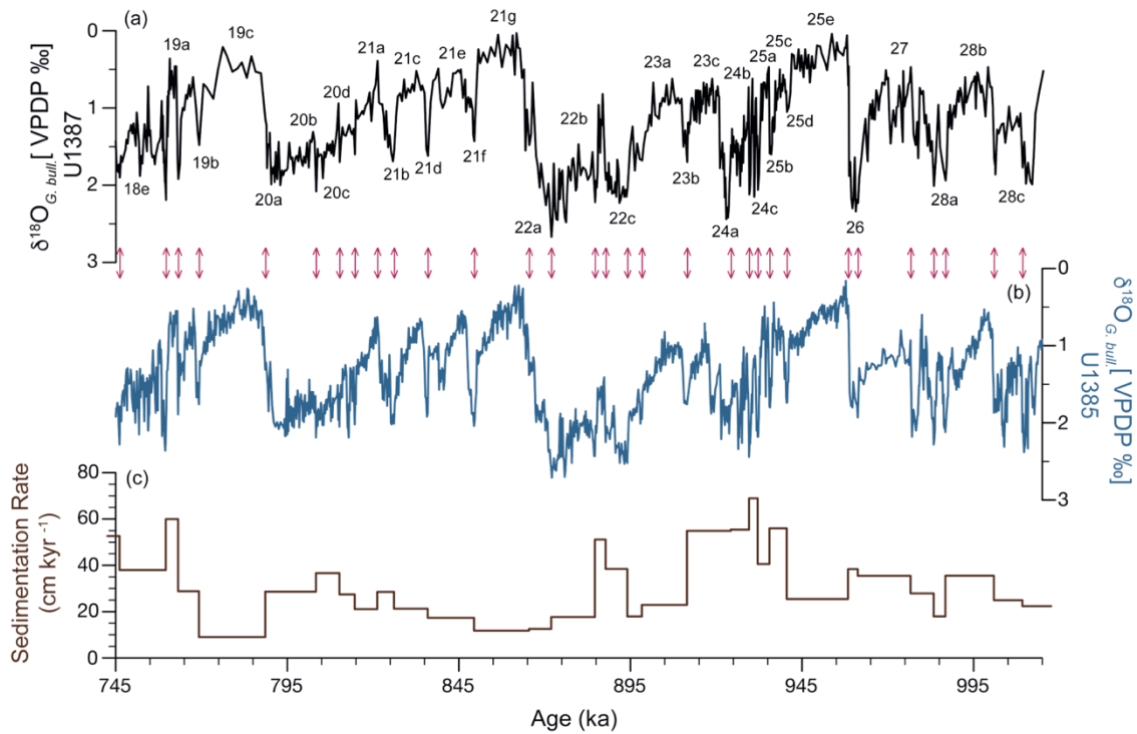


Supplementary Material 1 – S1

**Figure S1:** (a)  $\delta^{18}\text{O}$  record from planktic foraminifera species *G. bulloides* at IODP Site U1387 (Voelker et al., 2025) with Marine Isotopic Stages and substages (Railsback et al., 2015; Mega et al., 2025); (b)  $\delta^{18}\text{O}$  record from planktic foraminifera species *G. bulloides* at IODP Site U1385 on its LR04 related age model (Hodell et al., 2023). Magenta arrows between (a) and (b) indicate tuning points between the two records; (c) sedimentation rates ( $\text{cm kyr}^{-1}$ ) for IODP Site U1387.



**Table S1: Results of Q- and R-mode Principal Component Analyses (PCA) of benthic foraminifera assemblages at IODP Site U1387.**

Principal Component	Dominant Species	Loading / Score	Significant Species	Score / Loading	Explained Variance (%)
<b>Q-mode PCA</b>					
1	<i>Cassidulina laevigata</i>	7.4	<i>Bulimina aculeata</i> <i>Trifarina angulosa</i>	1.8 1.5	25.6
2	<i>Hyalinea balthica</i> <i>Cibicides pachyderma</i>	6.6 3	<i>Sphaeroidina bulloides</i> <i>Cassidulina laevigata</i>	1.6 1.5	19.6
3	<i>Melonis affinis</i> <i>Globocassidulina subglobosa</i>	5.0 3.2	<i>Trifarina angulosa</i> <i>Bulimina aculeata</i> <i>Bigenerina irregularis</i>	2.9 2.3 1.5	20.1
4	<i>Uvigerina celtica</i>	7.3	<i>Uvigerina celtica</i> <i>Cibicides pachyderma</i>	1.1 1.3	13.4
<b>R-mode PCA</b>					
1			<i>Nummoloculina irregularis</i> <i>Gavelinopsis translucens</i> <i>Trifarina angulosa</i> <i>Quinqueloculina</i> spp.	0.6 0.5 0.5 0.5	7.2

	<i>Cibicides lobatulus</i>	0.5	
	<i>Pyrgo</i> spp.	0.4	
	<i>Globocassidulina</i> <i>subglobosa</i>		
	<i>Bigenerina irregularis</i>	- 0.6	
	<i>Bulimina striata</i> subsp. <i>mexicana</i>	-0.4	
2	<i>Siphonina bradyana</i>	- 0.4	
	<i>Melonis affinis</i>	- 0.4	6.6
	<i>Lenticulina</i> spp.	- 0.4	
	<i>Pullenia bulloides</i>	- 0.4	
	<i>Dentalina</i> spp.	- 0.4	
	<i>Sigmoilina</i> sp.	- 0.4	
	<i>Trifarina angulosa</i>	0.4	
3	<i>Gyroidinoides</i> <i>neosoldanii</i>	0.4	4.4
	<i>Uvigerina</i> sp2.	0.4	
	<i>Sphaeroidina bulloides</i>	0.4	
4	<i>Martinotina</i> <i>communis</i>	0.4	
	<i>Cibicides mollis</i>	0.4	4.1
	<i>Cibicides pachyderma</i> <i>Gyroidina umbonata</i>	0.4	

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## References

Voelker, A. H. L., Mega, A., and Rodrigues, T.: Age model control points for the Marine Isotope Stage (MIS) 18 to MIS 28 interval of IODP Site 339-U1387, Gulf of Cadiz, <https://doi.org/10.1594/PANGAEA.974469>, 2025.

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