
Accurate Survey of a Hawaii Island Lava Tube for the Purpose of Conservation and Management

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Abstract

A major project of the Hawaii Cave Conservation Task Force is the preservation of Pahoa Cave, a major lava tube in the Puna District of the island of Hawaii. In 1987 the Hawaii State Departments of Land and Natural Resources and Agriculture requested that we accurately survey the portion of this cave underlying agricultural lots leased by the State to private growers. The problem of cave roof collapse due to heavy equipment had caused the lessees to return the land to the State. In order to determine which survey method would meet the required accuracy, we compared three non-electronic survey methods: theodolite, plane-table, and tripod-mounted compasses. We initially believed that the compass method would not be accurate because of the problem of paleomagnetism in the lava rock. We did not use triangulation due to time factors and occasional narrow passages. The theodolite, while giving the highest precision for individual readings, had the greatest closure error: 18.7 meters. The plane-table also had an unacceptable closure error: 11.4 meters. In spite of paleomagnetism, the tripod-mounted compasses gave the least closure error: 1.3 meters in 906 meters total distance. Since the theodolite and plane-table errors are cumulative, we decided that closure reduction by statistical methods was not acceptable, so we re-shot several stations. During the survey, we also determined that Pahoa Cave contained significant archaeological, biological, and geological features worthy of protection. The Hawaii Cave Conservation Task Force has been instrumental in developing a proposal in which the State has agreed in principle to lease 25 acres of land, including two miles of Pahoa Cave, to the University of Hawaii as a Cave Preserve.