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Submarine geomorphology of abrasion platforms off basalt sea cliff: based on multibeam bathymetry and SCUBA diving observations

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It is difficult to determine the sea floor geomorphology in the vicinity of the wave breaking zone on rocky shores. In this study, a multibeam bathymetric survey and SCUBA diving observations were conducted off a basalt sea cliff with vertical columnar joints at Keya, Fukuoka, Japan, to observe the geomorphology and environment of the abrasion platform in high resolution. The formation of abrasion platforms significant at the northern end of the cape, where the waves were concentrated. Two platforms were observed at depths of 12 m (13 m below mean sea level) and 17 m (18 m below mean sea level). The −12 m platform is covered by boulders of tens of centimeters to more than 1 m in diameter, and is formed by the erosion of the basalt sea cliff. These boulders may have been moved by storm waves and formed the −12 m platform by active abrasive erosion. On the landward area of the −17 m platform, sand and gravel are deposited between rounded boulders larger than 1 m in diameter. Scarce vegetation on the rounded boulders and sediments indicates that sediments may have been moved and displaced during storm surges. The seaward area of the −17 m platform also consists of large boulders with a diameter of 1 m or more, however, the numerous organisms attached to the surface of the boulders and rich biota around them implies that these boulders have remained stable for a long period of time. At depths greater than 20 m, the slope becomes smooth and gentle, with sand and silt. The absence of vegetation on the slope surface indicates that the sediments may move during storms. Considering the formation periods of the two abrasion platforms, the −12 m platform is considered to be a recent abrasion platform. In contrast, the −17 m platform is considered to be a relict landform of the abrasion platform that formed during the last interglacial period, owing to the gradual subduction trend of the study area. Assuming that the 104–107 m wide present abrasion platform (−12 m platform) eroded after about 8,300 years BP, when the postglacial sea level reached the present depth of approximately 10 m, the average retreat rate of the basalt sea cliff was estimated to be 1.25–1.3 cm/year.