Numerical Modelling of Tsunami Propagation with Implications for Sedimentation in Ancient Epicontinental Seas: The Lower Jurassic Laurasian Seaway

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Tsunamis are frequent events in the modern marine realm but evidence of their occurrence is rarely observed in ancient epicontinental sea deposits. It has been suggested that this is due to mis-identification or poor preservation potential. Herein we use a numerical modeling approach to evaluate the propagation potential of tsunamis in ancient epicontinental seas and show that such waves are subjected to substantial attenuation. This shows that the sedimentological impact of tsunamis in epicontinental seas will be spatially restricted. The Imperial College Ocean Model (ICOM) is used for this study and is first validated for the ability to accurately simulate tsunamis against the Sumatra-Andaman Tsunami of December 2004. A palaeobathymetric dataset is then presented for the Hettangian (Lower Jurassic) and idealised tsunami sources are situated on the continental shelf and within the adjacent oceanic basin. Results show that tsunamis forced from within ocean basins adjacent to the epicontinental sea are rapidly attenuated over the continental slope and fail to propagate great distances onto the shelf. Similarly, tsunamis forced from within the epicontinental sea are quickly damped down in the shallow water. This shows that tsunami deposits in ancient epicontinental seas would only occur in close proximity to the source region and this contributes their scarcity in the geological record.