# Carbon-14 dating of silica sinter deposits from El Tatio, Chile

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Silica sinter deposits are common surface expressions of underlying geothermal systems and epithermal Au-Ag deposits. They form when high silica, alkali chloride hot spring waters discharge and rapidly cool at the surface. Silica deposition entombs microbes that thrive in hot springs water, as well as plant material. The preservation of this organic matter allows radiocarbon dating of sinter in active geothermal systems. However, apart from YNP in the US and Orakei Korako in New Zealand, very few sites have actually been dated.

At the El Tatio geothermal system in the Altiplano of northern Chile, extensive silica sinter deposits occur. Recent studies have proposed that the extreme environmental conditions at El Tatio, including high altitude (~4.200 m a.s.l.) and significant diurnal variations in temperature (~up to 40ºC), result in increased silica precipitation rates. This hypothesis remains untested due to the lack of absolute ages of the sinter deposits.

Here, we present twenty radiocarbon (14C) ages of silica sinter from El Tatio, obtained using Accelerator Mass Spectrometer (AMS). In order to reconstruct the evolution of silica deposition, our sampling strategy included the collection of rocks from meter-thick stratigraphic profiles of fossil sinters outcrops.

Our radiocarbon data yielded ages much older than previous estimations, reaching 20 kyr BP. This makes El Tatio one of the oldest and longest-lived active geothermal system in the world. By integrating the absolute ages with a detailed characterization of the stratigraphic profiles, we provide a more accurate determination of silica precipitation rates. These data also allow us to better constrain: 1) the effects of environmental conditions on silica precipitation in high-altitude geothermal systems, and 2) reconstructing the variations of geothermal activity through time.