



The response of the Alpine orogenic wedge to enhanced erosion driven by Mediterranean desiccation and climate change in the Messinian

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The Tertiary history of the European Alps is primarily one of development of an orogenic wedge by accretion of crustal material and progressive, outward expansion of the doubly-vergent crustal wedge structure. At the end of the Miocene, the Alps underwent a major tectonic change characterized by the cessation of tectonic activity on both deformation fronts and a shift of tectonic uplift and exhumation into the orogen interior, specifically into the external massifs. This is consistent with a change from wedge “construction” to “destruction” reflecting an increase in the ratio of erosional flux to accretionary flux. We demonstrate the coincidence of this change with an increase in sediment yield from the Alps implying an absolute increase in erosional flux, rather than a decrease in accretionary flux. Stratigraphic and thermochronometric control on timing indicates that this change is effectively synchronous with the Messinian salinity crisis. We attribute the increase in erosional flux to a combination of base-level fall during Mediterranean desiccation and climate change corresponding to the wetter conditions that characterize the late, Lago Mare, phase of the Mediterranean salinity crisis. This also corresponds in time to a decrease in global ice volume inferred from deep sea isotopic records which is taken to mark the end of late Miocene glaciation. These observations suggest that early Pliocene, post-glacial European climate was characterized by warm, wet conditions, with high Alpine erosion rates and destruction of the Alpine topography.