Precious opal deposits at Wegel Tena, Ethiopia: formation through successive pedogenesis events

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Since the discovery of many precious opal deposits around Wegel Tena (Wollo province, Ethiopia), the expansion of mining activity allowed to investigate more easily the context for opal formation. The conditions to form precious opal remain to be clarified: What is the pH story of the formation process? Did life play a role in this process? What is the silica source and which process can release enough silica to form opal ?

Wegel Tena is located on a wide, Oligocene, ignimbritic plateau. Opal occurs in layers strongly weathered showing continental pedogenetic features such as roots traces, clays pellets, dessication cracks and illuviation marks [1]. Roots are also fossilized inside the opal, implying a crystallization of the opal during their life or shortly after their death. We propose freshly deposited ignimbritic ashes were weathered through pedogenesis, releasing silica [2]. As this occurred in a nearly flat landscape, silica was not evacuated by flowing water. Hence it could accumulate in the soil and then precipitate into opal. The process ended with the deposition of a new, fresh ashes layer. In some mines, we observed several opalized layers superimposed, vertically separated by a welded, fresh ignimbrite layer. We propose that the opalization process is periodic during the deposition of ashes and that the pedogenesis process responsible for precious opal formation repeatedly occurred at the same place.

Finally, we observed that all opalized layers were observed in a limited vertical range, less than 20 meters thick. This indicates that the pedogenesis events associated with opal formation are time-limited during the whole volcanic event.

[1] Rondeau *et al* (2012), *GEEA,* **12**, 93-104 [2] Bern *et al* (2010), *GEOCHIM COSMOCHIM AC*, **74**, 876-889