DISCUSSION: "GEOPHYSICAL STUDIES AT KARTCHNER CAVERNS STATE PARK, ARIZONA"

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These comments concern natural-potential (NP) survey anomalies as measured by Lange (1999) over portions of Kartchner Caverns. Lange attributes the anomalies to electrokinetic effects (streaming potentials) from downward filtration of meteoric water "through the more permeable rock comprising the cave roof" or, in dry conditions, to "evapotranspiration and capillary flow" upwards from water in the cave.

Meteoric water falls uniformly on the area over and surrounding the cave. This water should filter downward almost uniformly through the soil and rock. I do not understand why there is a filtration anomaly only over the cave. Where is the evidence that water would filter down more rapidly over the cave, or filter down only over the cave, or that the cave roof and the bedrock all the way to the surface consists of more permeable rock? Portions of Kartchner along the survey line do have vertical faults that may be conduits, but this is not the general case. Faults not associated with caves may also give rise to NP anomalies but such anomalies are not generally attributed to streaming potentials.

Every electrical-methods prospector is aware of natural potentials when water is poured onto dry ground to wet an electrode site for proper contact. However, the potential quickly dissipates. If the area has seen recent rain, no artificial wetting is necessary and there is rarely an associated natural potential from the downward seeping water. The only potentials seen are those from telluric currents.

Streaming potential anomalies from evapotranspiration are well known from valley areas where concentrations of willows or other phreatophytes cause large amounts of groundwater to be pulled to the surface. However, at Kartchner such concentrations of vegetation do not exist over the cave or surrounding area. If there is increased evapotranspiration over the cave because the cave contains water, then there should be a corresponding manifestation on the surface, either in type or quantity of vegetation. To my knowledge, this has not been demonstrated. If the vegetation is equally distributed, then there should not be any distinct anomaly due to evapotranspiration.

An alternate explanation is proposed as the cause of these observed NP anomalies. Natural telluric currents constantly flow through the earth. When flowing over voids, the currents are forced near the surface causing a change in the measured potential from a normal constant gradient. This possibility is discussed in a previous paper (Lange & Kilty 1991). In the Black Rock Desert of Utah, I have measured a NP anomaly over a lava tube where the possibility of streaming potentials is extremely remote. The roof thickness is very thin and no precipitation had fallen for months. This NP anomaly mimics a complex gradient-array resistivity anomaly in shape and location to an astonishing degree. It would seem impossible for such a NP anomaly to be caused by anything other than telluric currents—a "pseudo-resistivity measurement," so to speak. If so, a proper resistivity survey would reveal a more definite response to voids with consistent, repeatable results that would allow for computer modeling. Modeling cannot be done easily with NP surveys.

Lange's NP anomalies are most likely real and caused by voids in the earth but no experimental evidence has been performed to demonstrate that they are the result of streaming potentials.

REFERENCES

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