

Enhanced Weathering of Oman Peridotite as an approach for Carbon Dioxide Sequestration

SOBHI NASIR¹, SANKARAN RAJENDRAN², ARSHAD ALI¹, ALI S AL BIMANI³ AND YAHYA AL-WAHAIBI¹

¹Sultan Qaboos university

²Qatar University

³National University of Science and Technology

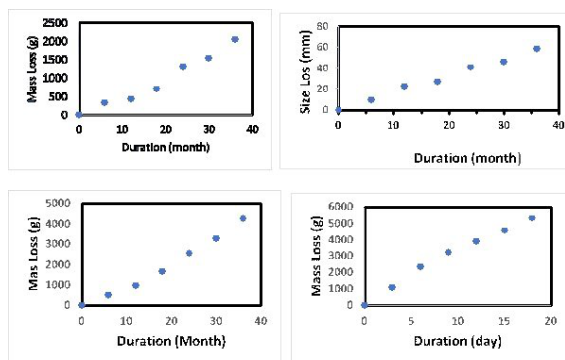
Presenting Author: sobhi@squ.edu.om

The concept of this study involves the acceleration of natural weathering process of peridotite by spreading different grain size along a small portions of the beach tidal area of Oman by making use of repeated grain collision, rubbing, bumping and abrasion under the action of currents and waves [1]. We have spread 10 tons of dunite and harzburgite of different grains size (0.01 mm to 30 cm) directly on a rough part of Al Seeb beach-Muscat, which has an adequate wave attack. We covered an area of 100 m length, 10 m width with a layer of 5-30 cm of crushed dunite and harzburgite. To measure quantitatively the weathering rate of olivine in seawater we filled a wooden box with 20 kg of powdered dunite (0.5 to 10 mm). The box was covered with a sieved mesh (0.1 mm opening). Experiments were carried out also by filling 7.5 kg dunite in a tumbler filled with seawater to produce an artificial surf action. After 3 years the final grain size of the dunite beach samples (30 cm in diameter) were reduced to a size of 24 cm, with mass loss of 2.5 kg out of 30kg. The mass loss of dunite in the box was 4.5 kg out of 20 kg. This indicates around 20 % of size reduction due to abrasion and weathering. The peridotite grains were polished and rounded, which means that they have continuously lost little slivers of olivine due to bumping and scraping against each other. The micron size dunite slivers are expected to react with sea water and might change rapidly to carbonate. After 18 days of tumbling, all large grains of dunite (7.5 kg- 8 cm size) have been disintegrated into smaller grains with around 71% loss in mass. Figs. 1a-g shows field and lab works. Figs. 2a-d show the reduction in weight and volume of the dunite samples. From above it is evident that natural weathering rates are considerably faster than weathering rates determined in the laboratory under sterile conditions.

[1] Schuilung R.D., Krijgsman P. (2006). Climatic Change. 74, P. 349—354.



Figs.1a-g. (a) spreading rocks on the beach. (b) Dunite in wood box. (c) Dunite after Tumbling. (d) Carbonate precipitation in beaker after heating and rotation for 6 months. (e-f) Dunite samples used for spreading on the beach and in tumbling. (g) Dunite samples after 3 years of beach surfing.



Figs.2a-d. (a) Mass loss of 10 kg dunite sample after 36 months. (b) Loss in size of 30 cm dunite sample after 36 months. (c) Mass loss of dunite sample in the wood box after 36 months. (d) Mass loss of 7.5 kg dunite sample after tumbling for 18 days.