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The modes of instability of the Antalya (SW-Turkey) coastal cliffs

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Cliff erosion and the consequent instabilities present a significant risk to Antalya city (SW-Turkey). Erosional processes include the chemical action of mixing zone water, the mechanical action of waves, salt erosion and biological degradation. The rock properties (lithology, stratification, strength etc) are the controlling factors to this erosion. The coastal cliffs of Antalya are composed of tufa type carbonate rocks which occur in a wide range, from collapsible soil to hard rock. The instability problems of the cliffs of Antalya tufa commonly involve: rock fall, cave collapse, raveling, washout of weakly lithified tufa, shear failure and secondary toppling. Secondary toppling type instabilities, Culmann type failures and complex failures, a combination of these two, are widespread on the cliffs. The occurrence of large failures are usually associated with heavy rainfall as heavy rainfall causes the saturation of pores, increases pore water pressures and reduces the strength of the rock. Comparison between aerial photographs and topographic maps of different dates, do not provide evidence of considerable retreat. According to the historical data there has been little or no cliff retreat for 2000 years. Therefore the erosion rate of the Antalya tufa cliffs is said to be so very slow that retreat is valid only in a geological timescale. However in an engineering timescale these cliffs are subjected to instabilities and to local failures causing local retreats.

Keywords: Antalya, Coastal cliff, Cliff erosion, Cliff instability, Tufa