Unsolving the formation of a massive bivalve colony grave at the eastern Nankai subduction zone from a geological and geochemical view

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Cold seep activity in the Nankai and Tokai regions are common, supporting wide varieties of chemosynthetic communities. This study focuses on an extinct *Calyptogena* spp. bivalve colony covering an area over 47,000 m^2 discovered on the south slope of the Daini Tenryu Knoll off Tokai. The unusual size and the condition of these shells raises questions on the process involved in forming a chemosynthetic community this size. Methane seeps are known to be ephemeral allowing for possibilities that the colony was gradually formed over time. Yet the sheer volume of dead shells may suggest that past major geological events may have disrupted the underlying methane hydrate layer that is known to be found in this region. ^{14}C radiocarbon dating was adopted on shells found at the colony (600 m) off Tokai using a Single-Stage Accelerated Mass Spectrometer (AMS) at AORI, UTokyo (Yokoyama et al., 2007, Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms), revealing three ^{14}C age groups (ca. 1400, 1912 and 6000 cal BP). Suitable calibration model was created for this environment using δ13C DIC measurements of the shell (3‰) and the gill (-39‰) suggesting that the bivalve incorporates carbon from different sources for growth. The δ13C DIC value of porewater collected from the sediments below the bivalve colony also matches the gill measurements collected in this study (Tomonaga et al., 2016, Blue Earth Symposium). Seawater ^{14}C DIC depth profile of the region were also measured at 50-100m intervals to observe for any abrupt changes near the colony. Geological analyses of sub-bottom profile (SBP) data below and around the colony region using ROV Navigable Sampling System (NSS) highlights multiple areas with steep and shallow faults facing in a NE-SW direction which matches the major Kodaiba thrust that exists in the region. Majority of these faults feature further south of the colony. The region directly below the colony revealed a depression which may have been a result from a past tectonic activity possibly disrupting the underlying structure which could have provided the necessary passage for hydrocarbon rich fluids to pass through to support such a large colony.

Keywords: Cold seeps, Active fault, Radiocarbon dating, Bivalve shells

