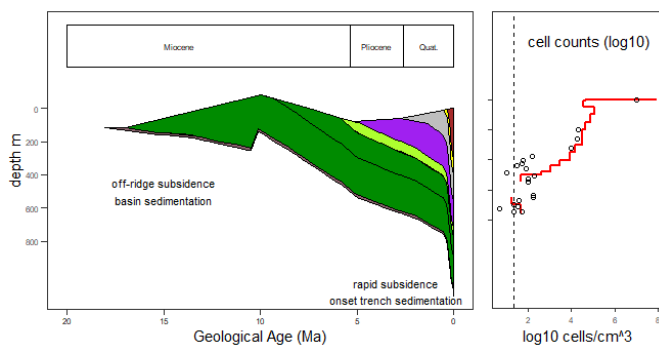


# Modelling Deep Biospheres Over Geological Time; sediment-hosted deep biosphere, Nankai Trough

STEPHEN A. BOWDEN

School Geoscience, University of Aberdeen, Aberdeen, UK,

Using geological data from which a burial curve is calculated, and allowing for key metabolic and geochemical processes, it is possible to forward model cell abundances within the deep biosphere [1]. In this modelling approach a surface or near-surface deep biosphere is projected forwards through geological time and buried, exposing it to different environments. Basin modelling is very different from modelling approaches based on regression of surface datasets as a function of depth [2], because each subsurface depth-bounded biome is a unique ecosystem with unique geological history. To date basin models of the deep biosphere have depended on the mechanistic coupling of geological, geochemical and metabolic processes that control the transfer of organic carbon between the living deep biosphere and other geochemical reservoirs. Because of the focus on processes, the effects of very proximal geochemical aspects as well as far field tectonic process can be investigated. Taking the subsurface biosphere of Nankai Trough, Japan as an example [3], it is possible to include such things as rifting, subduction, the onset of methane generation, the ingress of hot mineralising fluids and the accumulation and loss of overpressure [4].



**Figure 1.** LHS: Burial history for IODP 370, site C0023 [4]; RHS: prediction (red) cell abundances for mesophile biosphere and cell concentrations reported in IODP 3703.

[1] Bowden et al., 2019 *Basin Res.*; **0**: 1–26. [2] Kallmeyer et al., 2012 *PNAS* **109**, 16213–16216. [3] Heuer et al 2017 *Proc. IODP* **370**; [4] Tsang et al 2020 *JMPG* **112**, 104080.