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

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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 ^{10}Be 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、削剥速度
Keywords: chemical weathering, cosmogenic radionuclides, denudation rate

琉球列島久米島東部における堡礁地形の高解像度マルチビームマッピング
High-resolution multibeam bathymetric mapping of barrier reef geomorphology of eastern Kume Island, the Ryukyus

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In contrast to the vast knowledge that has been accumulated regarding terrestrial landforms, few previous studies have dealt with shallow seafloor landforms. Since a broadband multibeam echosounder (Sonic 2022, R2 Sonic, LLC) and its accessory system were introduced to H. Kan's laboratory in 2010 using JSPS Grant-in-Aid for Scientific Research A, we have been conducting high-resolution multibeam bathymetric surveys around the Ryukyu Islands, southern Japan, and mapping the coral reef geomorphology with a horizontal grid size of 1–2 m.
Accurate descriptions of coral reef geomorphology improve our understanding of reef environments. Here, we introduce our mapping project, which covers of a total of 39 surveyed areas across five islands, and present an example illustrating the barrier reef and island shelf geomorphology of eastern Kume Island (1.8 ×6.5 km bathymetric area, with a depth range of 0.4–161.3 m) combined with SCUBA and VTR observations.
The bathymetric area comprises two contrasting reef edge formations: a double reef in the western area, and a deep breakwater reef in the eastern area. The latter shows the high-energy window condition which is accompanied by spur and groove formation in the lagoon, formation of circular spits or bowl-shaped depressions behind the lagoon patch reefs, and traces of movement of coral boulders in the lagoon following typhoon storm surges. These observations enable us to understand and reconstruct the paleo-geomorphology and sedimentology in reefs associated with the Holocene high-energy window, and can also contribute to predictions of coastal environmental change associated with future sea level rise.
On the island shelf, we observed several reef terraces at depths between 80–95 m, and isolated patch reefs at 135 m depth. The discovery of these features may contribute to reconstructions of past sea level and reef growth in the northwestern Pacific.

キーワード：サンゴ礁、マルチビーム測深、礁湖、海底段丘
Keywords: coral reef, multibeam ecosounder, lagoon, submarine terrace

The significance of landslide dams on large Chinese rivers

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Landslides forming natural dams across rivers pose considerable hazards, particularly the risk of catastrophic flooding after dam failure. In China, documentary records of large earthquakes and river blocking landslides have enabled inventories to be compiled. However, the record is far from complete as the remote and rugged terrain shelters evidence both of recent landslide dams and of ancient landslides which occurred before documentary records. Geospatial technologies enable the detection of anomalies in fluvial geomorphological systems which may indicate the past influence of river blocking landslides. Field evidence of sediment deposited behind landslide dams, enables the location of palaeo-landslides to be inferred. Recent discovery of an ancient landslide which dammed the main stem of the Yangtze River, China (crest height 200 m; lake volume 11.4 ±1.3 km^3) indicates that very large rivers have –and can be - impacted by persistent river-blocking landslides. As the magnitude of this landslide dam was much greater than examples in the historical record, it is argued that the potential for large earthquakes to generate enormous river-blocking landslides may be underappreciated as a mega-hazard.

Keywords: landslide dam, flood hazard, Yangtze River

Solitary Step in Bedrock Rivers

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A solitary step is often observed to be formed in the mixed alluvium and bedrock rivers, which will be described later as "bedrock river" for simplification. Once a step is formed on the river bed, due to bedrock erosion, it is wondered whether the step is maintained and propagates in the upstream direction, or change its profile continuously. Compared with the bed of alluvial rivers which is easily eroded by flow, the mechanisms of bedrock erosion are more complicated, mainly including abrasion by bedload, plucking and macroabrasion. Based on this complexity, in this paper, we employ the Macro-Roughness Saltation Abrasion Alluviation model to analyze the evolution of a convex solitary step, featuring a subcritical region upstream and supercritical region downstream, in abrasion-dominated bedrock rivers. From the results of the analysis, we obtain that the convex solitary step cannot migrate in the direction of upstream with maintaining its profile. In addition, the erosion rate tends to be constant in the downstream reach, while the erosion rate increases drastically in the upstream reach. From a numerical simulation, it is found that the slope of the upstream region becomes larger and the curvature of the step downstream reach is maintained in relatively long time.

Keywords: Bedrock river, Solitary step

Velocity and Sediment Concentratin Distributions of Turbidity Currents

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Abstract. In this work, we present a mathematical model to describe the
distribution of the velocity and the particle concentration of the turbidity
currents. The turbidity current is described by the Navier-Stokes equations
with the use of Boussinesq approximation to approximate the e ect of sed-
iment concentration on the
ow, the di usion/dispersion equation for the
sediment transport, and k- turbulence model for the problem closure. The
model is simpli ed by a roof-like con guration which allows a steady equilib-
rium state of the
ow. The numerical solution of the distribution of the
ow
velocity, the sediment concentration, the turbulence energy, and the dissipa-
tion rate are obtained by the nite-di erent numerical scheme. The study
shows that the entrainment capacity of sediment due to turbulence and the
dampening characteristic of turbulence is aliated with Richarson number
and non-dimensional settling velocity. The model is capable of capturing the
fundamental characteristics of the turbidity current which provides a vital
base state for the analysis of morphodynamics generated by the turbidity
current.

Keywords: turbidity current

異種災害の比較と類似性の抽出
Comparison of different kind disasters and find of the similarity

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This study compared the damages and revival processes of Kawauchi village with Miyake Island. Kawauchi village was damaged by the 2011 Off the Pacific Coast of Tohoku earthquake. On the other hand, Miyake Island was damaged by volcanic eruption.
Kawauchi village is located in Fukushima prefecture, northeastern Japan. The population of 2010 was 2997 people. In this village, depopulation and aging advanced. The main industry was tertiary. Kawauchi village damaged by the 2011 Off the Pacific of Tohoku earthquake. The most serious damage was nuclear hazard. This village evacuated outside in 16, March, 2011. The refuge continued until January, 2012.
Miyake village is the Island of active volcano belonging to Tokyo city. The population of 1999 was 3872 people. The main industry before the volcanic eruption was sightseeing business. Miyake volcano erupted in June, 2000. A large quantity of volcanic gas and volcanic ash were spouted out. Landslide disasters were occurred frequently. All islanders of Miyake village evacuated outside of Miyake Island in September, 2000. The refuge continued until February, 2005. The service industry, the retail trade, the wholesale trade were decreased greatly. A village office moved under the influence of volcanic gas.
This study divided the damages of the two villages into two types. The first type affected the industry. Another one affected the community. We found same kind of damages and revival processes in different disaster.

キーワード:東日本大震災、三宅火山、災害
Keywords: The Great East Japan Earthquake, Miyake Volcano, Disaster