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Giant-landslides as possible causes for fast exhumation of intrusive rocks in Fuerteventura

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Rapid erosion through giant-landslides is often considered to drive long-term landscape evolution of Volcanic Islands. In the case of Fuerteventura, the evolution of the recent topography of the basal complex is discussed as being primarily derived from movement of giant landslides. Stillmann (1999) and Carracedo (1999) suggested a giant landslide event at about 15 Ma that lead to the destruction of the Central Volcanic Complex with transport of the associated material towards the west. The morphology of the ocean floor surface west of the basal complex area subsequently indicates several large landslide masses (Carracedo 1999). Denudation through rapid movement of large parts of a volcanic complex will induce fast cooling of the volcanic rocks below the landslide detachment. Thermochronological dating techniques provide therefore an excellent tool to reconstruct the fast cooling of these rocks.

In order to reveal the evolution of the island's exhumation history, Miocene Intrusives as well as Lower Cretaceous siliciclastic sedimentary rocks from the Basal Complex of the Central Volcanic Complex in western-Fuerteventura were analyzed with low-temperature thermochronometric methods. The methods applied include fission-track, and (U-Th-Sm)/He dating techniques. The obtained thermochronometric data yields a very slow rate of cooling in the order of 1.5-3°C/Myr from ∼50-20 Ma for the Early Cretaceous siliciclastic rocks. These sedimentary units have never been heated significantly above 240°C after deposition and still record the submarine onset of the island's formation in the Eocene. At about 20 Ma a rapid cooling of about 160°C is indicated by the numerical modeling of the thermochronological data. Thereafter, the cooling rate slowed down again to 3-6°C/Myr. Intrusive bodies associated with the early Miocene magmatic activity of the central volcanic complex of the island show a similar rapid cooling of about 160°C at ∼15 Myr. Palaeosols overlying the sedimentary units are themselves covered by Pliocene basalt flows and reveal that the sedimentary rocks reached the surface before ∼5 Ma. The thermochronological data as well as the results of the numerical modeling are interpreted to suggest that periods of rapid cooling associated with mass movement through giant landslides occurred at least twice, (i.e. at ∼20 Ma and ∼15 Ma respectively) within the landscape evolution of Fuerteventura.