Low Risk Pseudokarstic Caves of Earth as Useful Analogues of Martian Caves

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At least since lava tube trenches were identified through Martian orbital photography, pseudokarstic caves on Mars have been proposed as habitation sites for astronauts. Further, they may be prime localities for refugia of Martian life, past or present. However, some advocates of astronaut habitation and/or study of Martian caves may have been incautious about certain basic constraints. These include vulnerabilities of current space suit technology to sharp points and edges and other risk analyses by NASA safety engineers. Some proposed investigations would require astronauts, clad in space suits, to rappel and vertically ascend 10 to 165 meters in suspected Martian lava tube caves, a technique which clearly is beyond levels of technology of the foreseeable future.

At the 2010 annual meeting of the Geological Society of America, four members of our vulcanospeleological team began to discuss physical characteristics of terrestrial pseudokarstic caves in the context of types of pseudokarstic caves likely to be found on Mars. Coincidentally at this GSA meeting, an international team centered at the University of Utah proposed Utah's ancient Lake Bonneville as an analogue of a Martian ocean. In 1953 and 1954, a Utah Speleological Survey team inventoried littoral caves of Lake Bonneville , with publication of two technical reports and another of more general readership. These reports plus recent advances in the study of littoral caves in the western USA and in the United Kingdom suggest that analogue "walk-in" littoral caves of Mars should especially be sought for astronaut habitation. As for lava tube caves, reconsideration of sharp-edged basalt rocks characteristically present just outside entrances of terrestrial examples suggests that orbital photographs of Martian lava tube trenches should be scanned especially for cave entrances where such hazards have been blanketed by accumulations of wind-blown materials. Hollow tumuli, piping caves, glacier caves and some types of crevice caves appear likely to offer safe, effective shelter but require further investigation. Small-diameter types of pit craters may be suitable as landing sites in the distant future. Terrestrial crevice caves in recent volcanic rocks present such unfriendly environments that no amount of accumulation of wind-blown material is likely to make them habitable. Intensive study of the Hawaiian analogue to lunar rills strongly suggests that Martian analogues of rills will be found to have very limited spelean relevance.