

RRH: FLUECK ET AL.-DENTAL FLUOROSIS FROM VOLCANIC ASH IN  
WILD DEER IN PATAGONIA

## **SEVERE DENTAL FLUOROSIS IN JUVENILE DEER LINKED TO A RECENT VOLCANIC ERUPTION IN PATAGONIA**

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### **ABSTRACT:**

The Puyehue-Cordon Caulle volcanic eruption deposited large amounts of tephra (ashes) on about 36 million ha of Argentina in June of 2011. Tephra were considered chemically innocuous based on water leachates, surface water fluoride levels determined to be safe, and livestock losses attributable to inanition and excessive tooth wear. To evaluate effects on wild ungulates, we sampled wild red deer (*Cervus elaphus*) at 100 km from the volcano in September-November 2012. We show that these tephra caused severe dental fluorosis, with bone fluoride levels up to 5.175 ppm. Among subadults, tephra caused pathologic development of newly emerging teeth typical of fluorosis, including enamel hypoplasia, breakages, pitting, mottling, and extremely rapid ablation of entire crowns down to underlying pulp cavities. The loss of teeth functionality affected physical condition and none of the subadults were able to conceive. Susceptibility to fluorosis among these herbivores likely resides in ruminant food processing: 1) mastication and tephra size reduction, 2) thorough and repeated mixing with alkaline saliva, 3) water-soluble extraction in the rumen, and 4) extraction in the acidic abomasum. Although initial analyses of water and tephra were interpreted not to present a concern, ruminants as a major component of this ecosystem are shown to be highly susceptible to fluorosis, with average bone level increasing over 38-fold during the first 15.5 mo of exposure to tephra. This is the first report of fluorosis in wild ungulates from volcanic eruptions. The described impact will reverberate through several aspects of the ecology of the deer, including effects on population dynamics, morbidity, predation susceptibility, and other components of the ecosystem including scavenger and plant communities. We anticipate further impact on livestock production systems, yet until now, existence of fluorosis had not been recognized.

Keywords: Cervids, *Cervus elaphus*, dental fluorosis, fluoride, pathology, teeth, tephra, volcanic eruption.