Long-term carbonate bedrock denudation rates with cosmogenic 36Cl in two Mediterranean environments: Slovenia and Türkiye

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Abstract

Quantifying denudation rates under different climatic and tectonic conditions is fundamental to understanding landscape evolution. Due to their high solubility, carbonate rocks often respond differently to climatic and tectonic forces than other rock types. Here, we will present long-term bedrock denudation rates and their controlling factors for carbonates in the Mediterranean coastal mountains at two regions: the Taurus Mountains of Türkiye and the Dinaric and Alpine Karsts of Slovenia. Steady-state denudation rates with in-situ cosmogenic 36Cl in 34 rock samples from different locations range from 0.2 to 10 cm per thousand years. Denudation patterns show a decreasing trend from the temperate coastal zones to the drier interior plateau. In between, at high elevations where mean annual surface temperatures are low, denudation rates are strongly correlated with precipitation. These rates are lower than the theoretical maximum dissolution rates predicted under zero evaporation, suggesting that climate is the dominant control on carbonate denudation. These results indicate that chemical weathering is the dominant denudation process at the high-elevation sites, whereas physical erosion dominates at the coastal and inland sites. In addition, significant infiltration of surface runoff results in strong subsurface karstification at the expense of surface drainage. This process has created an imbalance between uplift and denudation that has preserved the high-elevation topography of the Mediterranean coastal mountains.

Keywords: Carbonate, Denudation, 36Cl, Türkiye, Slovenia

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