

日本列島の花崗岩山地における化学的風化速度：宇宙線生成核種と地球化学的物質収支法に基づく推定

Chemical weathering rates in granitic mountains in Japan: Estimation from cosmogenic radionuclides and geochemical mass balance method

*八反地 剛¹、松四 雄騎²、佐藤 昌人³、小口 千明⁴、松崎 浩之⁵

*Tsuyoshi Hattanji¹, Yuki Matsushi², Masato Sato³, Chiaki T Oguchi⁴, Hiroyuki Matsuzaki⁵

1.筑波大学生命環境系、2.京都大学防災研究所、3.筑波大学大学院生命環境科学研究科、4.埼玉大学理工学研究科、5.東京大学総合研究博物館タンデム加速器分析室

1.Faculty of Life and Environmental Sciences, University of Tsukuba, 2.DPRI, Kyoto University, 3.Graduate School of Life and Environmental Sciences, University of Tsukuba, 4.Graduate School of Science and Engineering, Saitama University, 5.MALT, the University of Tokyo

Recently denudation rates or exposure ages in mountains underlain by granite were estimated from cosmogenic radionuclides. Many studies also combined this method with geochemical mass balance approaches and estimated chemical weathering rates in granitic mountains, assuming steady state conditions. We applied the modified methods to three mountainous areas (North Alps, Rokko Mountains, and Abukuma Highland) in Japan with various tectonic and climatic conditions. The three surveyed areas include small target basins; 9 basins in North Alps, 4 basins in Rokko Mountains, 2 basins in Abukuma Highland. All these basins are underlain by biotite granite, and basin-wide denudation rates were estimated from cosmogenic ¹⁰Be in stream sediment. We collected stream sediment as weathered material in these basins and several fresh bedrock samples in each study area. Stream sediment is sieved into three fractions; F: 0.063 - 0.25 mm, M: 0.25 - 2.0 mm, C: 2.0 - 9.5 mm. We measured chemical compositions of fresh bedrock and the fractions of stream sediment in each basin with X-ray fluorescence analysis (Phillips PW2400, Saitama Univ.), and calculated chemical depletion fraction (CDF), which is defined as the ratio of chemical weathering rate to total denudation rate. Both grain-size distribution of soil and chemical composition in the three fractions of stream sediment were used for calculating mean concentration of immobile elements in weathering materials. Titanium was treated as an immobile element for calculation of CDF. Chemical weathering rates generally increase with increasing basin-wide denudation rates, although they are more diverse for basins with high denudation rates (> 1000 mm/kyr). The values of CDF ranged from 0.02 to 0.40 for North Alps, 0.12 - 0.33 for Rokko Mountains, and 0.43-0.67 for Abukuma Highland. Contribution of chemical weathering to total denudation is relatively high in Abukuma Highland where landscape is gentle and denudation rates are low (< 100 mm/kyr). The causes for decrease in CDF in North Alps would be; (1) physical weathering processes due to cool climate in high elevation zones, and (2) erosion of saprolite after landsliding in basins with high denudation rates.

キーワード：化学的風化、宇宙線生成核種、剝蝕速度

Keywords: chemical weathering, cosmogenic radionuclides, denudation rate