[EE] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG54]Hard-Rock Drilling: Oman to Oceanic Lithosphere to Island Arc Formation and Beyond

convener:Eiichi TAKAZAWA(Department of Geology, Faculty of Science, Niigata University), Katsuyoshi Michibayashi(Department of Earth and Planetary Sciences, Nagoya University), Peter B Kelemen (共同), Damon A H Teagle (Ocean &Earth Science, National Oceanography Centre Southampton, University of Southampton, SO14-3ZH, Southampton, UK)

Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The on-going Oman Drilling Project (OmDP) has drilled numerous hard-rock cores of ancient oceanic lithosphere and the underlying subduction zone of the Samail ophiolite in Oman, with support from ICDP, IODP, the Sloan Foundation's Deep Carbon Observatory, and Japanese, US, and European research agencies. Moreover, a number of IODP expeditions have focused on hard-rock drilling over the last 5 years including Expedition 352 in 2014, which drilled the volcanic sequence associated with subduction initiation in the Bonin fore-arc, Expedition 357, which drilled the Lost City hydrothermal field, Expedition 360, which drilled the lithosphere associated with ultraslow-spreading at the Southwest Indian Ridge in 2016, and Expedition 366, which drilled the serpentinite seamounts in the Mariana fore-arc. In this session, we invite presentations on the scientific results of hard-rock drilling at these and other sites. We also invite related presentations on oceanic lithosphere, island arc formation, and any other significant issue that could be addressed by future hard-rock drilling. This includes marine studies of oceanic lithosphere and on-land geological investigations of ophiolites, accreted arcs, and subduction complexes. The session is intended to be interdisciplinary, including the fields of geophysics, geochemistry, petrology, engineering, and biology.

[SCG54-P08]Overview of Hole CM1 in the Oman Drilling Project Phase 2: Crust-Mantle boundary

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Direct observation of the transition between the Earth’s crust and mantle has been a major quest of geoscientists for more than half a century, even before the development of plate tectonic theory in the 1960s. Oceanic crust is thinner (about 7 km) than continental crust (about 40 km), so our quest has focused on the oceans. One of the primary goals for four generations of international ocean drilling ships, culminating with the state-of-the-art, Japanese Drilling Vessel “Chikyu”, has been to drill through intact oceanic crust to reach this critical horizon, which has never been directly observed.

A “preview” can be obtained from blocks of oceanic crust and upper mantle that are thrust onto the continents by plate tectonics, and exposed by faulting and erosion. The largest and best-preserved block is the “Samail ophiolite”, in the Sultanate of Oman and the United Arab Emirates. Scientific drilling of the Samail ophiolite (Oman Drilling Project; OmanDP) had been conducted from December 2016 to March 2018 (Kelemen et al., 2013, *Scientific Drilling J.* **15,** 64-71, doi:

10.2204/iodp.sd.15.10.2013). OmanDP is an international collaboration supported by the International Continental Scientific Drilling Program (ICDP), the Deep Carbon Observatory, NSF, IODP, JAMSTEC, and the European, Japanese, German and Swiss Science Foundations, with in-kind support in Oman from the Ministry of Regional Municipalities and Water Resources, Public Authority of Mining, Sultan Qaboos University, and the German University of Technology.

OmanDP Hole CM1A drilled the crust-mantle boundary from 15 November 2017 to 13 December 2018, representing the ICDP Expedition 5057 Site 7. The Hole CM1 is located at 22°54.433’N, 58°20.15′E and 622 m above sea level in Wadi Zeeb of Wadi Tayin massif in the Samail ophiolite, ~80 km south of Muscat, the capital of Oman, and ~30 km NNW of the frontier town of Ibra.

A succession of layered olivine gabbro through massive dunite to harzburgite was recovered over a cored interval of 404.15 m at Site CM1. The upper cores comprise a mafic unit of 160 m of mostly olivine gabbro overlying ~150 m of dunite and ~75 m of harzburgite, with a compositionally gradational zone of 15m between dunite and harzburgite. The upper mafic parts are compositionally heterogeneous, dominantly layered olivine gabbro, but with anorthosite, troctolite, wehrlite and dunite layers. Some layers are irregular with cross-cutting features, but well graded decimetric layers grading progressively upward from olivine-rich troctolite or wehrlite into olivine gabbro are observed several times. Dunites appear from the depth of 118m downward and some dunites cut layering in olivine gabbro from 129 m. A clear-cut contact between olivine gabbro and cross-cutting dunite is present at 160 m. Dunites dominate downward to 309 m, with a few gabbros cutting dunites, as in Core 108 at the depth of 251 m (Figure). The lower boundary of dunite above harzburgite is compositionally gradational from 313 to 328 meters, with irregular variations in pyroxene content. There is massive harzburgite below 328 m.

There are many different hypotheses concerning the genesis of dunites in the crust-mantle transition zone. The Oman Drilling Project recovered the first continuous cores from layered gabbro through dunite to harzburgite. Are these dunites igneous cumulates deposited in dikes and sills? Products of reactive porous flow, with pyroxene and plagioclase dissolution in olivine-saturated magmas? Residua of partial melting, perhaps due to incorporation of seawater into magmas at the base of the crust? Or a combination of all three? In turn, the answer to these questions determines the inferred composition of primary magmas that form igneous oceanic crust, and the temperature of the convecting upper mantle.