

Selective evolution of tafoni in tuff cliffs due to salt weathering and occurrence of rock fall in Wakayama, Japan

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Tafoni is a small cavity appeared on steep rock slopes, and it is believed to have formed due to mainly salt weathering. Piling up of rock blocks on the foot of such cliffs indicates that evolution of tafoni and notch may be closely related to rock fall from the cliffs. Tafoni are well developed in the cliffs of the Kumano acidic rocks in Wakayama, Japan. They are found mountain area with altitude of about 200m.

Size of tafoni observed cliff is variable, and range 0.5 to 10m in diameters. Upper roof of tafoni is usually concave, whereas lower floor is flat. Consequently, profile of them are similar one another in this area. And also they tend to develop on steep slopes characterized by massive medium-grained tuff.

Distribution of moisture content on rock surface shows that it takes highest value on concave roof surface, and this may be almost independent of weather condition and time. This supports that concave roofs have been formed due to high rate of salt weathering in high humid condition.

Formation processes of tafoni are estimated; (1) inward infiltration of water from cliff surface of tuff, (2) solution of rock materials in water, (3) concentration of water into roof of tafoni, (4) occurrence of tensile failures probably due to sulfuric acid and salt precipitation in surface portion of rocks, (5) exfoliation and degradation of rocks on rock surface.

Development of tafoni make a sort of canopies overhanging on steep cliff, and such unstable portions fall down as rock fall. In addition to development of tafoni, cracks within tuff cliff are also one of causes of rock fall. Such cracks occurred due to rotational moment of overhanging portion. Consequently, weathering rates of rocks due to salt weathering and spacing of these cracks may control the frequently of rock fall in these cliffs.