



Effects of the carbon storage in an orogenic system – An example from Tai-Yuan Basin, Taiwan

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Throughout the carbon cycle, carbon is transported with varying forms in between each reservoir and would stay in balance. During the mountain building process, the organic and inorganic carbon are exhumed, exposed and in the end transported into the ocean. These deposits of carbon would eventually go back to the global carbon cycle either via the subduction of marine sediments or due to the uplift of seafloor strata. Recent studies in the Himalaya orogenic belt have suggested that the mountain building process and the carbon cycle are highly related. Although the mechanisms between the carbon cycle and active orogeny are vital, there are not sufficient researches focusing on their relationship yet.

Taiwan is located in an active orogeny with high uplift rates and receives high frequency of storms every year. The rivers in Taiwan therefore are mostly characterized with high slope gradient, short length, and strong stream power, leading to the quick delivery of terrestrial sediments from the mountains to the adjacent ocean basins. Records have shown that the rivers in Taiwan supply 384×10^6 t yr⁻¹ of suspended sediments in which about 35% ($1.3 \pm 0.1 \times 10^6$ tC yr⁻¹) is identified as the fossil organic carbon (OC_{fossil}). Although the amount of OC_{fossil} in Taiwan orogen has been estimated to be similar to the Himalaya, the average sediment yield exported to the ocean can reach 40-90 times more than that of the Himalaya. If those exposed carbon could all store into the lithosphere, it could strongly affect the global carbon cycle and the pattern of climate change. It is therefore crucial to understand the behavior and mechanisms between the orogenic process and the carbon cycle in Taiwan.

The Tai-Yuan Basin, located in the Southern Coastal Range, is a synclinal forearc basin resulted from the arc-continent collision between the Eurasian Continental Plate and the Philippine Sea Plate. The stratigraphy of Tai-Yuan Basin recorded part of the denudation history regarding the Taiwan orogeny from 3.75 to 0.7 Ma and therefore the capacity of total carbon load in these sediments shows the carbon budget stored during the geotectonic evolution of Taiwan orogeny.

In this study, 43 outcrops were picked to sample the sandstone and shale strata along the Madagida-chi (33 outcrops) and Songbokeng Xi (10 outcrops) from the central and north part of the basin respectively. The samples were analyzed with Elemental Analyzer to acquire their total organic carbon (TOC), total inorganic carbon (TIC), total carbon (TC) and total nitrogen (TN) concentrations after removing fossil and carbon granule. The results for the sandstone portion are: 0.25% (TOC), 0.35% (TIC), 0.05% (TN) and 5.45 (C/N ratio) and for the shale: 0.40% (TOC), 0.35% (TIC), 0.08% (TN) and 5.51 (C/N ratio). We also observed that the TOC in our samples increases as the grain size drops. With this study, we hope to gain more understandings of how the shredded detritus from active orogens affect the global carbon cycle.