GRAND JUNCTION GEOLOGICAL SOCIETY

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FEBRUARY MEETING

WEDNESDAY, FEBRUARY 19, 2020
Joint meeting with the CMU Geology Students
7:30 PM
Saccomanno Lecture Hall
(In the Wubben-Science Building)

G. Lang Farmer
Department of Geological Sciences,
University of Colorado Boulder

Will Speak On

"Why Was There Voluminous and Widespread Volcanism in Southwest North America During the Cenozoic?"

Guests Are Always Welcome
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Why Was There Voluminous and Widespread Volcanism in Southwest North America During the Cenozoic?

G. Lang Farmer
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Much of Earth's volcanism is readily understood in the context of plate tectonics. Volcanism at convergent plate margins occurs in arcs located some 200 km inboard of the plate boundary, whereas volcanism at divergent plate boundaries occurs along linear "rifts" where oceanic crust can be created from melting of upwelling asthenosphere. This model characterizes volcanism worldwide over at least the past 2 billion years, with a few notable exceptions. One prime exception is the volcanism that affected southwestern North America (SWNA), including southwestern Colorado, during the Cenozoic. Volcanism at this time widespread and voluminous but occurred up to 1,000 km inboard of the continental margin and in regions underlain by Precambrian continental lithosphere that was previously stable and free of volcanism from at least the Mesoproterozoic. Exactly why this volcanism occurred remains enigmatic, but the question can be addressed through space-time-composition patterns in the volcanism, itself. At present, there are over 5,000 whole rock isotopic and chemical analyses from Cenozoic (<40 Ma) volcanic rocks in the SWNA available in on-line databases (NAVDAT) that can be used for this purpose. As shown in this talk, space-time-composition patterns in basaltic volcanic rocks show that a key to understanding the volcanism are physical and chemical changes that occurred in Precambrian, continental lithospheric mantle (CLM) during an episode of low-angle subduction of oceanic lithosphere at the western margin of the continent during the Late Cretaceous to Early Cenozoic Laramide Orogeny. Low-angle subduction primed the CLM for in situ melting due to refrigeration by the slab and through addition of slab-derived fluids, even in the continental interior. When that oceanic lithosphere subsequently "rolled back" from the base of the continental lithosphere, reheating and melting of the CLM was triggered. Volcanism produced in this fashion belongs to the "ignimbrite flareup" that affected much of SWNA in the mid-Cenozoic, such as the San Juan Volcanic Field. The presence of in situ melts in the CLM weakens what had been stable, long-lived mantle lithosphere and results in the sinking of this mantle into the underlying convecting asthenosphere. Destruction of the CLM, in turn, leads to upwelling and decompression melting of asthenosphere, the eruption of small-volume Late Cenozoic basalts throughout SWNA, and the development of the extension-related, Basin and Range Province.