

Porosity-depth trends of carbonate deposits along the northwest shelf of Australia (IODP Expedition 356)

Eun Young Lee (1), Michelle Kominz (2), Lars Reuning (3), Hideko Takayanagi (4), Wolfgang Knierzinger (1), Michael Wagreich (1), and IODP Expedition 356 shipboard scientists (5)

(1) Department of Geodynamics and Sedimentology, University of Vienna, Vienna, Austria (eun.lee@univie.ac.at), (2) Department of Geology, Western Michigan University, Kalamazoo, MI, USA, (3) Geological Institute, RWTH Aachen University, Aachen, Germany, (4) Institute of Geology and Paleontology, Tohoku University, Sendai, Japan, (5) <http://iodp.tamu.edu/scienceops/precruise/indonesianthruflow/participants.html>

The northwest shelf (NWS) of Australia extends from northern tropical to southern temperate latitudes situated offshore from the low-moderate-relief and semi-arid Australian continent. The shelf environment is dominated throughout by carbonate sedimentation with warm-water and tropical carbonate deposits, connected to the long-term northward drift of Australia bringing the NWS into tropical latitudes. IODP expedition 356 cored seven sites (U1458-U1464) covering a latitudinal range of 29°S-18°S off the NWS. This study focuses on porosity-depth trends of the Miocene - Pleistocene carbonate sediment on the NWS. The NWS is an ideal area to study regional (and furthermore general) carbonate porosity-depth relationships, because it contains a nearly continuous sequence of carbonate sediment ranging in depth from the surface to about 1,100m and in age from Pleistocene to Miocene. Porosity-depth trends of sedimentary rocks are generally controlled by a variety of factors which govern the rates of porosity loss due to mechanical compaction and of porosity loss (or gain) due to chemical processes during diagenesis. This study derives porosity data from Moisture and Density (MAD) technique conducted during IODP Expedition 356. MAD samples were collected from packstone (44%), wackestone (27%), mudstone (15%) and grainstone (7%), with the rest from floatstone, rudstone, dolostone, sandstone and other subordinate lithologies. To understand porosity-depth trends, the porosity data are arranged both exponentially and linearly, and correlated with age models and lithologic descriptions provided by IODP shipboard scientists. Porosity(%)*-*depth(m) trends of all the porosity data are $\text{Porosity} = 52e^{-0.0008/\text{Depth}}$ (exponential) and $\text{Porosity} = -0.03\text{Depth} + 52$ (linear). Porosities near surface and in the deepest parts of each well are least well represented by these trend lines. Porosity values of Pleistocene sediment are generally higher than those of Miocene - Pliocene sediment. The initial porosity in porosity-depth trends increases from 52% to 57% with increasing mud content from grainstone to packstone, wackestone, and mudstone. Carbonate sediment that includes non-skeletal grains usually has lower porosity values than the trend lines.

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