

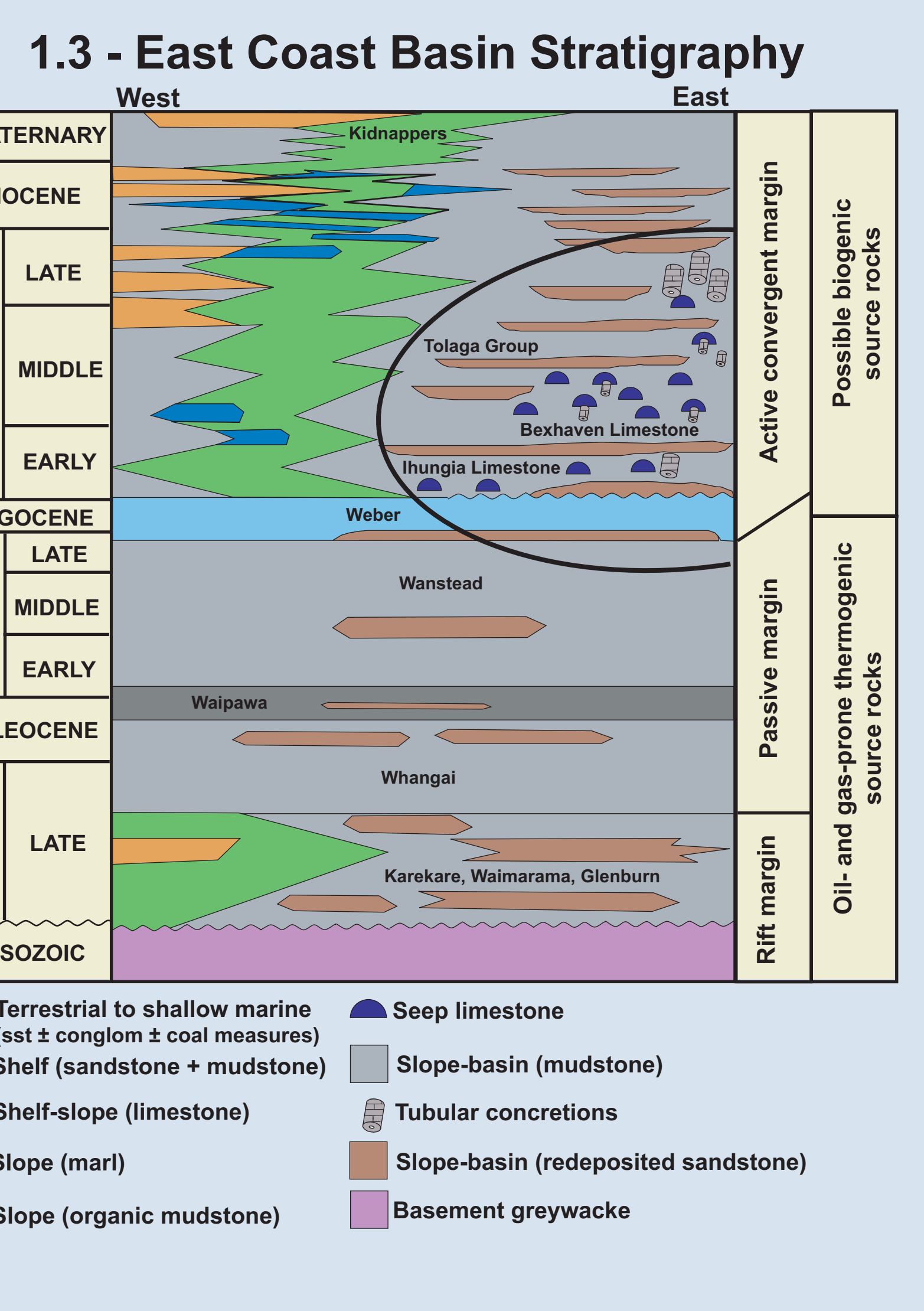
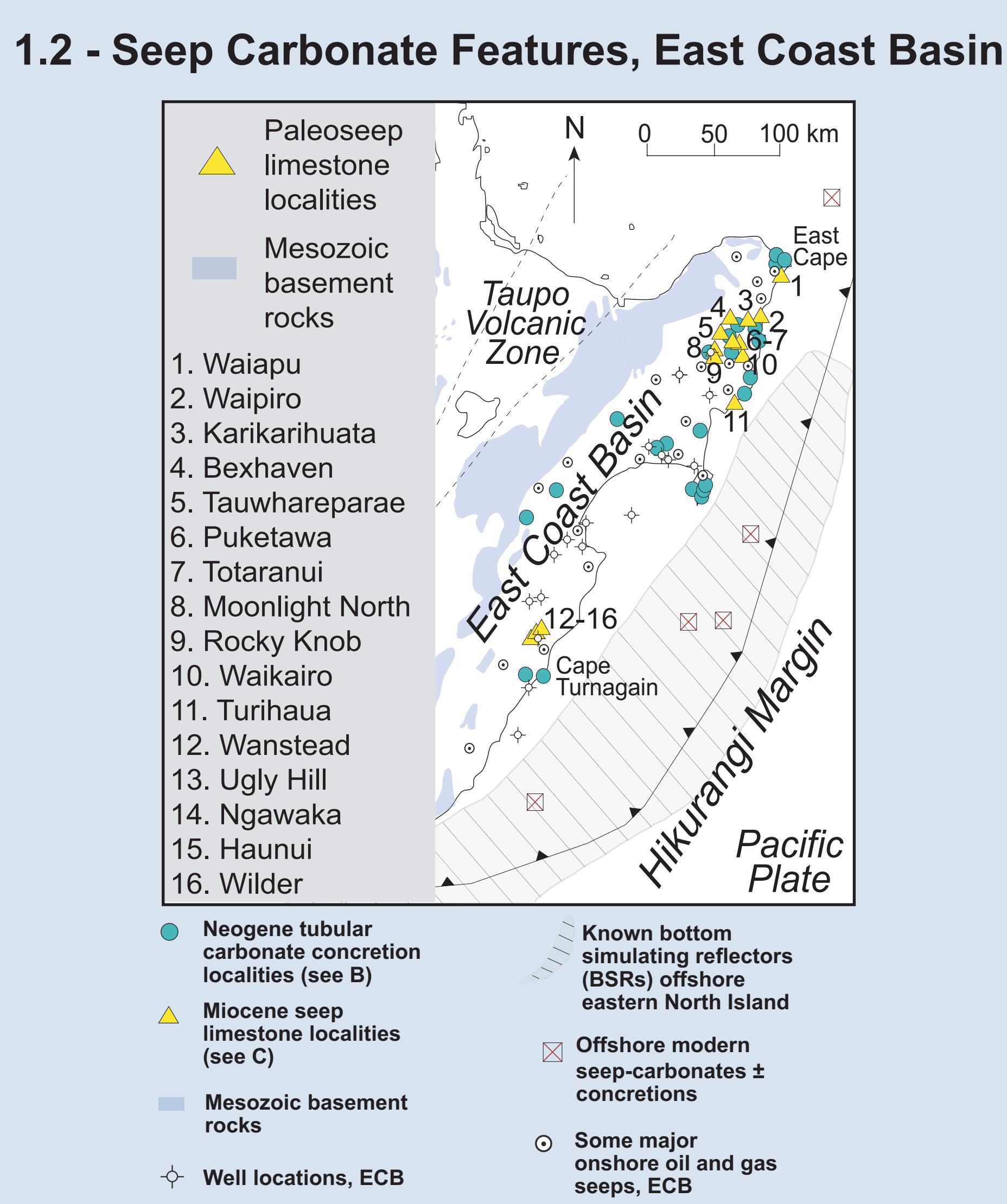
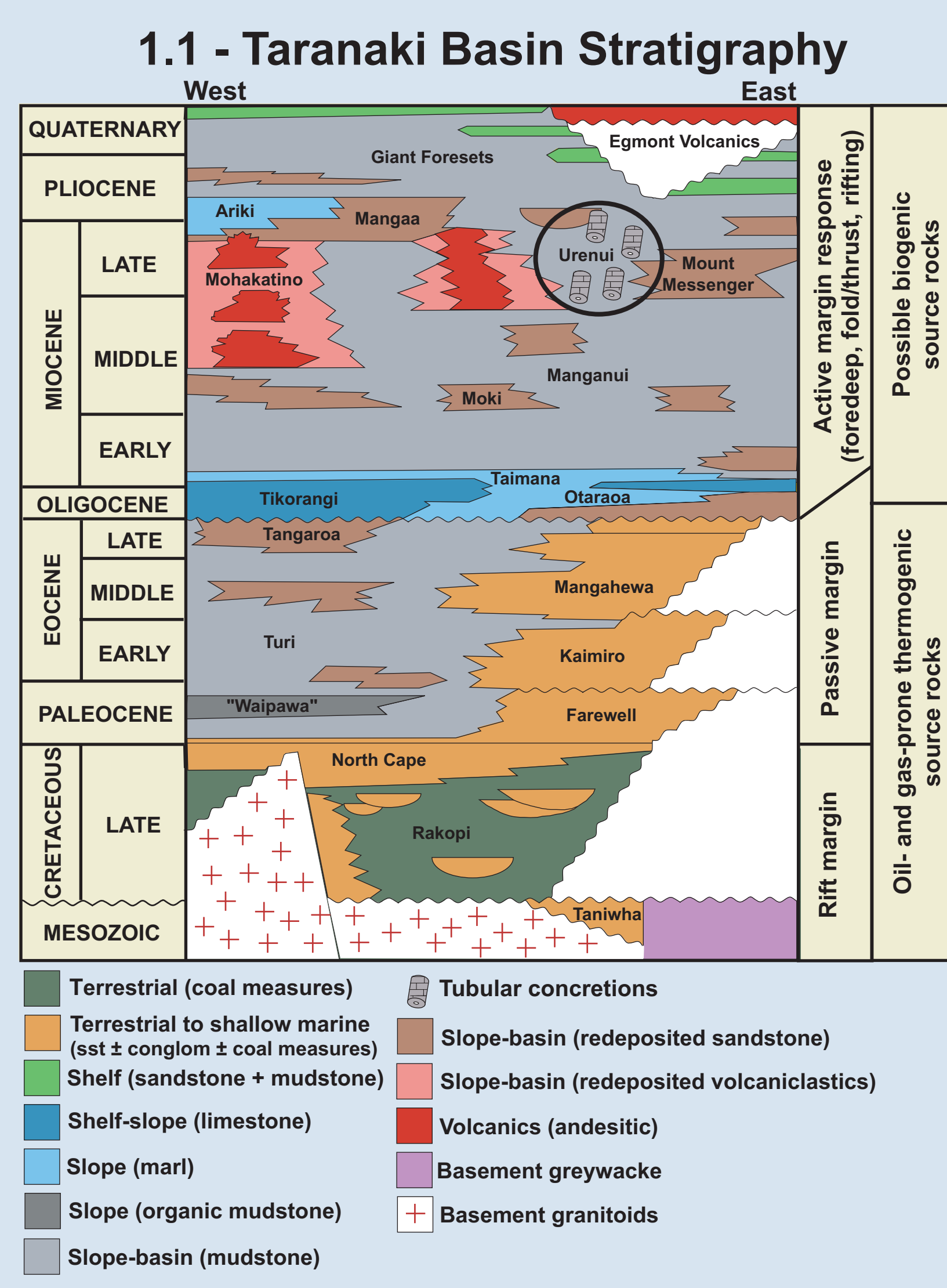
Methane-derived authigenic carbonates (MDAC's) in East Coast Basin, New Zealand: Miocene hydrocarbon seep-carbonate systems

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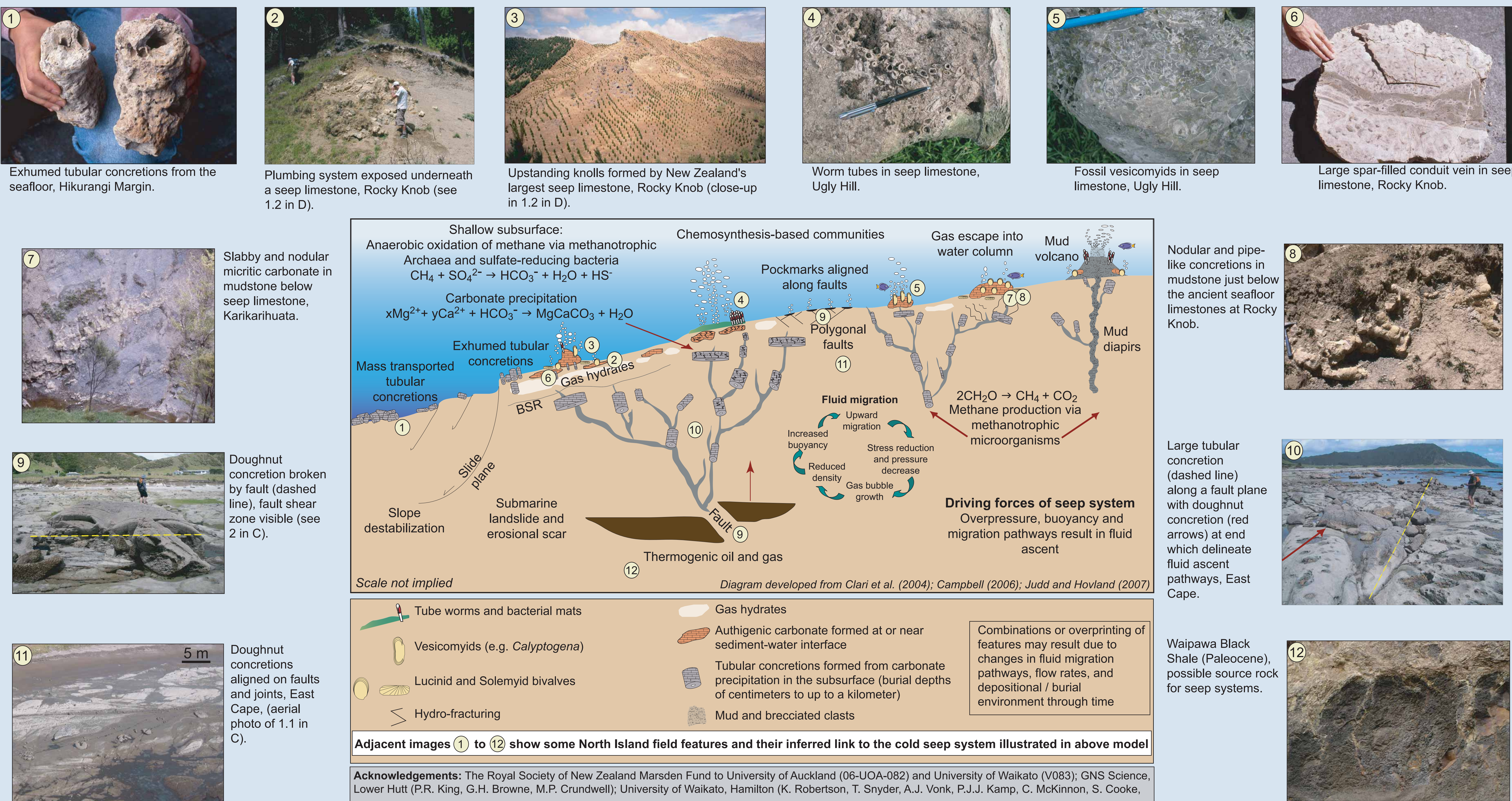
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A. Geologic Setting

1. Goals: Deep-water mudrocks of Miocene age in Taranaki Basin (TB) and East Coast Basin (ECB), North Island, New Zealand, include discrete occurrences of unusual limestone bodies and tubular concretions, respectively interpreted to be paleo-seafloor deposits and subsurface plumbing networks of ancient hydrocarbon seep-carbonate systems. This ongoing study will evaluate the significance of these fluid-flow carbonate features as tracers of hydrocarbon migration in time and space, and their impact on sedimentary basin development. This poster focuses primarily on the East Coast Basin occurrences.

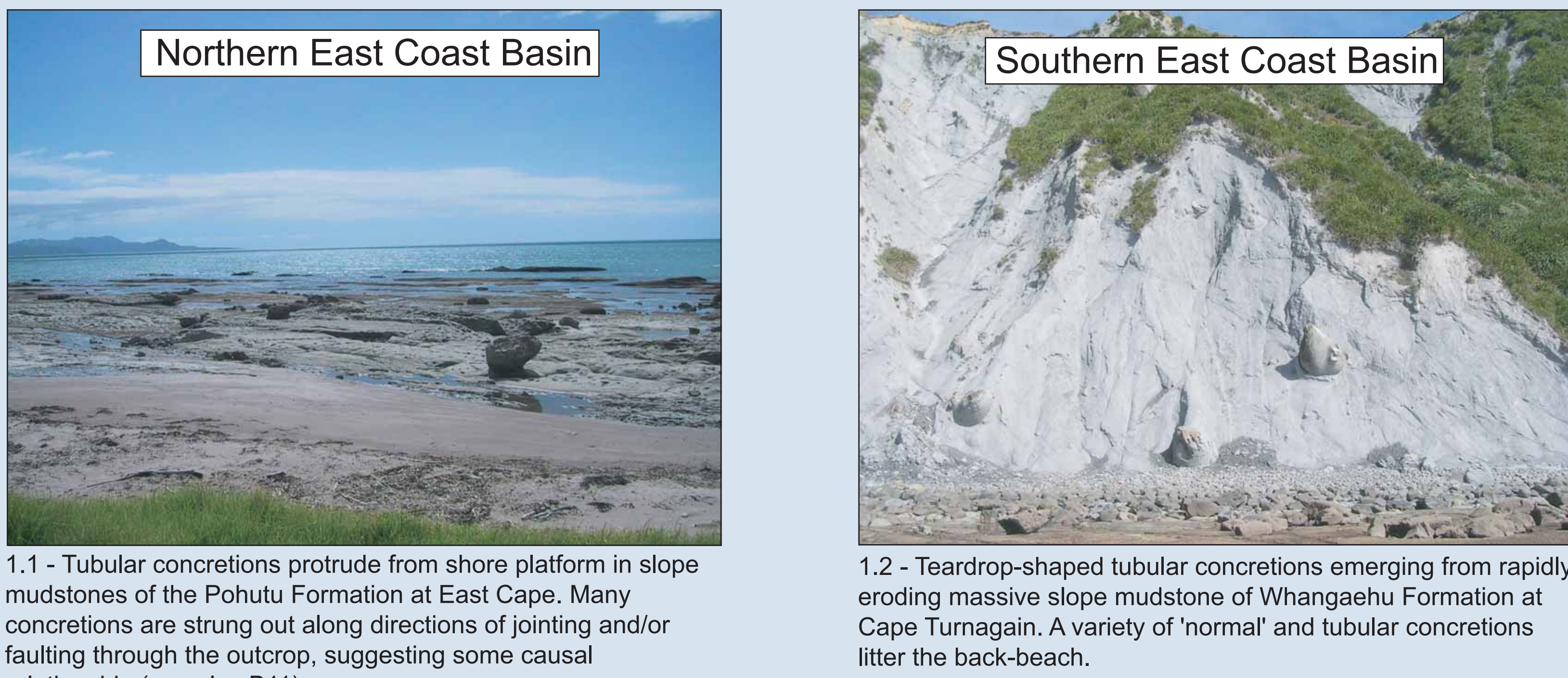


B. Fluid Migration and Cold Seep Development: A Schematic Model

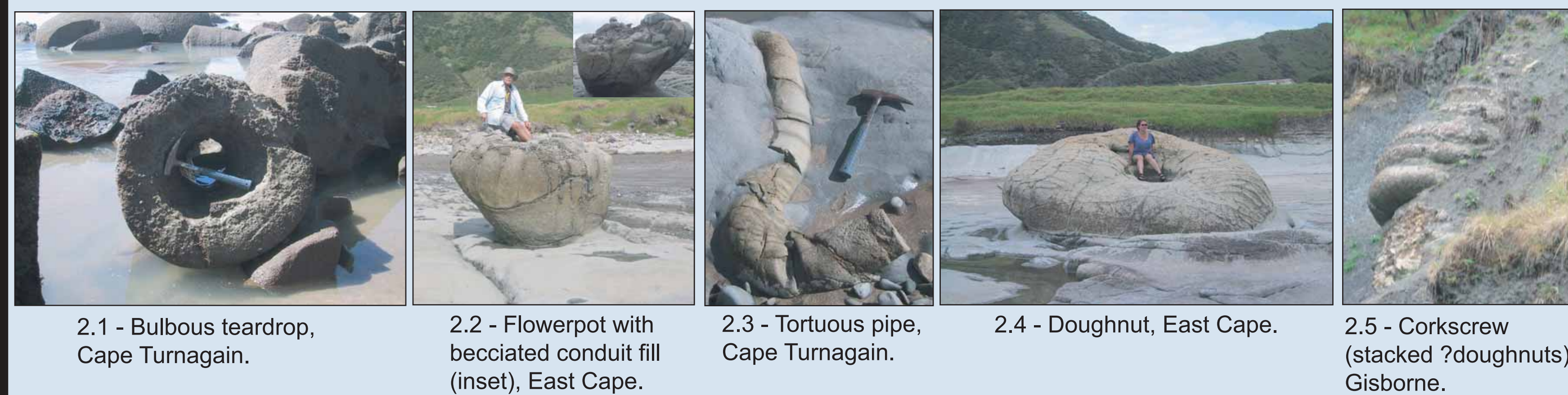


C. Tubular Concretions: the Subsurface Plumbing

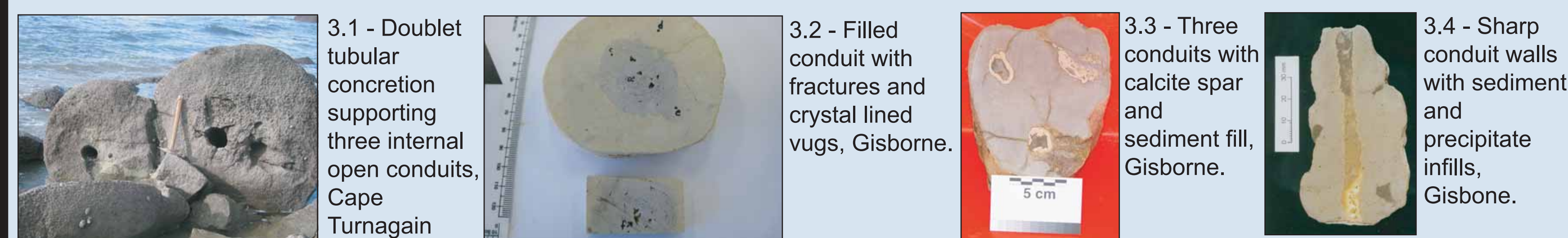
1. Tubular Concretions in Outcrop: Range from several centimeters to meters across, and lengths limited only by outcrop perspective and size, the tubular concretions are mainly oriented at high angles to bedding and are characterized by a near central conduit that is either empty or variably filled with later generation cement and/or sediment.



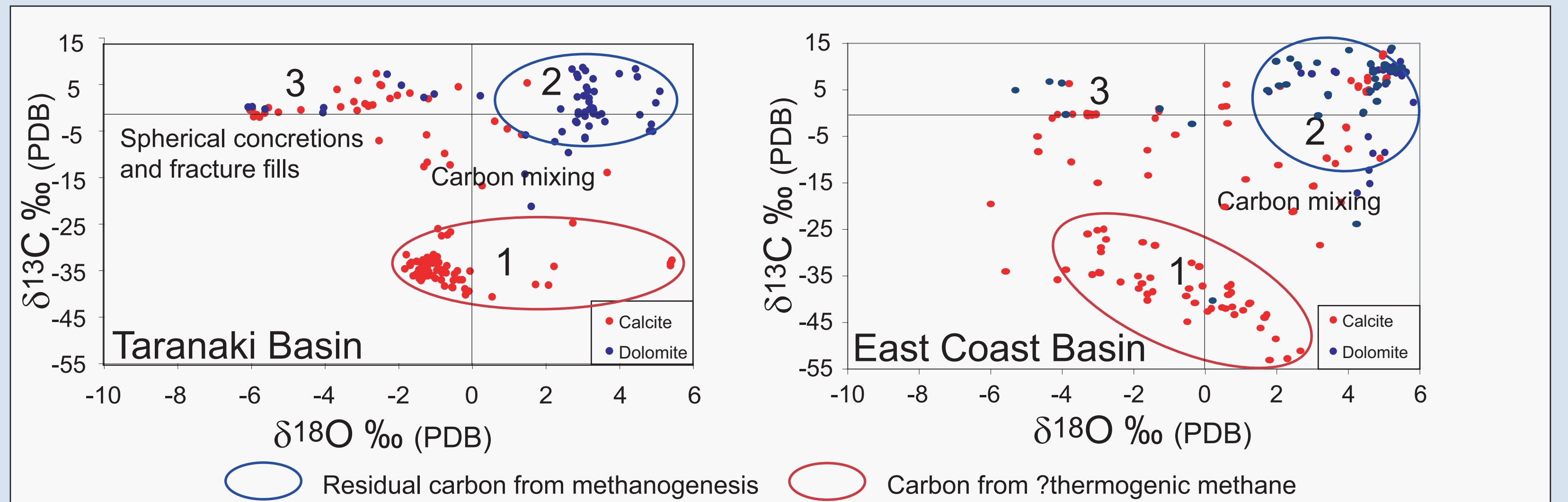
2. Morphologies: The tubular concretions are dominated by pipe, bulbous, and layered types, but there are wide variations within and between these groups. The tubular concretions can trace straight, sinuous, or highly tortuous paths; they may branch, anastomose, and coalesce; and they can curve downward, producing slabs, or taper upwards or downwards, producing teardrops.



3. Internal Structures: The tubular concretions comprise (a) concreted host mudstone (0.1 to 5+ m diam), (b) a near-central conduit(s) (up to 5 cm diam), empty to fully filled by sediment and/or cement, and (c) possible internal brecciation.



4. Isotopes: Carbonate cements and fracture fills, including those from Taranaki Basin, plot in three groups on a $\delta^{13}C$ vs $\delta^{18}O$ diagram. Group 1 is associated with calcitic pipe concretions and ranges from $\delta^{13}C$ -45 to -25‰ and $\delta^{18}O$ -2 to +2‰. Group 2 corresponds to dolomitic bulbous concretions with $\delta^{13}C$ values -10 to +15‰ and $\delta^{18}O$ +2 to +6‰. Group 3 involves conduit and fracture fill calcitic cements in tubular concretions, and stratigraphically associated subspherical concretions ($\delta^{13}C$ -5 to +5‰, $\delta^{18}O$ -6 to -2‰). Remarkably, the same trends occur in the Taranaki Basin.

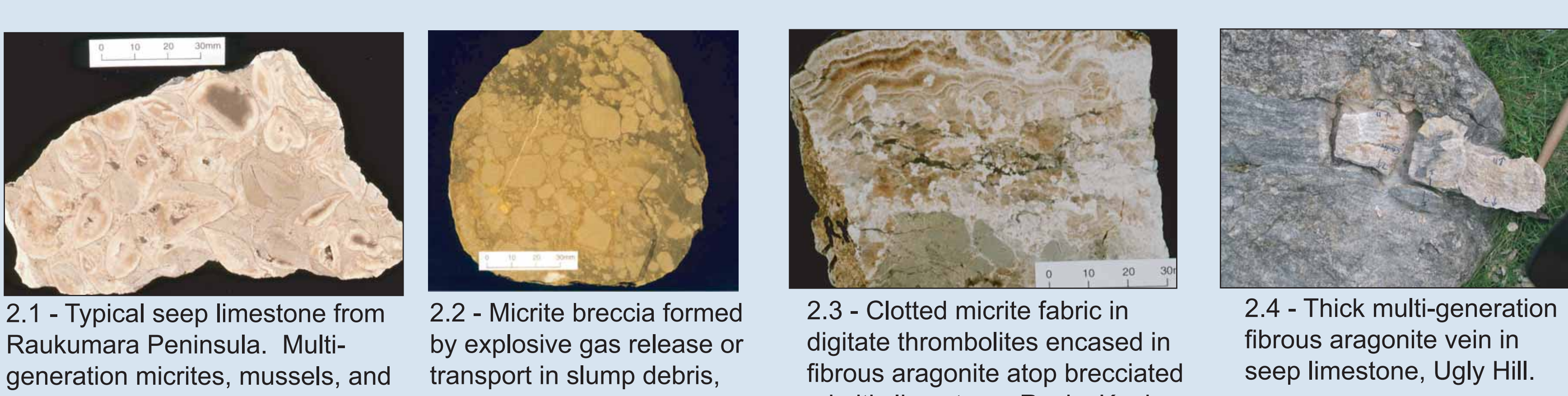


D. Seafloor Seep Limestones

1. Seep Limestone in Outcrop: Seep limestones are presently known in North Island only from within thick (1500-3500 m) sections of Early to Late Miocene slope mudrocks in the forearc structural domain of East Coast Basin (1.2 and 1.3 in A). The limestones occur in small pods and lenses, each up to a few 100 m long by up to a few 10s of m thick, which crop out as upstanding resistant knobs within the surrounding readily erodible host mudrock. Beneath some of these limestones, examples of the tubular concretionary material described in C are preserved in the associated host mudstones, so that a genetic connection between the two is implied.



2. Lithologic Features: The seep limestones involve a wide range of lithologies. The main components are varying combinations of micritic carbonate (detrital and precipitate), whole and fragmented megafossils (some inferred to be chemosymbiotic), siliciclastic sediment, brecciated carbonate clasts, and complex sparry carbonate precipitates/cements.



3. Fossils: Include chemosynthesis-based biota such as worm tubes, bathymodioline mussels, and vesicomyid, lucinid, and thyasirid bivalves.



4. Isotopes: Despite wide scatter, $\delta^{13}C$ values support thermogenic methane as a source for carbonate precipitation in the seep limestones. Variations in composition reflect fluid evolution over time, seep location, the different seep components (not differentiated here), and any diagenetic overprint, all remaining to be assessed.

