

Weathering systems, tectonics and climate

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Weathering systems in the humid tropics produce mainly ferrallitic or podzolic saprolites according to site drainage. Evolution towards 'white sand' residues of almost pure quartz takes place under hydromorphic conditions, and total dissolution of silicate rocks is possible. However, weathering profiles should be seen in continuous disequilibrium over different time-scales, including those of plate-tectonic movement and post-Mesozoic dissection of the continents. Climatic zonation of weathering products is widely, but not universally, accepted and models incorporating climatic change and plate tectonic movement are now available. Less attention has been paid to relations between weathering and uplift rates. Models are presented to describe the development and transformation of the weathering mantle through time, under different climatic and tectonic conditions. Formation of 'grus', the significance of 'white sands' and a possible mechanism for the formation of kaolin deposits are discussed.

Keywords : Weathering systems, saprolites, white sands, grus, kaolin.

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Particle Size Characteristics and Microfracture Patterns in I and S-Type Granitoid Weathering Profiles: some examples from Eastern Australia**J. S. WRIGHT**Department of Geography, Staffordshire University, UK
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Granitoid rocks are susceptible to moisture attack and under suitable conditions of moisture availability undergo extensive breakdown. It has been suggested that the deformation characteristics of quartz crystals and the alteration of the biotite component may strongly influence the breakdown of granitoid rocks and the particle size characteristics of the resulting weathering profiles. In order to investigate these aspects further particle size and microfracture characteristics of various granitoid weathering profiles from eastern Australia were examined. Within this area two categories of granitoid rocks occur in close proximity, I-type and S-type granitoids. These two groups differ in their mode of origin and this has influenced their biotite content and the degree of deformation displayed by the constituent quartz grains. Results indicate that for both granitoid types there is what appears to be a consistent upward decline in grain size within the weathering profiles, suggesting that as weathering proceeds there is a progressive disintegration of particles. Microscopic observations indicate that there may be a strong relationship between the pattern of microfracture development in quartz, degree of rock breakdown and biotite content.

Key words: granitoid weathering, I-type and S-type granitoids, particle size characteristics, biotite content

A Growth Model of Weathering Rinds

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A model of weathering-rind growth was proposed based on the study of andesite cobbles sampled from a modern floodplain and four fluvial terraces (0 ka, 20 ka, 130 ka, 290 ka and 660 ka) in central Japan. The time elapsed since the above ages are assumed as the weathering periods. The 0-ka rocks are not visibly weathered. The 20-ka rocks have an alteration layer with a thickness of 1 mm on their surface. The 130-ka, 290-ka and 660-ka rocks have brown weathering rinds with a thickness of 3-6 mm. Based on the measurements of rock properties, weathering rinds are divided into two bands. The outer brown band contains abundant Fe due to the accumulation of ferric hydroxides. This band experienced both oxidization and dissolution. The inner band is characterised by the dissolution of Ca, Mg and Na. The inner border of this band is located at the place where the amounts of CaO and Vickers' hardness numbers start decreasing with decreasing depth. Based on these observations, a growth model of weathering rinds in andesite rocks was proposed. The total thickness of the two bands, corresponding to a dissolved zone, is related to both rock porosity and time, whereas the thickness of the outer band or an oxidized zone is basically independent of porosity.

Key words: weathering rate, weathering rind, dissolved zone, oxidized zone, andesite.

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**Seasonal Changes in Salt efflorescence and brick damage at
Shimoren Kiln, Japan**

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Salt weathering of bricks was studied at Shimoren Kiln, a brick building located at Nogi Town, Japan. The damage of brick walls is more evident on the walls with abundant salt efflorescence. Salt efflorescence on a severely damaged wall shows seasonal changes with an annual cycle. The amount of efflorescence is generally little in summer under high relative humidity, while it is much in winter under low relative humidity. Although the amount of crumbled materials also shows seasonal changes, the changing pattern is different from that of salt efflorescence. The largest amount of crumbled materials is produced not in winter but in spring. Laboratory experiments have shown that many brick particles fell from the brick body placed in a desiccator with water, but not in a desiccator with silica gel. From these observations, damage of bricks here is considered to be caused through the following processes: (1) crystallization of porous salts on the brick surfaces during autumn and winter, (2) partial deliquescence of the salts and (3) peeling and falling of the compacted salts with adhering surface brickbats during spring.

Key words: salt weathering, brick, cultural properties, deliquescence, epsomite.

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Granite Tafoni Topography on the Pacific side of Kochi Prefecture Western Japan

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There are many types of granitic topography of which one representative type is "Tafoni". However, there are very few places in Japan where this type of topography can be found, and the author has often wondered why this is so. Recently, he discovered a sizable distribution of some small-scale Tafoni on two uninhabited islands off the Pacific coast of Shikoku Island in Western Japan and reports on his find here. This discovery proved that even in Japan, if conditions for its development are right, Tafoni can be found. The conditions that work against its development in Japan seem to be:

1. In general, in the environment of regions of granitic topography in Japan, the climate tends to be warm and wet, so the surface of the rocks and rock blocks weather dramatically.

This makes it difficult for granitic rock surface conditions known as Tafoni to develop because weathering destroys the microtopography, i.e. there are few places where conditions for its development exist in Japan.

2. Even if Tafoni develops, it will be very small scale because of the location of Japan geologically and topographically; Japan is a relatively young mountain chain with granite that has a high density of cracks and joints. Such rocks easily break down by erosion, and large scale Tafoni cannot develop.

Key words: tafoni granitic topography weathering Western Japan

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Structural Control of Granite Landforms Koh Samui, Southern Thailand

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The landscape on the east coast of Koh Samui, Surat Thani Province is characterized by rocky granitic headlands and sandy pocket beaches. The granite is Triassic in age and is composed of large K-feldspar phenocrysts imbedded in a groundmass of medium-grained quartz, plagioclase, and biotite. Granite landforms exposed on the headland south of Lamai Beach include boulder tors, vertically elongate blocks (turrets), and weathering pits. The distribution of boulder tors and turrets is structurally controlled by two orthogonal joint sets, which are both steeply dipping ($80-87^{\circ}$). Joint spacing is typically 2 to 3 meters. The round shape of the boulder tors indicates that they were exposed to intense subsurface weathering before being exposed by wave erosion. The weathering pits are both elliptical and linear in shape. The linear-shaped one is probably structurally controlled as its orientation is essentially the same as one of the main joint sets in the area. The rounded shape of weathering pits suggests that they have been formed by moisture attack along either structurally or lithologically favored locations. The presence of boulder tors and turrets is more prevalent on the east or oceanward side of Koh Samui where headland erosion is more rapid suggesting that they have been exhumed by wave erosion following intense subsurface weathering of the granite in a tropical climate.

Key words: Thailand, granite, boulder tors, turrets, weathering pits

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Weathered Mesozoic Conglomerate Misinterpreted as Pleistocene River Terrace Deposits in the Khorat Plateau, Northeast Thailand

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Thick gravel beds forming topographic rises are distributed typically along large rivers on an extensive gently undulating area, the Khorat Plateau, in Northeast Thailand. From the location of their occurrence, the sedimentary facies, and the solidity of matrix, the gravel beds have been regarded as Pleistocene fluvial deposits, and the rises, which is called "High Terraces," were interpreted to have resulted from relief inversion. Various data by our investigations, however, led to a disparate conclusion; the gravel beds are not overlying the plateau but intercalated in the bedrock of the plateau. This conclusion implies that the gravel beds are weathered Mesozoic conglomerates and that the High Terraces are structurally controlled landforms. The chert and orthoquartzite gravel in the conglomerate are considerably resistant to weathering even under the tropic climate compared to the underlying and overlying sandstone and the matrix of the gravel, then the weathered Mesozoic conglomerate can make topographic rises of unconsolidated gravel beds on an erosional plain.

Key words: weathering, tropics, structural landforms, gravel, Khorat Plateau

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Block Displacements on Scarp Slopes, Causes and Controls

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Mass movements are a common feature of scarp slopes worldwide. In this paper special attention is given to displacements of creep blocks at the rim of a limestone-mudstone cuesta scarp in Central Germany (Muschelkalk scarp). Creeping as a consequence of lateral spreading is generally interpreted as an introductory phase of more rapid and hazardous mass movements (falls, topples, slides). About 10% of the length of the scarp have been affected by Holocene mass movements. When rock creep is registered on the scarp, no unrestricted construction work should be permitted. Long-term measurements (about 25 years) of block displacements velocities (steel tape, extensometers) were conducted at a number of sites in different scarp sections. The creep blocks were progressively moving in the course of the observation period with times of acceleration and deceleration. Creeping velocities increase in times of higher moisture input into the slope system. A comparison between displacement rates and precipitation amounts showed that there is a clear connection between periods of increased rainfall and accelerated movement velocities. At two sites major rockfalls were registered during the observation period. Before the rapid movements occurred, creeping velocities had significantly increased. Measurements of creep velocities seem to be an adequate tool for predicting slope instability.

Keywords: mass movements, creep blocks, scarp slopes

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