Chalk: an updated stratigraphy and insights into periglacial weathering profiles, offshore windfarm, UK

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Understanding geological variability of the subsurface is key to the successful development of offshore windfarms and associated infrastructure. In particular, in sites with shallow bedrock, it is critical to identify weathered bedrock and to map the boundary between weathered, residual soils and competent, structured bedrock. In this study we focus on the Chalk offshore the UK continental shelf, where the depth to bedrock ranges from outcropping at the seabed down to over 100 meters below seabed. Through the Middle and Late Pleistocene, much of upland and lowland Britain were covered by successive ice sheets that extended out onto the continental shelf. As the ice sheets advanced and retreated, the Chalk bedrock experienced weathering, fracturing and erosion associated with repeated freeze-thaw cycles under periglacial conditions (Johnson et al. 2023). This weathering can alter the structure, strength and geotechnical behaviour of the Chalk which must be characterised during site investigations. With different areas experiencing different levels of weathering and some Chalk units being more susceptible to weathering than others, the resulting weathering profiles are highly variable and challenging to predict. Using high-resolution 2D seismic data and sediment cores recovered from boreholes to ground-truth the ground model, we evaluate the impact of glacial processes on Chalk bedrock at an offshore windfarm site in the Southern North Sea. We present an updated stratigraphy of the Chalk, using onshore analogues to classify the lithology of the Chalk from the Cenomanian to the Campanian and to compare how weathering varies across the stratigraphy as well as spatially. With a multidisciplinary approach integrating geological, geophysical and geotechnical data, we construct a ground model that characterises the extent of weathering in the Chalk bedrock at type localities. Our study highlights how geological observations and geophysical mapping contribute to offshore site investigations, providing site developers and geotechnical engineers with information on soil-type and behaviour.

References

Johnson., K.R., Dakin, N., Carter, G.D.O., Phillips. E., 2023: Geo-challenges for ground model development in previously glaciated and periglaciated terrains. Innovative GeoTechnologies for Energy Transition, the Society for Underwater Technology. Pp. 881-889. ISSN: 2754-6322.