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Deformation of Pyritized Burrows: A Novel Technique for the Detection and Estimation of Core Shortening in Gravity Cores

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A novel technique was applied to estimate differences in core shortening in three gravity cores taken at the same core location on the Portuguese continental slope using different coring devices. No obvious deformational features are visible in the fresh core sediments, the isotope stratigraphy and abundance maxima of ice-rafted debris, representing North Atlantic Heinrich-events, indicate identical stratigraphic range in all three cores. However, one of the cores is significantly shorter than the others. X-ray radiographs of the cores reveal that the shorter core shows typical deformation structures whereas the two other cores are lacking signs of deformation. This serious disturbance had likely gone unnoticed had it not been for the X-ray radiographs. As an approach to semi-quantitatively estimate the core shortening, we used the fragmentation and displacement of the pyritized trace fossil Trichichnus that is easily recognizable in X-ray radiographs through its high contrast. The Trichichnus data indicate that a shortening of 50-60% occurred in the lower part of the shorter core. This estimate is in good agreement with variations in apparent sedimentation rates for the interval considered. Accurate flux rates are essential for our understanding marine biogeochemical cycles in general and the marine budgets of nutrients such as carbon and phosphorus in particular. X-ray radiographs are very useful in assessing the intactness of the sedimentary records and the presented method has potential to become a valuable tool in correcting sedimentation rates in disturbed gravity cores.