UC **SANTA BARBARA**

Department of Earth Science

Speakers Club

WEBB 1100 • THURSDAY APRIL 26th.• 3:30 PM

Using Molybdenum Geochemistry to Understand Earth's Ancient Atmosphere

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For the first two billion years of Earth's history, the atmosphere lacked oxygen – an element vital to sustain life as we know it. At ~2.4 Ga, a chemical shift is thought to have occurred during a period known as the Great Oxidation Event – when the Earth's atmosphere became slightly oxidized. While we can't directly measure the 2.4 Ga atmosphere, we can look to the existing rock record for evidence of this change. Paleo-redox "proxies" are used in place of direct atmospheric measurements to estimate the amount of oxygen present during this time period. Molybdenum, a transition metal with multiple oxidation states, is one of these proxies. Molybdenum is fluid-mobile when oxidized and immobile when reduced, so the behavior of Mo during crustal weathering is expected to be different under an anoxic vs. oxic atmosphere. Therefore, Mo is predicted to have been removed en masse from the exposed continental crust and transported to the oceans just after the rise of atmospheric oxygen at 2.4 Ga.

For the past decade, researchers have studied Mo abundances and isotopic signatures in ocean sediments to infer geochemical processes that were happening at the atmosphere-crust interface. However this approach is indirect, and several assumptions must be made about the geochemical behavior of Mo in the ocean as well as on the Earth's surface in order to draw conclusions about the chemical composition of the atmosphere. Here, I will present data on Mo isotopes in crustal weathering products that directly interacted with the ancient atmosphere. We can use these data to place more direct constraints on when oxygen first became abundant in our atmosphere.

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