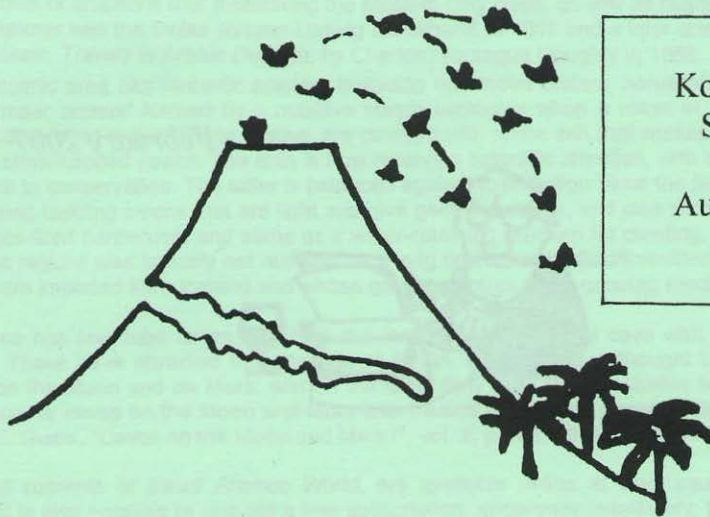


International Union of Speleology  
Union Internationale de Spéléologie

*Commission on Volcanic Caves*



Korea:  
Sept. 2008

Australia:  
2010

49

*February 2007*

*The Newsletter is send free to members  
of the Commission, and others who are  
interested in lava-tube caves.  
It is not possible to subscribe – but news  
and information is always appreciated ...!*

Honorary President: Dr. W.R. Halliday  
bnawrh@webtv.net

*February 2007*



Chairman & editorial address: (a.i.)

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Here an article from "William Pengelly Cave Studies Trust", number 97, ISSN 0309-9180 (page 8/9).



## Lava Tubes in Saudi Arabia and on Mars

The issue of the journal *Saudi Aramco World*, for March/April 2006, has an article on "Volcanic Arabia", by Peter Harrigan, on pp. 3-13. Western Saudi Arabia is covered not only with sand but with vast fields of lava, amounting in total to 180,000 sq. km. or nearly 70,000 square miles (which can be compared to just over 130,000 sq. km. as the land area of England and Wales). The area was for a long time strangely neglected, even by international vulcanologists, even though there are records of eruptions that threatened the Moslem holy cities, as well as major earthquakes. An early explorer was the Swiss Johann Ludwig Burckhardt in 1815 and a later account is a 600,000 word classic, *Travels in Arabia Deserta*, by Charles Montague Doughty in 1888.

The volcanic area has fantastic scenery including enormous craters, some of the largest of them being "maar craters" formed by a massive steam explosion when a mass of molten magma met with underground water. Some craters are covered with white ash that makes them look from the air like snow-capped peaks. The area is now receiving scientific attention, with both geotourism and attention to conservation. The latter is balanced against exploitation since the lava material is useful for making building blocks that are light and give good insulation, and also some of it is suitable for lining gas-fired barbecues, and some as a water-retaining medium for planting. The potential of the volcanic regions was actually not realised for a long time even by Saudi residents, whose barbecue linings are imported from Iceland and whose garden centres stock growing media from Italy.

The area has lava-tube caves, of which the largest is the Hibashi cave with 580 metres of passages. These have attracted the attention of NASA since they are thought to be similar to lava tubes on the Moon and on Mars, and on the latter they may provide shelter for future astronauts. Evidence for caves on the Moon and Mars was treated in an early paper in *Studies in Speleology* (John E. Guest, "Caves on the Moon and Mars?", vol. 2, part 5, 1971, pp. 161-175)

The full contents of *Saudi Aramco World*, are available online at [www.saudiaramcoworld.com](http://www.saudiaramcoworld.com), where it is also possible to request a free subscription, apparently indefinitely, to the well-produced printed version.

Back numbers to 2000 can also be found online, and there is an article on: "Saudi Arabia's Desert Caves", by John Pint with photographs by Lars Bjurström, in the issue for March/April 2000 (pp. 26-38 of the printed issue). This is a long article, with fascinating details of remarkable caves and formations beneath the desert, including accounts of first explorations by the author. They refer to the limestone area further east, where the oil is found, with no mention of lava caves. (The entry for Saudi Arabia in the *Underground Atlas* by John Middleton and Tony Waltham also lists only the limestone caves.)

The article refers to a website [www.saudiacaves.com](http://www.saudiacaves.com) which has a gallery of pictures taken by John and Susy Pint, many of them associated with accounts in the article. The pictures are arranged by year from 1999 to 2003, and those for 2002 and 2003 show lava caves including Hibashi. There is also a collection of the favourite pictures of Lars Bjurström, and a separate set of pictures, mainly of caves, from Lebanon. In total it is an extremely fine collection of pictures.

Alex Andrew





## Lime-decorating lava tubes(Yongchoen and Dangcheomul caves) in Jeju Island: Their potential for the World Heritage Nomination

Kyung-Sik Woo<sup>1</sup>, Kwang-Choon Lee<sup>2</sup> and In-Seok Sohn<sup>3</sup>

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The Jeju Island in Korea is essentially made of one shield volcano with more than 200 hundred parasitic cones around it. Among more than 120 lava tubes, the lava tubes in low elevation areas sometimes contain calcareous speleothems. Especially, the Yongchoen and Dangcheomul caves are famous for its superlative beauty from these speleothems, and became potential sites for the World Heritage Nomination. The cave includes calcite speleothems such as soda straws, stalactites, stalagmites, columns, cave corals, curtains, flowstone, rimestone, and cave pearls as well as lava speleothems. Wind-blown sediments, forming carbonate sand dunes, transported from beaches nearby are present over the tubes. Dissolution of the carbonate sediments by meteoric water and the supply of calcium carbonate through plant roots and cracks are responsible for the formation of carbonate speleothems.

Textural and geochemical of the column in Dangcheomul Cave revealed that the column is mostly composed of columnar calcite, and numerous growth laminae are present. The growth laminae were produced by coating of clay minerals from the soil zone above. Zones of spaced growth laminae (SGL) exhibit continuous growth of the calcite crystals, whereas zones of dense growth laminae (DGL) are characterized by instantaneous cessation. DGL is commonly associated with corroded surfaces. This suggests that the growth of the column was hindered and calcite crystals were corroded due to the increased supply of meteoric water that was undersaturated with respect to calcite. Carbon isotopic compositions are more enriched in SGL (ca -2‰, PDB) than DGL (ca -10 ~ -8‰). This indicates that the carbon in SGL was mostly supplied from the overlying carbonate sediments. Also, more depleted carbon isotopic values in DGL should reflect more influence by organic carbon within the overlying soil. This opposite trend should be closed related to vegetation density, soil development, and ultimately the amount of rainfall in this region. Growth of the DGL may well reflect more vegetation, better soil development and higher precipitation rate.





During the NSS Convention (Bellingham, U.S.A. – 2006) Bill Halliday gave this lecture.

## **The Jeju Volcanic Island World Heritage Proposal**

William R. Halliday

IUS Commission on Volcanic Caves

bnawrh@webtv.net

After several years' discussions with scientific and management consultants, the government of Korea has nominated a tripartite arrangement of related volcanic sites on Jeju Island for World Heritage designation. As UK consultant Chris Wood pointed out in 2002, "arguably the greatest geological heritage resource on the island is its lava tube cave systems." In the present proposal these are represented by a single area including world-class Manjang Cave, labyrinthine Bengdwi Cave and two newly-discovered lava tube caves profusely adorned with white carbonate speleothems (Yongcheon Cave and Dangcheomul Cave). The other two specified areas are the summit of Mount Halla (the island's shield volcano) and Ilchulbong, an extraordinary littoral tuff cone.

Omitted from the present version of the proposal are several additional volcanic features recommended by geological and speleological consultants; the most important of these appears to be Bilemot Cave (longest lava tube known on the island, with extraordinary three-dimensional complexity). In 2003 Australian consultant Greg Middleton concluded that "A Jeju Island volcanic features nomination is inconceivable without its inclusion;" I agree, but its inclusion can be accomplished at a later date. Also excluded are the three Hallim Park (Hyopje) Caves. Only one of the latter is world-class (Hwanggeum Cave, for its content of white carbonate speleothems which, however, are less impressive than are those of Dongcheomul Cave). All three are well protected in a private nature park whose owners have no interest in its being included in a World Heritage site. These three caves thus may be excluded from the proposal.

Bilemot Cave is said to have been badly trashed a decade ago and has not been cleaned but this is not an acceptable reason for its exclusion. Additional world-class caves still are being discovered and mapped on the island; provision should be made for the eventual inclusion of such caves and that of Bilemot Cave.

Greg Middleton further pointed out in 2003 that "all of the authorities consulted to date agree that the lava caves should be the focus of any Jeju nomination." I agree. Ideally they should be interpreted in geological context, as an integral part of the overall volcanic landscape within the World Heritage area. However, political pressures may shrink the proposed area still further and if necessary, the Manjang-Dangcheomul-Yongcheon system could stand alone as a World Heritage site.

For several reasons it is unlikely that the present proposal will be accepted in its present form. With a proviso that the island's World Heritage site be expected to undergo subsequent enlargement to include other world-class caves, the NSS should support any Jeju World Heritage proposal which includes at least Manjang, Dangcheomul and Yongcheon Cave.





This article came from "Argentina Subterránea" #14, Abril 2006. The front shows a lava tube, the Cueva de las Cascadas, length 390 m. A page here about "La Caverna del Tigre", 263 m. long. All in Mendoza.

## NUEVAS DEPREDACIONES EN LA CAVERNA DEL TIGRE

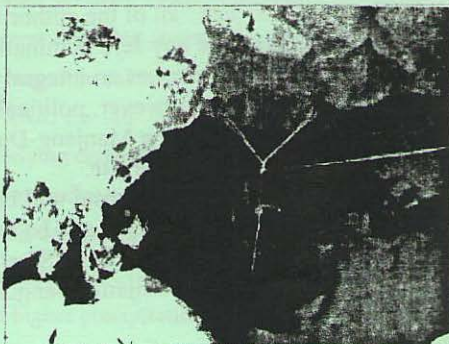
Una reciente visita de reconocimiento del espeleólogo federado Miguel Lavayen (FAeE – Tandil) permitió comprobar la recurrente depredación de que es objeto la Caverna del Tigre (M-12), Departamento de Malargüe, Mendoza y efectuar operaciones de remediación.

La cavidad es un importante tubo lávico situado al norte del área conocida como La Payunia. Posee un solo acceso vertical (foto1), en su parte media.

La historia de las depredaciones se remonta algunas décadas atrás. Hace 10 años existía en el sitio la presencia de cartelera indicando la ubicación de la cueva, una rudimentaria escalera de madera y era común hallar gran cantidad de basura. Posteriormente la escalera de madera fue reemplazada por otra mucho más grande y de hierro, presuntamente por operadores de turismo que incluyeron la cueva en su oferta de turismo aventura. El impacto antrópico se multiplicó e incluso era frecuente hallar deyecciones humanas en su interior. El INAE efectuó una campaña de limpieza y retiró la escalera.

La FAeE dispone desde el año 2001, la autorización de los propietarios del terreno para realizar investigaciones, mantener saneada la caverna y desalentar el ingreso de turismo no habilitado, cosa que ocurre con frecuencia ya que la cueva se encuentra muy cercana a la reconocida laguna de Llancanello y es invitación permanente para que algún o algunos agentes de turismo la integren a sus recorridos. Se procedió a eliminar los carteles y limpiar el terreno. Desde entonces el acceso al cavernamiento solo fué posible mediante técnicas de espeleología.

En abril de 2006, Lavayen comprobó que se había colocado una nueva escalera metálica (la tercera que se coloca en la cueva), de manufactura casera, a fin de sortear el dificultoso ingreso. Se retiró la escalera que presentaba signos de oxidación (foto2) y se limpió nuevamente la cueva. Vale destacar que la colocación de objetos extraños a las cavidades naturales constituye una violación a la LEY PROVINCIAL DE ESPELEOLOGIA, al igual que su explotación turística sin los estudios y manejo correspondiente. Los dueños no han autorizado a agentes turísticos a explotar el lugar, destacándose la falta de control permanente debido a lo inhóspito de la zona.





From "Speilaion" (# 30) this information was forwarded. As editor I do not speak Spanish, so just accept this ....

CARLOS BENEDETTO

## VULCANOESPELEOLOGÍA EN PAYUNIA

Como todos los años, en marzo visitó Malargüe el Dr. Eduardo Liambías (UNLP) para continuar con su tarea de preparación de becarios en las temáticas vulcanológicas: el día 11 de marzo Liambías dictó una charla para alumnos de la Modalidad Minería de la Escuela 4-018 y mantuvo varias reuniones de discusión con el I.N.A.E.

Pero también tuvimos visitas extranjeras, según relatamos en este escrito que dimos a conocer en esos días:

### ¿Qué es la Asociación Ardito Desio?

"Ardito Desio" es un nombre italiano, que quizás pueda resultarnos extraño a los que vivimos en este lejano sur mendocino. Pero tiene mucho que ver con nosotros, como tiene que ver la ciencia italiana, que cada vez más pone sus ojos en nuestro Departamento.

Ardito Desio fue un geólogo, geógrafo, explorador y espeleólogo italiano que nació en 1897 y falleció en el 2001, a los 104 años. Licenciado y profesor de Ciencias Naturales, trabajó en las universidades de Florencia, Pavia y Milán. El Instituto de Geología de esta última fue de su creación. Publicó cerca de 400 trabajos científicos sobre investigaciones personales llevadas a cabo en Asia y Africa. Dirigió 15 expediciones internacionales, incluyendo la que escaló por primera vez el pico K2, la cima más alta del mundo después del Everest. Fue Desio quien descubrió que Libia es un país montado sobre un mar de petróleo, entre otros méritos. Su hija Mariela (en realidad se llama Emanuela) ya estuvo dos veces en Malargüe. Y su nieta practica escalada libre en varios países, incluyendo el nuestro, específicamente en Mendoza.

Mariela forma parte de un grupo de investigadores que están trabajando para la UNESCO en un proyecto de conocimiento a fondo de Payunia. Espeleólogos Italianos amigos de ese proyecto nos habían puesto sobre aviso que la hija del gran científico italiano seguía los pasos de su padre, y que estaba enamorada de Malargüe, cosa que corroboramos personalmente cuando la conocimos en una noche lluviosa de fines de febrero de este año, antes de partir hacia Payunia.

Esa noche acompañaban a Mariela el Prof. Giorgio Pasquaré (Universidad de Milán), el Prof. Francesco Mazzarini (Universidad de Pisa), un guardaparques malargüino, y la geóloga argentina Elizabeth Rovere (SEGEMAR).

Pasquaré estaba entusiasmado con el hallazgo de la colada basáltica más extensa del planeta (174 Km)... en Payunia. Y aseveraba entonces que nunca había practicado la espeleología, y que seguramente Payunia encierra las cavemas de basalto más grandes del país, o del continente, no se sabe.

Allí mismo, esa noche, surgió la posibilidad de que un espeleólogo del I.N.A.E. los acompañara al campo para descender un pozo vertical, para medir así los estratos de lava de una gran colada cerca de Salinillas.

Y así fue que el espeleólogo nativo de estas tierras (Rubén Cepeda), capacitado como pocos para estas tareas difíciles, participó de un tramo de este proyecto científico y aportaba datos a los vulcanólogos que de otra forma no habrían podido conseguir.

Pero no terminaba aquí la cosa.

En la despedida nos enterábamos de que la Asociación Ardito Desio (fundada en Milán en el 2003, aconsejamos ver [www.arditodesio.it](http://www.arditodesio.it)) estaba proyectando crear filiales en distintos puntos del planeta, y que Malargüe iba a ser nuevamente visitada en el futuro. Y que en las investigaciones interverían muchos científicos y exploradores (incluyendo en este caso a espeleólogos) en el relevamiento de una geografía que es única en el mundo.

Pensamos entonces en la importancia que tendrá, complementariamente a esto, la creación en plazo breve de la primera "Escuela de Espeleología" del país (en Malargüe, por supuesto), y asociamos mentalmente con el hallazgo de un gran dinosaurio hace poco tiempo, por obra de otro investigador local... y no queda más que concluir que el mundo le ha echado el ojo a Malargüe y que Malargüe corresponde como debe: desarrollando sus propios recursos humanos para estar a la altura y para no seguir siendo meros observadores de lo que otros vienen a investigar.

Por suerte las autoridades municipales están también a la altura de estos acontecimientos. Lo cual no es poca cosa, no?





## Introduction to .....

### Volcanic caves of the world - Today and Tomorrow

**William R. Halliday**

Founder and Honorary President, Commission on Volcanic Caves, International Union of Speleology

6530 Cornwall Court, Nashville, TN USA 37205 [bnawrh@webtv.net](mailto:bnawrh@webtv.net)

#### Abstract

Vulcanospeleology is the study of volcanic caves of the Earth and other terrestrial bodies. Here on Earth, its primary focus is on lava tube caves. Yet in the future – on Earth and beyond – other types of volcanic caves may be more important.

Here on Earth, the second half of the 20th Century was a time of remarkable progress in this previously overlooked subsience. Major lava tube caves were identified and studied on all the continents except Antarctica, and on many volcanic islands around the world. Jeju, Iceland, and Hawaii were recognized as three of the world's leading locations for their study. Further, it was recognized that major volumes of these islands were emplaced through lava tubes, demonstrating their major role in basic geology of such islands and archipelagos.

Many important discoveries were made in these caves. It became clear that more minerals are present in lava tube caves than in any other type of cave. A good beginning was made in study of their other microfeatures. This soon led to recognition that lava tube caves form and mature in different ways in different environments: roofing of lava rivers at their vent or in mid-flow, and by drainage of established pathways in flow fields. Thus their patterns and geometries are more varied than any of us would have guessed 50 years ago.



In the middle of this half-century, lava tube caves became recognized as objects of great potential value as shelters and as sources of water, ice and minerals in space colonization (as on Earth), yet also as terrestrial geohazards conducting hazardous sewage-laden groundwater. The more we study these remarkable caves, the more we find to study. Volcanic microbiospeleology especially is still in its infancy.

Unsurprisingly, large lava tube and other volcanic caves were the first to attract attention and receive study. Later, scientific attention turned to smaller examples. Through investigating every human-sized orifice in a 1919 Hawaiian lava flow 4 km long and 3 km wide, our teams found more than 200 caves where only a handful were known 12 years ago.

Most of these new caves are lava drainage structures, not classical mature lava conduits: hollow tumuli, perimeter caves around the edges of lava rises, hollow flow lobes and tongues, and even little breakout cavities. Here there are no ramifying systems of conduits from vent to flow forefronts, and new mechanisms must explain emplacement of such pahoehoe flow fields. Just as a continuum exists between some eruptive fissures and some mature lava tube conduits, a continuum appears to exist between some simple drainage cavities and some mature lava tube conduits here.

Much more remains to be accomplished, even in simple identification and documentation of these and other volcanic caves. This is the only lava flow on the "Big Island" of Hawaii which has been investigated in such detail, and similar-appearing orifices elsewhere can be observed by merely hiking on certain established trails.

Exploration and study of vertical karstic pits necessarily lagged far behind that of horizontal karstic caves. This also has been true in volcanic pseudokarsts, but application of vertical caving techniques to vertical volcanic crevice caves and to open vertical volcanic conduits is well underway. Tectonic crevice caves in Hawaii have been mapped to a depth of 183 m, with evidence of longitudinal lava flow at depth after formation of the crevice. Nearby, careful penetration of breakdown which seemingly terminated a deep pit crater yielded another fracture cave. This one contained a lava tube cave formed within the crevice. Even deeper open vertical volcanic conduits have been measured in Hawaii and in Iceland. Several types of open vertical volcanic conduits have been identified.

Almost every new volcanic cave everywhere in the world contains microfeatures different from those found everywhere else. The need to document them all is enormous. Yet I expect many of the most important discoveries of the next half-century to be in volcanic caves of other types - certainly here on Earth and perhaps far beyond.

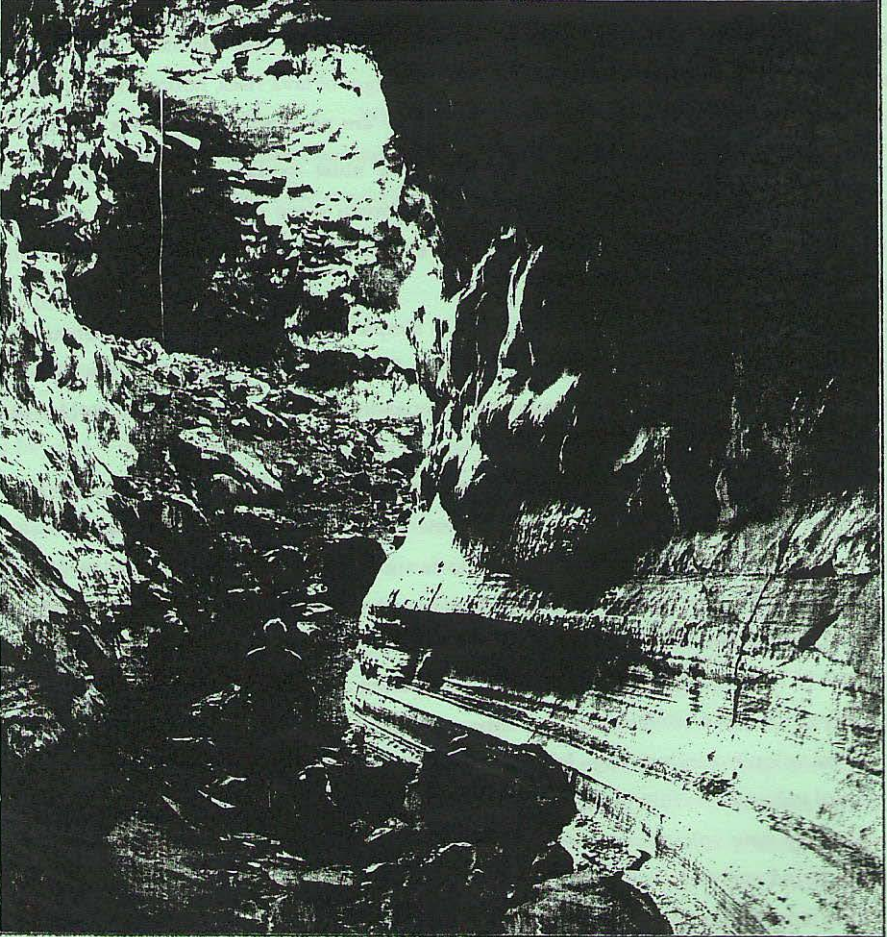




Newsletter  
**Hawai`i Speleological Survey**  
of the  
**National Speleological Society**

Spring 2006

Number 19





There are not too many publications dedicated to just lava tubes or volcanic caves. One is the "Hawai'i" Speleological Survey". A fascinating one, just dedicated to Hawaii. But full of new discoveries. In my collection now issue 17 to 20 (so two per year), resp. pages 28, 20, 28 and 22. Several in color. It should be realized the subscription for USA is much lower than 'rest of the world'. So just ask in case of interest.

*Hawai'i Speleological Survey Newsletter - Fall 2006*

The *Newsletter* of the Hawai'i Speleological Survey is published, at least once a year, by the Hawai'i Speleological Survey of the National Speleological Society. The editor is: Hazel Medville, 11762 Indian Ridge Rd., Reston, VA 20191 (e-mail: [hazelmedville@verizon.net](mailto:hazelmedville@verizon.net)).

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Bill Halliday will always react to articles who do not realize or pay respect to our lava tubes (or volcanic caves). Here one of his reactions.

Dr. William R. Halliday  
Honorary President,  
Commission on Volcanic Caves of the  
International Union of Speleology  
6530 Cornwall Court  
Nashville, TN 37205

As a long-time Conservancy member, I have always considered American Archaeology to be both authoritative and reliable. But you really blew it in your Fall 2006 issue. Your article "Archaeologists Discover Ancient Use of Lava Tubes" asserts that lava tubes are merely "cave-like features".

In fact, any subterranean space large enough and dark enough to qualify as a cave is a cave, regardless of the type of rock which surrounds it. The Redmond Caves have been described and discussed as such for more than 50 years.

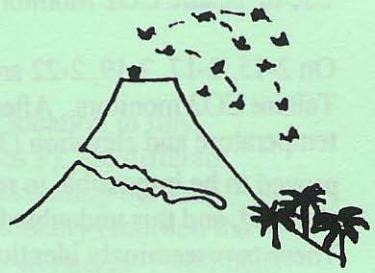
Innumerable references regarding this subject can be cited. Examples: the 2004 "Encyclopedia of Caves and Karst Science", and the section on definitions of the Federal Cave Resources Protection Act. The latter is particularly relevant to planning future management of these caves and their environment. Its protective provisions cannot be evaded by merely asserting that these caves are not really caves, but "cave-like features".

Half a century ago, the largest cave in Hawaii's Ewa karst was destroyed without protest because it was incorrectly listed as a "sinkhole" with an archaeological site number. But those days are long past. American caves now are protected by law and by the mobilized conscience of the American people. I request that you correct this serious misunderstanding at your earliest convenience.





During his explorations of the Kilauea Caldera Bill Halliday needed special permits due to CO<sub>2</sub>. See a report about the amounts of CO<sub>2</sub> actually measured.



## Introduction

Small amounts of CO<sub>2</sub> are degassed through innumerable small cracks within and outside caves in the 1919 lava flow of Kilauea Caldera. In part because of the lack of a sturdy portable CO<sub>2</sub> monitor, their output has not been quantified.

Under the terms of permits # HAVO-2006-SCI-0110 and -0111, in February 2006 all persons in Kilauea Caldera caves were required to wear one of two approved CO<sub>2</sub> monitors at all times when underground. We substantially complied with this requirement in order to be allowed to finish my 1994 study of caves in the 1919 lava flow. None of these caves was hypercarbic clinically but some of them were hyperthermal. The results are of uncertain scientific validity. Both approved types of these monitors function by infra-red spectroscopy likely to be affected by heat and steam.

Use of "CO<sub>2</sub> Buddy" monitor and data from it

On 15 February 2006 Don Swanson of the US Geological Survey carried a "CO<sub>2</sub> Buddy" monitor. In Fractured Tumulus Cave, it stabilized at a spurious 0.00% CO<sub>2</sub> in the entrance room; it had been exposed to wisps of steam in the entrance.

In Curious Lizard Cave, the entrance temperature was 122 degrees F. The instrument stabilized at a spurious 5.9% CO<sub>2</sub>.

In the main passage of Amau Cave, in the passage between the two entrances a probably valid reading of 0.25 % CO<sub>2</sub> was obtained. (Four days later it was 0.29 % CO<sub>2</sub> at the same location using a Telaire CO<sub>2</sub> Monitor. On 2-15-06, the Telaire instruments were still in a state of shock from Curious Lizard Cave).





On 2-15, 2-17, 2-19, 2-22 and 2-25-06, Harry Shick and I both carried Telaire CO2 monitors. After surface testing, we set them for ambient temperature and elevation (3500 feet) at the start of each trip. It proved to be impossible to reset the temperature in caves every time it changed, and this undoubtedly introduced errors in the data below. These two seemingly identical instruments were observed to differ in response/lag time and at times they periodically diverged by more than 10% for no apparent reason. They appeared to be very sensitive to imperceptible wind currents, human breathing, body heat, steam, and imperceptible water vapor -- both in caves and in test situations on the surface.

In several cave passages, it was not possible for me to pass constrictions while wearing the Telaire instrument as directed. In these locations, it was necessary for me to remove its pack and to push it ahead of me. This bothered Don Swanson sufficiently that he elected to remain on the outer side of the constriction at the entrance of the inner room of Fractured Tumulus Cave. There he could observe sampling sites and he could direct Harry Shick and myself in taking appropriate samples as required by permit # HAVO-2006-SCI-0010.

#### Telaire cave data and its validity

In the side room of Amau Cave, the figure obtained (about 0.5% CO2) showed some fluctuation with palpable wind currents.

In windy Stubby Stalactite Cave, an attempted initial reading fell to 0.000% with exposure to moderately hot water vapor in the main entrance.

The entrance temperature in Curious Lizard Cave was 122 degrees F. This is stated to be the upper limit of function of Telaire CO2 monitors. The instrument momentarily was very erratic, then went blank. This apparently was a response to a combination of heat and water vapor.

Two readings in normothermic Roofed Crack Cave (T 85.5 and 97.0 degrees F) apparently were recording the body temperature of the investigator who was on rope.





Readings varied especially rapidly in a single location in tiny, slightly steamy Aalii Too Cave (T 91.0 degrees F). 28 different readings were obtained in about 2 minutes, fluctuating between 0.242% and 0.5326% CO<sub>2</sub>. These readings probably recorded the effect of wind currents on a local heat source. In nearby Two Plants Cave (T 85.3 degrees F), an initial unstabilized reading of 0.82% CO<sub>2</sub> quickly fell to 0.0786 %.

The most credible-seeming data were obtained in Amau Cave (3 of 4 readings - see above), Fallen Slab Caves (3 readings), Fractured Tumulus Cave (2 readings), Missed Cave (1 reading), Orange Spots Cave (1 reading), Roofed Crack Cave (1 of 3 readings - see above), Secondary Ceiling Cave (2 readings), Stubby Stalactites Cave (2 of 3 readings - see above), and Uwekahuna Trail Cave (1 reading):

Baseline (USGS HVO parking lot): 0.0380 %

Amau Cave (0.2026%, 0.29%, 0.4254% CO<sub>2</sub>)

Fallen Slab Caves (0.0381 %, 0.0409 %, 0.0558 % CO<sub>2</sub>)

Fractured Tumulus Cave (0.0426 %. 0.0501 % CO<sub>2</sub>)

Missed Cave (0.0464 % CO<sub>2</sub>)

Orange Spots Cave (0.0484 % CO<sub>2</sub>)

Roofed Crack Cave (0.0412 % CO<sub>2</sub>)

Secondary Ceiling Cave: (0.045 %, 0.048 % CO<sub>2</sub>)

Stubby Stalactites Cave: (0.0465 %, 0.0689 %, CO<sub>2</sub>)

Uwekahuna Trail Cave: (0.057 % CO<sub>2</sub>)

Telaire monitor vehicular data

During an episode of moderate trade winds on 22 February 2006

4

Harry Shick and I tested CO<sub>2</sub> concentrations along the Crater Rim Drive in the caldera outlet where USGS COSPEC readings are obtained. With one exception (where there was no shoulder to pull off), readings were obtained at intervals of 0.1 mile. Concentrations were from 0.0306% to 0.073% CO<sub>2</sub>. Most were from 0.040 to 0.059% CO<sub>2</sub>. The highest readings were alongside the Halemaumau parking lot. In the east end of the parking lot itself, concentrations up to 0.148% CO<sub>2</sub> were measured. No USGS summit CO<sub>2</sub> output estimates are available for this period.

### Conclusions

Small, durable CO<sub>2</sub> monitors are needed to quantify CO<sub>2</sub> output through innumerable cracks in caves of the 1919 lava flow of Kilauea Caldera.

Present portable instruments do not meet this need but may be considered first generation instruments. This project may have been the first attempt to use the current generation of these instruments in caves. They were designed and intended for indoor use and also function well in vehicles. In this cave use they were subjected to so many adverse conditions that the recorded data are of little or no scientific value. Besides compliance with the command-and-control decision which required them as a condition for completion of my 1994 project, their primary value may have been to identify potential sources of error in speleological use, for the benefit of future investigators.

Meanwhile, I have two slightly used CO<sub>2</sub> monitors for sale at a substantial discount...

### Acknowledgments

My receiving these permits was only possible because of vigorous support of vulcanospeleologists and cooperators in many parts of the world.

Field assistance by Harry Shick, Ric Elhard, Don Coons and other members and cooperators of the Hawaii Speleological Survey and Don Swanson of the US Geological Survey was essential for this field



work. Support and encouragement by former HVNP Superintendent Jim Martin, former HVNP Chief of Resources Management Dan Taylor and former HVNP Cave Specialist Bobby Camara were especially important during earlier stages of this 12-year project. For part of the required purchase of two Telaire monitors at \$445 each, financial support from the Hawaii Speleological Survey and the Hoffman Environmental Research Institute also was much appreciated.

William R. Halliday  
IUS Commission on Volcanic Caves  
13 March 2006

# **WARNING**

**STAY ON ESTABLISHED TRAILS**

**STAY OUT OF CAVES AND CRACKS**

**POTENTIALLY LIFE THREATENING**

**CONCENTRATIONS**

**OF CARBON DIOXIDE**

**IN CAVES AND CRACKS**



## REVIEW TO THE PAST SYMPOSIUMS ON PSEUDOKARST

### 1<sup>st</sup> Symposium: Janovičky u Broumov – CS (Broumovské vrchoviny) 09-12 09 1982

Organisator / organized by: Česká speleologická společnost,

Klub 5-03 Broumov (J. Kopecký – J. Vitek)

Teilnehmer / participants: aus 3 Nationen (CS, DDR, PL) 87 Personen /  
from 3 nations 87 persons

Exkursionsführer / Field trip guide: im A4 Format mit 8 Seiten /  
in A4 format by 8 pages (böhmisch/Czech 100 %)

### 2<sup>nd</sup> Symposium: Janovičky u Broumov – CS (Broumovské vrchoviny) 03-06 10 1985

Organisator / organized by: Česká speleologická společnost,

Klub 5-03 Broumov (J. Kopecký – V. Stárka)

Teilnehmer / participants: aus 5 Nationen (A, CS, DDR, PL, S) 75 Personen /  
from 5 nations 75 persons

Abhandlungen / Proceedings: im A5 Format mit 154 Seiten / in A5 format  
by 154 pages (böhmisch/Czech 60 %, englisch/English 20 %, deutsch/German 15 %  
polnisch/Polish 5 %)

### 3<sup>rd</sup> Symposium: Königstein – DDR (Sächsische Schweiz) 30 09 - 03 10 1988

Organisator / organized by: Kulturbund der DDR Gesellschaft für Natur  
und Umwelt ZFA Höhlen- und Karstforschung, Dresden  
(F. Börner – B. Wutzig)

Teilnehmer / participants: aus 6 Nationen (A, CS, D, DDR, PL, SU)  
zirka 40 Personen / from 6 nations ca. 40 persons

Abhandlungen / Proceedings: im A5 Format mit 44 Seiten / in A5 format  
by 44 pages (deutsch/German 85 %, englisch/English 15 %)

### 4<sup>th</sup> Symp: Podolánky u Čeladná – CS (Moravskoslezský Beskydy) 27-30 09 1990

Organisator / organized by: Česká speleologická společnost,

Klub 7-01 "Orcus", Bohumin (J. Wagner)

Teilnehmer / participants: aus 9 Nationen (A, CS, DDR, GB, H, I, PL, S, SU)  
61 Personen / from 9 nations 61 persons

Abhandlungen / Proceedings: im A5 Format mit 150 Seiten / in A5 format by  
150 pages (böhmisch/Czech 60 %, englisch/English 25 %, deutsch/German 14 %,  
holländisch/Dutch 1 %)

### 5<sup>th</sup> Symposium: Szczyrk – PL (Beskid Śląski) 22-25 09 1994

Organisator / organized by: Klub Taternictwa Jaskiniowego, Bialsko-Biała  
(G. Klassek)

Teilnehmer / participants: aus 4 Nationen (CZ, D, H, PL) 21 Personen /  
from 4 nations 21 persons



Abhandlungen / Proceedings: im A4 Format mit 42 Seiten / in A4 format  
by 42 pages (polnisch/Polish 26 %, deutsch/German 25 %, böhmisch/Czech 20 %,  
englisch/English 12 %, slowakisch/Slovak 12 %, ungarisch/Hungarian 5 %)

**6th Symposium: Galyatető – H (Mátra-hegység) 19-22 09 1996**

Organisator / organized by: MagyarVulkánszpeleológiai Kollektíva, Isztimér  
(I. Eszterhás)

Teilnehmer / participants: aus 8 Nationen (A, CZ, D, H, NL, PL, RO, SK)  
32 Personen / from 8 nations 32 persons

Exkursionsführer u. Zusammenfassungen / Field trip guide and Abstracts: im  
A5 Format mit 32 Seite / in A5 format by 32 pages (englisch/English 80 %  
deutsch/German 20 %)

Abhandlungen / Proceedings: im A5 Format mit 182 Seiten / in A5 format by  
182 pages (englisch/English 45 %, deutsch/German 40 %, ungarisch/Hungarian 15 %)

**7th Symposium: Arad – RO (Munții Codru-Moma & M. Zarandului) 06-10 10 1999**

Organisator / organized by: Clubul de Speologie "Liliacul", Arad  
(T. Tulucan)

Teilnehmer / participants: aus 5 Nationen (A, H, NL, PL, RO) 10 Personen / from  
5 nations 10 persons

Programm u. Exkursionsführer / Program and Field trip guide: im A4 Format  
mit 25 Seite / in A4 format by 25 pages (englisch/English 100%)

Abhandlungen / Proceedings: im A4 Format mit 53 Seite / in A4 format by 53  
pages (englisch/English 80 %, deutsch/German 16 %, französisch/French 4 %)

**8th Symposium: Teplý Vrch – SK (Krupinská & Cerová vrchovina) 25-29 05 2004**

Organisator / organized by: Správa slovenských jaskýn, Rimavská Sobota  
(L. Gaál)

Teilnehmer / participants: aus 10 Nationen (A, CZ, D, FIN, H, I, NL, PL, RO, SK)  
48 Personen / from 10 nations 48 persons

Exkursionsführer u. Zusammenfassungen / Field trip guide and Abstracts: im A5  
Format mit 56 Seite / in A5 format by 56 pages (englisch/English 100 %)

Abhandlungen / Proceedings: im B5 Format mit 144 Seiten / in B5 format by  
144 pages (englisch/English 57 %, italienisch/Italian 16 %, böhmisch/Czech 14 %,  
deutsch/German 7 %, ungarisch/Hungarian 5 %, slowakisch/Slovak 1 %)

**9th Symposium: Bartkowa – PL (Beskid Sądecki & B. Niski) 21-27 05 2006**

Organisator / organized by: PAN Instytut Ochrony Przyrody & Beskidzkiego  
Klub Jaskiniowego, Speleoklub Białsko-Biała, Kraków (J. Urban)

Teilnehmer / participants: aus 12 Nationen (A, CZ, D, E, F, FIN, H, I, NL, PL, RUS, SK)  
64 Personen / from 12 nations 64 persons

Exkursionsführer u. Zusammenfassungen / Field trip guide and Abstracts: im B5  
Format mit 100 Seiten / in B5 format by 100 pages (englisch/English 100 %)

Abhandlungen / Proceedings: (Die Ausgabe ist im Gang / The issue is in the running)

István Eszterhás  
Hungarian Volcano-speleologic Team  
Isztimér, Hungary



Abstract of "Jeju Volcanic Island World Heritage Proposal" by Bill Halliday, a proposed paper for C & M session.

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Abstract

After several years' discussions with scientific and management consultants, the government of Korea has nominated a tripartite arrangement of related volcanic sites on Jeju Island for World Heritage designation. As UK consultant Chjris Wood pointed out in 2002, "arguably the greatest geological heritage resource on the islands is its lava tube cave systems". In the proposal these are represented by a single area including world-class Manjang Cave, labyrinthine Bengdwi Cave and two newly-discovered lava tube caves profusely adorned with white carbonate speleothems (Yeongchon Cave and Dongcheomul Cave). The other two specified areas are the summit of Mount Halla (the island's shield volcano) and Ilchulbong, an extraordinary littoral tuff cone. Omitted from the present version of the proposal are several additional volcanic features recommended by geological and speleological consultants; the most important of these appears to be Bilemot Cave (longest lava tube cave known on the island, with extraordinary three-dimensional complexity) and the three Hallim Park (Hyopje) Caves. Only one of the latter is world-class (Hwanggum Cave, for its content of white carbonate speleothems which, however, are less impressive than those of Dongcheomul Cave). All three are well-protected in a private nature park whose owners have no interest in its being included in a World Heritage site.

Bilemot Cave is said to have been badly trashed a decade ago and has not been cleaned but this is not an acceptable reason for its exclusion.

Additional world-class caves still are being discovered and mapped on this island; provision should be made for their eventual inclusion and that of Bilemot Cave.

Greg Middleton pointed out in 2003 that "all of the authorities consulted to date agree that the lava caves should be the focus of any Jeju nomination." I agree. Ideally they should be interpreted in geological context, as an integral part of the overall volcanic landscape within the World Heritage area. However, political pressures may shrink the proposed area still further and if necessary, the Manjang system could stand alone as a World Heritage site.

For several reasons it is unlikely that the present proposal will be accepted in its current form. With a proviso that the island's World Heritage site be expected to undergo subsequent enlargement to include additional world-class caves, the NSS should support any Jeju World Heritage proposal which includes at least Manjang, Dangcheomul and Yeongchon caves.

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My presentation will include an English-language video disc prepared for the WH authorities. Also I should have a display space wide enough for photos and maps somewhere near the lecture hall.  
Aloha, Bill H.