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Tectonic control of Uranium and Strontium isotope distribution in river waters- A case study in Taiwan Accretionary Prism

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Taiwan is located at the plate boundary between the Philippine Sea Plate and the Eurasia Continental Plate and is one of the most active orogenic belts in the world. The highest uplifting and erosion rate on the island were observed occurring at the central mountain region with an average physical denudation and chemical weathering rate of 1300 and 65 mg/cm^{2}yr respectively. The major factors affecting the short-term erosion status on land are regional seismic activity and climatic events (i.e., typhoon). In order to gain a better quantification of relationships between regional tectonic activity and the status of weathering, we have analyzed U and Sr isotopes, as well as major and trace elements, in river waters from several drainage systems in north, central and south Taiwan including Tan-shui, Chou-shui, Erjen, Kao-ping and Pei-nan rivers. The analytical precision for Sr (TIMS) and U (ICPMS) isotopes are 6 ppm and 0.4 permils, respectively and the uncertainty for multi-trace element and IC major ions are better than 3%.

Each Taiwanese river shows characteristic chemical and isotopic compositions reflecting regional tectonic, local ambient rock/sediment types, seasonal sea-salt contribution and monsoon precipitation. The dissolved major anion and cation (i.e., Cl and Na) vary largely from the upstream stations with low Cl and high Na/Cl ($>$30) to the estuary stations with high Cl and low Na/Cl (0.88). The significant increased of Na/Cl in the upper stream samples can be understood in terms of selective chemical weathering of Na-bearing minerals. On the other hand, the dissolved Ca and SO_4 show strong positive correlation indicating possible dissolution of carbonates. The dissolved 87Sr/86Sr

ratios are much more radiogenic at upstream stations (0.714338) due to contributions from Miocene ambient rock/sediment (0.71678-0.72216). For the near estuary stations, sea-salt spray plays a dominant role to decrease 87Sr/86Sr to seawater value of 0.709207. The 234U/238U activity ratio in river waters deviate largely (up to $>$3.0) from the equilibrium value mainly due to α-recoil artifacts and display interesting correlation with 87Sr/86Sr and Na/Cl distribution. In particular, both U and Sr isotopes show systematic variation with local uplifting rate and wet precipitation. Currently we are conducting further experiments to quantify the U and Sr isotopic distributions in river waters and to decipher their relationships with regional climatic and tectonic conditions.