



Data- and Model-Driven Prediction of the Age and Depth of the Ocean Floor Through Time

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In an age of big data compilations, there is an increasing need to understand palaeo-ocean environments in the context of petroleum prospectivity. Knowledge of the age and depth of the ocean floor in the past is an underlying factor in calculating environmental conditions such as ancient ocean circulation and sea level fluctuation.

Previously published global grids of ocean age through time and at the Present Day are underpinned by tectonic models. They make use of dynamic plate boundaries, which are particularly important when predicting the age of crust that has not been preserved at the Present Day. Recent advances in the availability of big data compilations of seafloor fabric, including magnetic picks and structural and igneous features, present an opportunity to compile data-driven global maps of Present Day ocean age that do not rely on tectonic plate models.

We demonstrate a GIS-based methodology for the construction of such a data-driven, global grid of Present Day ocean age. This methodology is then combined with a global rigid plate tectonic model to predict the age of preserved palaeo-ocean floor for 30 reconstruction ages from the Berriasian to the Present Day. We apply a thermal cooling age-depth relationship that includes calculations to account for supra-crustal igneous features to our ocean age predictions; this allows us to represent the depth of preserved oceanic crust for each reconstruction timeslice.

The destruction of ocean crust through subduction inherently results in increasing uncertainty in the age and depth of ocean floor back through time, particularly where both flanks of an ancient spreading system are unpreserved at the Present Day. We explore a model-driven methodology to estimate palaeodepth in these regions by using depth estimates of preserved conjugate flanks, modern day analogues and plate model-constrained predictions of oceanic structural coverage.

Combining our data- and model-driven results for both preserved and unpreserved ocean floor, respectively, we categorise the palaeo-ocean floor into several oceanic environments; knowledge of these environments, coupled with onshore palaeogeographic and structural interpretations, heat-flow estimates and palaeoclimatic models, can provide powerful exploration tools, particularly in shallow-marine environments.