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The Commission on Volcanic Caves Newsletter has been published regularly since December 22, 1993. The Newsletter is available free of charge to all members of the commission, and to others who are interested in Volcanic caves.

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MISSION STATEMENT

The UIS Commission on Volcanic caves encourages exploration and scientific investigation on volcanic caves, and hosts the International Symposium on Vulcanospeleology about every two years

COVER and BACK COVER PHOTOS

A selection of photos (author Boaz Langford) of basaltic landscapes in Saudi Arabia, complementary to the article on page 10.

Editorial

It has undoubtedly been a great pleasure to participate in my first (personal) meeting of the Commission on the occasion of the 19th UIS Congress in Belo Horizonte, Brazil.

It was, in fact, the second in-person meeting attended by my country, Argentina, where volcanospeleology is making its way with great difficulty but with great ambitions. The first time was in Sicily, Italy, in 2021, and our representative was speleologist and artist Carlos D'Agostino. And we hope Argentina will also be represented at ISV 2022 in the Canary Islands in 2026.

It was also a pleasure to meet Giuseppe Priolo at the 19th ICS, with whom we are organizing an expedition to the pahoehoe lava flows of Northern Patagonia.

Upon returning home, we began the work of gathering and editing the contributions to this Newsletter, which reflects the diversity of perspectives that continue to exist within our membership.

Martin Mills complements the tribute paid to Bill Halliday in the previous issue.

Laurens Smets, Dominik Frölich and Boaz Langford provide a comprehensive report on cave exploration in Saudi Arabia, a country that, until recently, has not been readily accessible to tourists. Their article is complemented by photos by Boaz Langford on the front and back covers.

The spirit of international cooperation evident in the Saudi report resonates with a theme that was commonly expressed at the recent UIS Congress ICS19. That is, international friendship and cooperation in the speleo community, in contrast to rising political tensions in many parts of the world

Carlos Benedetto
Editor

Some of the commission members who participated in the recent 19th International Congress of Speleology, Belo Horizonte, Brazil

President's Column

Hello everyone

It was great to see and talk with so many members at the recent 19th International Congress of Speleology in Belo Horizonte, Brazil. What an incredible event the congress was! A special thanks to members who attended the commission meeting during the congress. I was also pleased by the number of visitors who attended the meeting and, in several cases, decided to join the commission. I extend a warm welcome to those new members.

The commission meeting followed a relatively short but strong presentation session on volcanic caves. The main item for discussion at the meeting was the next International Symposium on Vulcanospeleology (ISV), which will be held in the Canary Islands in November 2026. Further information on the ISV appears below.

At the meeting, there was a brief discussion about future ISVs and, in relation to the one due in 2028, I noted that while no offers had yet been received, there was interest in Argentina. However, for that interest to translate into a viable proposal, it was recognised that issues identified with earlier preliminary proposals would need to be addressed, including on the level of local support and on resolving a number of logistical issues for staging a multi-day field excursion into the remote interior.

There was also a suggestion from the floor that perhaps the ISV could be attached to a convention of the National Speleological Society (NSS) in the United States which, in 2028, has been proposed for the pacific northwest. This is an active volcanic province with innumerable caves. While the commission has initiated contact with the originator of the idea, it remains to be seen how the ISV would be organised and by whom and whether the commission should set aside its long-standing policy of maintaining the independence of ISVs by not incorporating them into a larger national or international speleological conference. Would it be feasible to run a stand-alone ISV that immediately preceded, or followed, the NSS Convention?

The meeting in Belo was informed that all offers to organise the ISV in 2028 would be considered in November next year at the next commission meeting, which will be held during ISV22 in the Canary Islands. Now is a good time to commence working on your proposal to host ISV23. Please!

A proposal to develop criteria for assessing the international significance of important volcanic caves has not made significant progress. Members were advised that a proposal for a task group to develop criteria was suggested after a presentation by Prof. Kyung-Sik Woo at the Galapagos ISV (ISV21) in April last year. Last year a number of people expressed interest in being involved, and several of them offered pertinent comments. However, the initiative has languished as nobody has offered to chair the task group and direct its work. Please contact me if you are interested in progressing this important initiative.

Finally, the meeting in Belo noted that several commission members had passed away since the last international congress. They included Rene Scherrer (Switzerland), Jim Werker (USA), Roberto Conti (Italy), Bill Halliday (USA) and, most recently, Raquel Daza Brunet (Spain).

Returning to ISV22 next year. As was noted in a recent email circulated to all members, the core activities (the principal presentation sessions, the main field trip and symposium dinner) will be held on Tenerife Island from 5 to 8 November next year. Optional field trips will be offered to caves and other volcanic features on Lanzarote (for several days before the main event) and on La Palma (for several days following the activities on Tenerife). The dates of these optional field trips will be advised to everyone after the organisers have finalised program outlines for each island, noting that a full day will be allowed in the full program for each inter-island transfer.

The team of key organisers for ISV22 (Tenerife: Pedro Oromi; La Palma: Octavio Fernadez and Lanzarote: Laurens Smets) is small. To ease the burden on the organisers, it has been decided that participants will have to make their own accommodation and inter-island travel arrangements. It is likely there will also be a separate registration fee for each island. Once again, this is to make things easier for the organisers.

It is also likely that there will be a cap on the number of participants. On Tenerife, the limit will be between 80 and 100 participants, based on the size of the meeting room the organisers plan to use. It may be necessary to further restrict numbers on the optional pre- and post-symposium field trips. This is for logistical reasons, which include transport practicalities, the need for small group sizes in some caves and also because of the limited availability of experienced cavers to act as trip leaders/ guides.

In response to all those who have asked why there will be limits on numbers, and in view of this, why a decision was made to convene an ISV on the Canary Islands, I simply note that a decision on where to convene an ISV is based on the best offer that is received. It is not unusual for there to be only one offer and this was the case for ISV22. It is also no secret that an ISV can only happen if a viable offer is submitted by, for example, an academic institution, a government instrumentality, or a group of individuals. Usually, it is the latter and the task imposes a significant work burden on organisers, especially when it is just a few individuals who are volunteering their time. I also note that several recent ISVs, including those in 2014, 2016, 2018 and 2024, placed caps on participant numbers and, as best I can recall, few if any members felt they had missed out.

To assist planning for ISV22, a survey will be circulated to all members within the next couple of months to gauge the level of potential interest in participating in (a) the ISV, (b) the field trips and (c), actively participating in the formal sessions by offering to do one or more presentations.

John Brush
President
UIS Commission on Volcanic Caves
20 August 2025

Fig. up and left: Our President in action during ISV20 in Vietnam and ISV21 on the Galapagos Islands.

A little more about Bill Halliday

Martin Mills

Congratulations to the members who wrote the two fine appreciations in the last Newsletter. Although I only met Bill once, upon reflection he was an influence in my journey in caving and more particularly in lava caves.

Lava joined Karst in my life when in August 1970 my club, Shepton Mallet Caving Club (UK), decided to go to Iceland to celebrate the club's 21st Anniversary, (largely at my urging), and to have a first encounter with lava caves. These were virtually unknown to us as information on both Iceland and lava caves was in that era somewhat sparse. Only Chris Wood (I think) had been to Iceland before. Due to our equipment, we travelled by boat like the Vikings. We could not obtain the required research permit for Surtshellir, etc in the Hallmundarhraun so a late change was made to Raufarhólshellir (now a show cave).

Obviously Iceland affected us for in 1972 a smaller party of six of us returned and I remember, with Chris Wood, finishing off in a café in Reykjavik our article "Original Contributions to Volcano speleology from Iceland" and posting it to Bill who presented it at the NSS Convention at White, Washington, on 16th August 1972, but due to technical problems we did not get our paper copies of the Proceedings until 1976. At the Gullborgarhraun at the base of the Snaefells Peninsula we investigated a group of caves before moving to the Hallmundarhraun to investigate in detail Surtshellir/Stefanshellir and also located Víđgelmir where we hacked through the iced-up entrance to survey and investigate this fine system (a highlight). Then to Myvatn and Askja where we had the misfortune to take the wrong route (?) passing beneath the north edge of the Vatnajökull Icecap we ran out of Landrover fuel. Miraculously a local came off the icecap and towed us to a refuge hut on the Sprengisandur cross country route from where we retreated to Rekjavik somewhat embarrassed.

In 1973, following our epic and less than ideal weather camping in Iceland the previous year, we were rather hoping for a more pleasant location. Meanwhile Bill appeared to be hurtling all over the globe investigating lava caves in far flung places. From reports of his earlier investigations in November 1971 that reached us there was mention of long lava tubes on Tenerife, including Cueva del Viento, with a total length of 6200m and uncertainty as to how it was split either side of the entrance. This all sounded very attractive and a suitable project so off to Tenerife. We initially had difficulty in locating the entrance and were reduced to writing the cave name of a piece of paper and showing it to local people in the main street of Icod de los Vinos who all pointed up the mountain. By the 6th day of surveying we had exceeded 5500 metres, but one passage would not close, and this led to a lava fall into an extensive, unexplored 2340m long lower cave, since named Galería de los Ingleses, and gave a total length of 7922m for the cave.

Fig. 1 - Outside Bill´s house in Seattle, Bill second from the left. Photo M.Mills

1974 was the year of the Grand Tour. Lifelong friend Ray Mansfield persuaded me and two other caving buddies to join him on a three-month tour of the US and Canada. Lodging with the Gurnee's in New Jersey we bought a used station wagon and then set off clockwise round the US via New Orleans to the Rio Grande and then San Francisco, up the Pacific coast to Vancouver then up to Jasper before returning to the US through Montana and the flatlands, eastwards back to New York. We drove 12549 miles, visited 27 limestone caves and 32 lava caves, visited 21 National Parks, 6 National Monuments, climbed 5 mountains, including Half Dome, Mt Whitney and Mt Rainier (where we also looked at the summit thermal caves. Bill had jointly written the guidebook in 1972 to the lower altitude Paradise Ice Caves.) We walked an estimated 240 miles of trails. Many adventures were had, including the Grand Canyon to the Colorado River and out in a day; Death Valley and Mount Whitney in a day; many well-known US cavers of the era were met but not Bill (that was in the future). Unfortunately, at the time there was a world petrol crisis together with restrictions on how much sterling currency we could take out of the UK, necessitating that it was a frugal tour. However, I must have had a few bucks left for in a New York bookshop I found "Depths of the Earth" by Bill, newly published, for $7.50 and brought it back to the UK. Guess who later took this copy from Edinburgh to Seattle to be signed?

1975 saw me with two friends in East Africa, visiting Jim Simmons in Nairobi, Mt Suswa caves, climbing Kilimanjaro, amongst other things (see Volcano Newsletter No 78, pp 62-64).

In early 1979 I was approached by Chris Wood as to whether I was interested in joining the importantly sounding UK Speleological Expedition to Hawai'i Island 1979. Never in my wildest dreams did I expect to be caving there so I upped the game and took 2 places as it satisfactorily resolved the question of a honeymoon, albeit slightly delayed. Kirsty and I set out from Edinburgh to London by train which inconveniently broke down (it was Friday 13th July) which slightly foreshortened our overnight stay in London. Also, being grant aided it was felt that we should fly by the cheapest route rather than direct, thus Heathrow/New York/Seattle/Hilo. Our route being via Seattle enabled us to stay overnight with Bill. He had laid on a reception for us and his Cascade Grotto specialists were there with a view to reaching a firm agreement on measuring lava tube caves. We had always (and still did) differ with the Americans on this, basically if there is one or more collapses/entrances part way along the length of the cave they regarded each section as a separate cave, irrespective of (as we saw it) the whole cave being formed at the same time with the roof collapsing either at the time of formation or subsequently. I remember listening to them arguing that if a roof collapse went right across a passage it was a separate cave/segment, but if it only went part-way across and you could pass it in the shade it was the same cave. I thought to myself this is a bit esoteric and nuts. The discussion got quite heated (the combination of jet lag, Olympia beer, and the fact that it was also 5am our time probably didn't help). I have often wondered who was responsible for the first list of the longest, deepest, etc? The last thing I muttered was that it would be better concentrating on visiting the caves – at that time the first rumours of long tubes in Jeju were emerging. (In the UK, back in 1969, two friends, Ray Mansfield and Tony Oldham. launched a publication CTS (Current Titles in Speleology) initially covering UK publications – it went International in 1972, hoping to cover the world's publications. And by offering to exchange publications, had a pretty good idea of what Cascade Grotto and others were up to!)

During our brief overnight stay Bill had given us a photocopy of an article entitled "Visiting Hawaiian Caves" by Libby and Jim Nieland in the Oregon Speleograph (September 1978), resulting from a trip in February of that year and including a description and part survey of Ainahou Ranch Cave which they had explored and surveyed for just under a mile and was still going both up and down flow. As far as I am aware this was typical Bill who did not appear to keep things secret (unlike some). Onward to Hilo was complicated – our flights had unknown to us been cancelled so we went standby to

Fig. 2. Chris Wood in Apua Cave.

Photo: A. C. Waltham

Honolulu and two island hops to Hilo where we arrived after 59 hours of travelling and it was raining – but warm rain! At the National Park.

HQ we were told that we were a day early and our accommodation was not available so we went to the campsite, put up a flysheet and fell over.

The Park gave us carte blanche to go wherever we wanted, even areas prohibited to the public. Our party consisted of seven, with four others joining us at various times and lasted seven weeks in total. Twenty caves were visited, nearly 22.4 km surveyed and a further 3.9km visited/checked and some followed the 29km trail to Mauna Loa summit at 4169m. We also experienced a 4.8 magnitude earthquake. Amongst an area of very large collapses found near the coast we encountered a "forest" of about 100 one-metre-high lava-mites the most spectacular display yet found at that time. We named it Apua Cave and advised the Park authorities.

Fig. 3. View out of the lowest entrance to Ainahou Ranch Cave with view of the Pali below. Photo M. Mills

When a spare day loomed, having found out from the park people where Ainahou Ranch was we set out armed with the photocopy article Bill had given us. After some searching we found two entrances (one with outstanding petroglyphs)and immediately started surveying. 1.7 km later we gave up for the day. We returned the next day and with two surveying teams pushed downflow to a terminal collapse on the Poliokeawe Pali (fault scarp). Those surveying upflow found a human skeleton, duly reported to the Chief Park Ranger who detailed a Ranger to accompany us the following day to take polaroid photos. The conclusion was it was pre-sugar arriving on the island, perhaps 200 years old, and may have crawled into the cave to die or been killed. That same day another 1.65km were surveyed. The result was the Nieland's survey of just under a mile became 7.11km with 16 entrances.

Another of our objectives was Kazamura Cave, first reported in 1972 at 6km long, and in 1975 at 10km and with 15 known collapse holes. However, we didn't know where it was. The one resident (in Honolulu) who knew the location wouldn't tell us but said he would show us when he visited. Meanwhile outside several caves there were nuclear fallout shelter signs and from the Civil Defence office in Hilo we obtained a map showing the location of all the shelters on the island, including Kazamura, which we surveyed to 11.55km. On his return journey to the UK, Chris Wood and Barry Weaver visited Ape Cave in Washington State and which we now know was apparently Bill's favourite – it took me until 28 July 2018 to visit it! Finally, I wanted to comment with the others about Bill's prolific writings, either solo or jointly with others. A quick scurry along my shelves reveals I have 14 plus 2 that went to revised second editions. (I was fortunate to get an original copy of "Caves of California" in 1962). Quickly looking at "A Guide to Speleological Literature" edited by Northrup et al 1998, I found at least a further dozen works listed. When last in Hawai'i I went to Basically Books in Hilo and bought a modern reprint edition of "Hawai'an Volcanoes" by Clarence Edward Dutton, originally published in 1883, reprinted 2005 by University of Hawai'i Press, which has a foreword and appendices written by Bill. Bill personally organised, chaired seminars and edited the Conference Proceedings of at least three of the early Volcano Symposia. A bibliography of his complete writings would be daunting. Surely, he has got to be in line for greatest contribution in the English Language on caving!

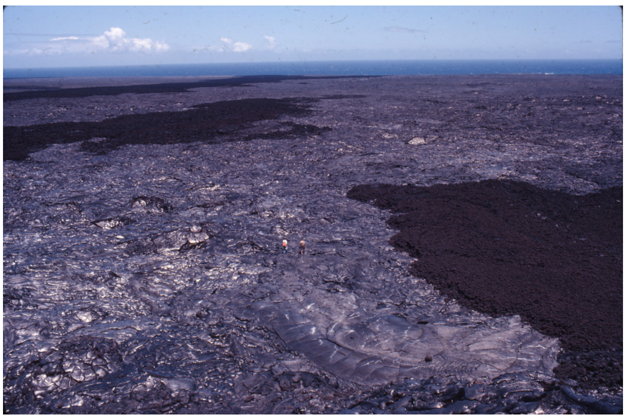


Fig. 4. View of the Pali below Ainahou Ranch Cave with John Cooper and Chris Wood in the distance. Photo M. Mills

Volcanic Caving as Geotourism in Saudi Arabia, Harrat Kishb--Harrat Rahat--Harrat Khaybar

Author : L.M.J. Smets.
Co-authors : B. Langford, D. Fröhlich

Key words: Harrat Kishb, Jabal Al-Hil, Harrat Rahat, Harrat Khaybar, Saudi Arabia, Speleological Reconnaissance of the Lava Conduit at the Jabal Al-Hil volcano, "in the Footsteps of John Pint".

Team members 2025: Boaz Langford (GB), Carmen Smith (GB), Dominik Fröhlich (D), Andrea Futrell (US), Mike Futrell (US), Rene Haemers (NL), Laurens Smets (NL), Dennis Verbrüggen (NL).

Guests: Marketa Jakovenko (CZ), Bohuslav Koutecky (Kocour, CZ), Michal Hejna (Cimbal, CZ).

Subject.
This report provides a brief overview of a geo-touristic tour organized in February 2025 in the Kingdom of Saudi Arabia. The trip was organized as a follow-up to the publications of John Pint, which documented numerous cave discoveries and highlighted several unresolved geological and speleological features at the Volcano Jabal Al-Hil at the Harrat Kishb Volcanic field.

Introduction

Saudi Arabia, officially known as the Kingdom of Saudi Arabia, is a country in West Asia and the Middle East. It occupies most of the Arabian Peninsula, covering approximately 2.2 million square kilometers, making it the largest country in the Middle East and one of the largest in Asia (see fig. 1: Wikimedia Commons).

***Fig 1:** Location map of Saudi Arabia (in red). From: Wikimedia Commons.*

The country is regarded as a holy land to Islam and was also sacred to pre-Islamic Arab tribes. Due to its religious significance, Saudi Arabia remained largely closed to general tourism for centuries. However, in recent years, the Saudi government has opened the country to tourists beyond religious pilgrimage and business travel. This shift is part of a national transformation initiative known as Vision 2030, launched by Crown Prince Mohammed bin Salman in 2016. The opening of the country presents new opportunities and Saudi Arabia now welcomes and encourages tourists to explore its hidden treasures, such as caves and other secret places. The country has opened its doors to adventure and geotourism, and it was under this umbrella that our reconnaissance trip to Saudi Arabia took place. We did not engage in scientific research—our focus was simply on observing geological features, describing them from a non-scientific perspective, and capturing them through photography and drawings, while showing respect for the place. A spokesman of The Saudi Geological Survey (SGS) warmly welcomed us with this goal.

In earlier years, despite restrictions on general access, cave research and surveys were carried out by both local and some Western researchers. Among them, John Pint has played a key role in reconnaissance and surveying efforts in collaboration with the SGS.

According to publications by the SGS and the National Centre for Wildlife (NCW), more than 1,800 caves and dolines have been identified across the Kingdom of Saudi Arabia. However, due to various restrictions, much of this data has not been made publicly accessible. Additionally, at the time, technical limitations restricted further exploration. As a result, numerous cave entrances were documented but left unexplored - often noted with symbolic question marks on maps.

2025 Reconnaissance trip

Based on this earlier limited information, two preliminary trips were made by Boaz Langford and Dominik Fröhlich in 2022 as a selfintroduction to Saudi Arabia. These trips aimed to assess logistical requirements and practicalities needed to establish connections with the local community and the approach to the remote areas.

After a long preparation, in February 2025, a multinational group of initially eight participants went to Saudi Arabia with the primary objective of investigating the 'cave question marks' previously documented by John Pint. Many documented entrances - some as deep as 50 meters and visible as long as 90 meters- had remained unexplored due to past technical limitations. It was during the 2025 trip that these long-standing mysteries were to be finally unraveled.

Our trip took place from February 15 to February 28, 2025 and the primary objective was to explore the volcanic region surrounding Jabal Al-Hil (area subunit Qh6), an ash cone volcano located in the Harrat (i.e. lava field in the local terminology) Kishb (fig. 2 and fig. 3).

Notably, lava caves are typically found in relatively young volcanic areas, generally not older than five million years (Pliocene to present).

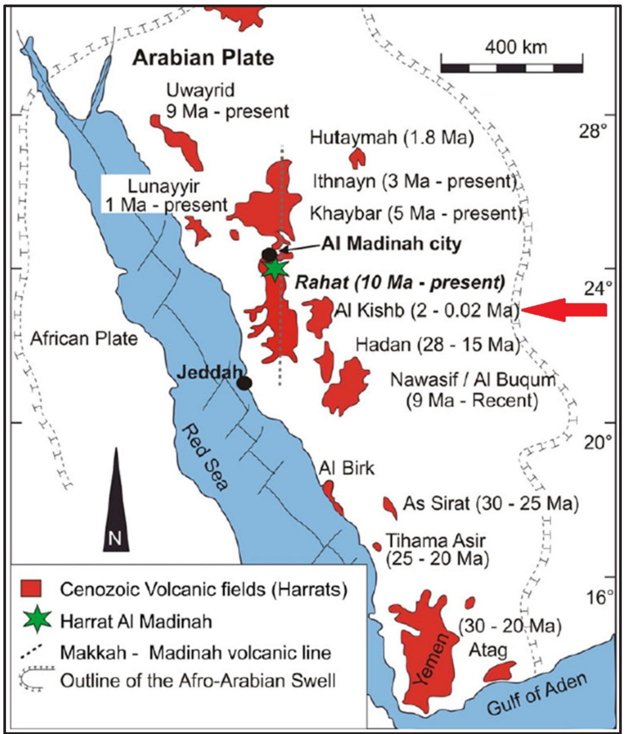


Fig 2: *Lava fields of the Arab peninsula (red patches).*
The fields are locally called Harra. They formed from 30Ma to the ~present when the youngest eruption happened in the early 19 century.

The Jabal Al-Hil volcano is dated to be no more than two million years old (last eruptions less than one million years ago) and has a height of 1,475 meters above sea level, ~ 200 meters above the lava field at its base. The volcano is a shield volcano - overflowing on all sides- with a crater depth of over 170 meters. In the southwest crater wall, it contains a cave shaft approximately 45 meters deep, with an entrance visible even on Google Earth.

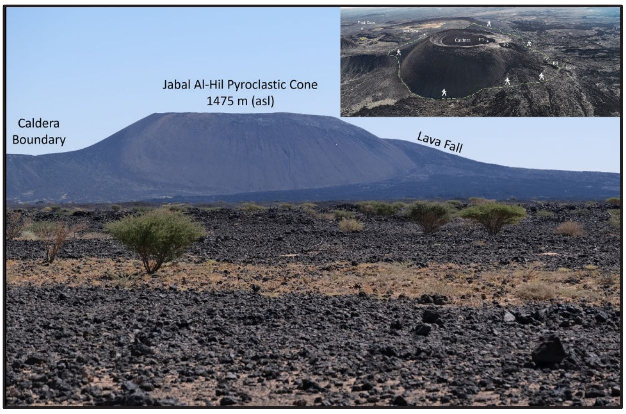


fig. 3:View on Jabal Al-Hil volcano;picture by B. Langford

Several large pukas (i.e. entrances to lava caves) were also noted on the volcano slopes, visible in satellite images and documented and published by John Pint and in the SGS reports. Since these openings appeared to be in a line, we anticipated a potential underground system of lava tunnels with a possible length of somewhere between 3 to 10 kilometers.

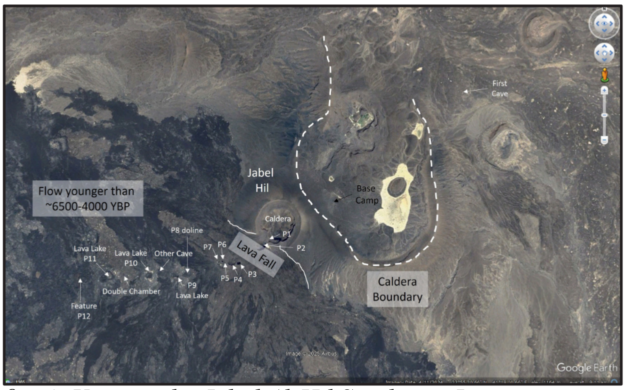


fig. 4: View on the Jabal Al-Hil Southwest Lava flow, the location of our Basecamp and the First Cave. Google Earth rendering by B. Langford

Notably, currently the longest known cave in Saudi Arabia is rumored to be up to 5 kilometers in length, though this claim has never been officially confirmed (the longest cave with published details including location and map is ~1,5 kilometers long called Umm Jirsan in the Harrat Khaybar area north of Al Medina).

In the first days of our trip a basecamp (fig. 4, 5 and 6) was set up in the crater of one of the large shield volcanoes in the Harrat Al-Kishb area.

The remoteness of the area presented significant logistical challenges. Two big pickup 4 x 4 cars, Toyota Hilux, were hired, and our inventory of materials consisted of essential supplies such as 300 liters of water, canned food for 2 weeks and 10 persons, 40 liters of gasoline, 7 tents, 200

Left: fig. 5, Basecamp at Jabal Al-Hil picture by R. Haemers. Right: fig. 6 Aerial view on basecamp Jabal Al-Hil picture by B. Langford

meters of rope, 2 air compressors, tire repair kits, 2 drills, dozens of anchors and karabiners, 7 Solar power kits etc. In the meantime, three additional guests from Czechia, who had just called to ask if they could participate, joined the group of eight (fig. 47d). They were self-sufficient, traveled in their own car, and had the opportunity to visit as guest several caves the initial team explored.

Altogether, more than eight caves were surveyed around Jabal Al-Hil. with a combined length of more than 1,3 kilometers. The deepest cave measured is 70 meters.

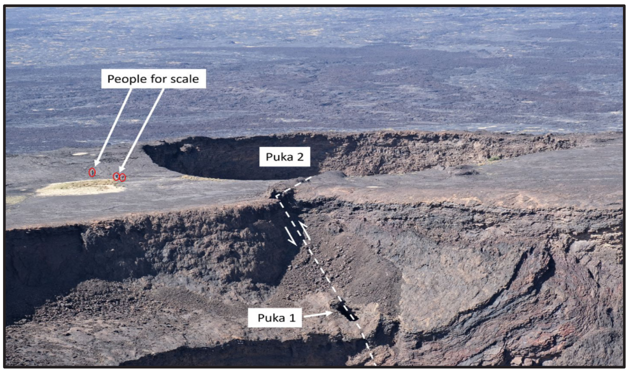


fig. 7: Aerial view on the crater and Puka 1; picture by B. Langford

fig 8: The entrance shaft of puka 1; picture by L. Smets

Jabal Al-Hil, the East to West Lava Cave Complex:

The Jabal Al-Hil Lava Tube.

The caldera of Jabal Al-Hil Volcano is an impressive, steep-walled collapse crater, measuring approximately 380 x 430 meters. According to Stephan Kempe (Oral sources), the volcano is classified as a shield volcano, meaning it experienced lava overflow on all sides.

Jabal Al-Hil reaches an elevation of 1,475 meters above sea level (asl), while the crater floor lies at approximately 1,340 meters asl. At the center of the crater, an apparent shaft or collapse feature was investigated; however, it was ultimately identified as a small doline and a shadow cast between rocks, rather than a significant cave opening.

The Jabal Al-Hil Caldera Cave Puka 1-2

Puka 1 is located in the middle of the inner slope on the southwest side of the steep-walled crater of Jabal Al-Hil Volcano (fig. 7 and fig. 8).To reach the entrance of Puka 1, one must descend approximately 40 meters down the crater slope using a rope to access a small shaft. This shaft features a small unstable bridge that leads to the main entrance shaft. Puka 1 and Puka 2 are both connected by an inflationary lava conduit.

According to the hypothesis of Stephan Kempe Puka 1 is in fact independent of the pyroduct beneath and therefore technically not a true "puka" (which typically refers to openings into lava tubes or pyroducts). Instead, due to its volume and formation, it is more accurately described as a pit crater, formed by the collapse of the magma vent at the end of the eruption. Puka 1 or Pit crater 1 is a vertical shaft approximately 45 meters deep and leading into a lava conduit at its base. On the caldera side, the conduit is obstructed by a massive boulder choke - likely the result of a landslide.

To the southwest, the lava conduit extends into a large collapsed doline - referred to as Puka 2 in the publications of John Pint. This doline measures approximately 120 by 120 meters and has a depth of approximately 70 meters. This collapse appears to have formed partly through explosive volcanic activity and partly by the collapse of underlying voids. To enter puka 2 one requires to descend a rope of over 30 meters onto a steep, rocky slope that leads toward the deepest part of the doline and to the main entrance of Puka 2 (fig.9). The cave entrance measures approximately 60 meters in width and 16 meters in height .

Cave A of Puka 2 is clearly an intrusion lava conduit, extending approximately 103 meters in length and reaching a total depth of 67 meters.

fig 9: R. Haemers at the entrance of cave A of puka 2; picture by B. Langford

Side passage, Cave B, was discovered on the south side of Puka 2. The passage has a small entrance that connects to the doline of Puka 2 at the halfway point of its vertical wall. Cave B appears to be at nearly the same elevation as the entrance to Cave A (fig.13). The passage extends approximately 75 meters before becoming blocked and exhibits a distinctive triangular cross-section (fig. 11) throughout its length. This triangular conduit resembles a channel that has been crusted over by accreting inward-growing shelves, with detached lava sheets still visible.

fig. 11: A typical triangular structure in Cave B of doline Puka 2; picture by B. Langford

However, it remains unclear how such a structure could have formed at this depth. A live lizard has been observed within the cave - likely a yellow fan-fingered gecko (Ptyodactylus hasselquistii, Ref. Boaz Langford) (fig. 10). Descending in collapsed and eroded volcanic craters and dolines is quite a challenge. While

fig. 10: Yellow fan-fingered gecko in Cave B of doline Puka 2; picture by B. Langford

lowering on a rope, rocks and parts of a wall can become loose and can form a risk for both rope and men.

Volcanic rock is very sharp and fragile. ‘A‘ā lava is composed of small welded volcanic blocks, insufficiently consolidated to be suitable for attaching ropes. It is worth mentioning that in general, volcanic rock is highly porous, filled with air bubbles, and lightweight - although its exterior can be as hard as glass, whereas the interior often consists of welded ash and scoria. On the other hand, Pāhoehoe lava, the more fluid type during its genesis, forms a thin, hard outer crust. Beneath this crust, however, the rock remains soft, riddled with holes and air pockets. As a result, finding or creating suitably robust and reliable anchor points, or belays, for descending shafts in such volcanic terrain proves to be a major challenge.

fig. 12: Use of dyneema, Korda's Rope and long M10 anchors in fractured Pāhoehoe lava; picture by R. Haemers

Notably, to maximize safety we used deep - drilled chemical resin anchors combined with dyneema slings (fig. 12), which are well-suited for use on sharp rock, coping with abrasion, and long slings wrapped around large boulders or lava balls (hot lava blocks, or lava lumps, roll down a volcanic slope during an eruption, gradually becoming round like snowballs).

Thanks to generous sponsorship from FSE (European Speleological Federation), we had the opportunity to use Korda’s IRIS 10mm rope, which performed exceptionally well, meeting our expectations. This super static rope minimized bounce, which was crucial for avoiding abrasion damage against sharp volcanic edges. In this way we were able to successfully and safely descend into pits and craters previously described as "too dangerous to enter."

Cave Puka 3 is a massive tunnel collapse measuring 40 by 52 meters, with a depth of approximately 44 meters. After descending 25 meters from the surface by rope, one lands on a boulder slope that leads through a massive heap of rocks to the remnants of a large lava conduit, visible on both the eastern and western sides of the doline. At the eastern side of the doline, the cave tunnel leads upwards into the flank of the volcano. Given the intense earthquakes,

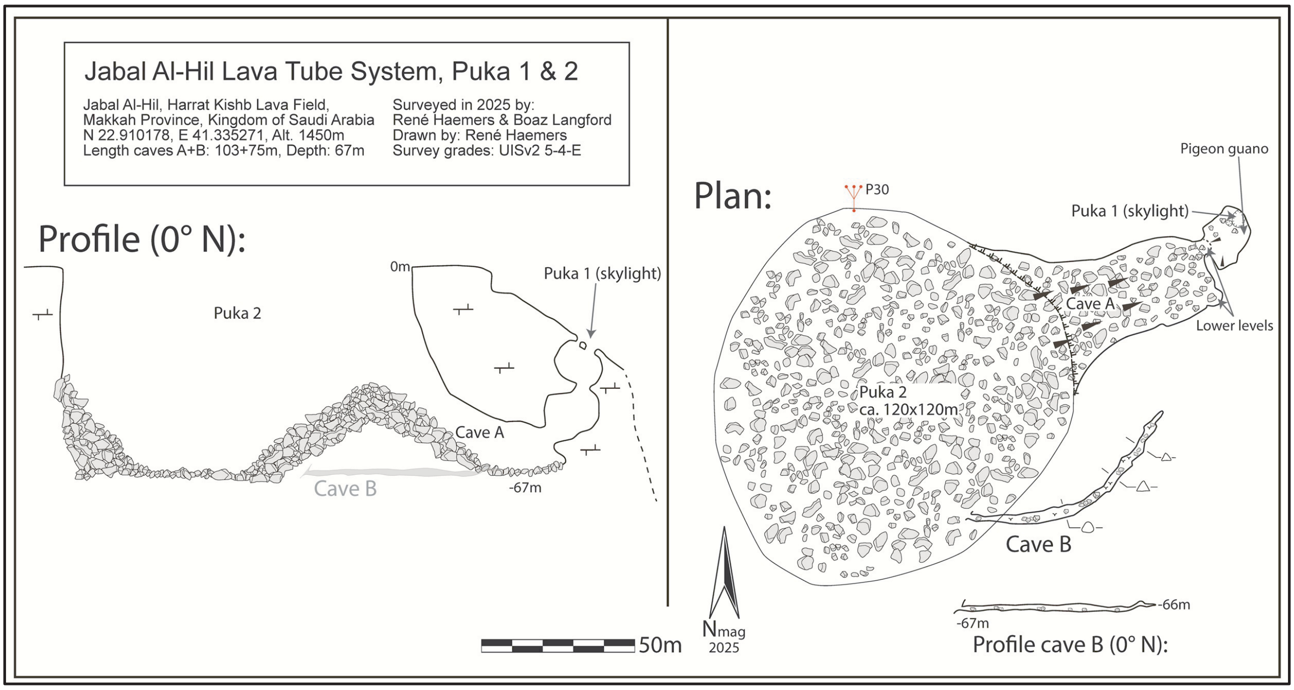


fig. 13: Jabal Al-Hil Lava Tube System, drawing of Puka 1 & 2;

Jabal Al-Hil Cave Puka 3 and Cave Puka 4 - 7

Lower down, at the base of the Jabal Al-Hil volcano near its southwestern flank, five entrances can be found. These were mentioned in Pint’s publications as Puka 3, 4, 5, 6, and 7.

Further downslope in the same southwestern direction, more entrances can be found, many of which can also be identified in satellite imagery. All of these entrances are aligned in a straight line and are associated with collapsed dolines or shaft - a key observation highlighted by John Pint and the Saudi Geological Survey (SGS) as evidence for the existence of a lava tunnel in the area. Some of the entrances reach depths of up to 27 meters, with large tunnel-like passages visibly extending from the surface. However, due to the fragile and unstable nature of the rock, as well as a likely lack of appropriate technical equipment at the time, the initial researchers were unable to explore these voids in detail.

explosions, and landslides, it is highly unlikely that there is still an open connection to the doline of Puka 2. Additionally, the slope is far too steep for inflation-formed conduits to remain open. A remarkable feature in the eastern cave passage is the presence of "Guanomites" (fig. 14a) - stalagmites formed from the accumulation of pigeon guano.

fig. 14a: C. Smith beside one of the Guanomites in Puka 3 east; picture by B.Langford

Another important find is the dried mummy of a Steppe Vulture (fig. 14b), which was found among the rocks in the inner part of this area of the cave. The mummy remained in place and was identified by photograph.

fig. 14b: Picture of the mummified Steppe Vulture in Puka 3 East; picture by B.Langford

At the far end, on one side, a faint current of fresh air even can be felt, suggesting limited airflow or unknown openings.

Above the entrance of the eastern cave tunnel, remnants of multilevel lava conduits (fig. 15) can also be observed, indicating a complex volcanic flow network.

On the west side of Puka 3 (fig. 16) lies the largest remaining section of the lava conduit. The inflating lava carved a tunnel here reaching a depth of 67 meters below the surface, ending in a collapse and a passage blocked by pāhoehoe lava.

Likely due to the intense pressure and heat near the lava source, a lava dome - probably gasdriven - formed at the tunnel's end. On the surface, a small doline can be found which is the result of the collapses of the underlying lava conduit between Puka 3 and Puka 4.

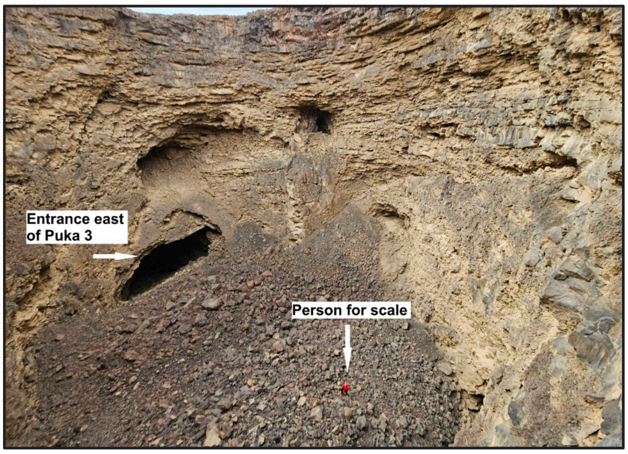


fig.15: Remnants of multilevel lava conduits above the entrance of Puka 3 east; picture by L. Smets

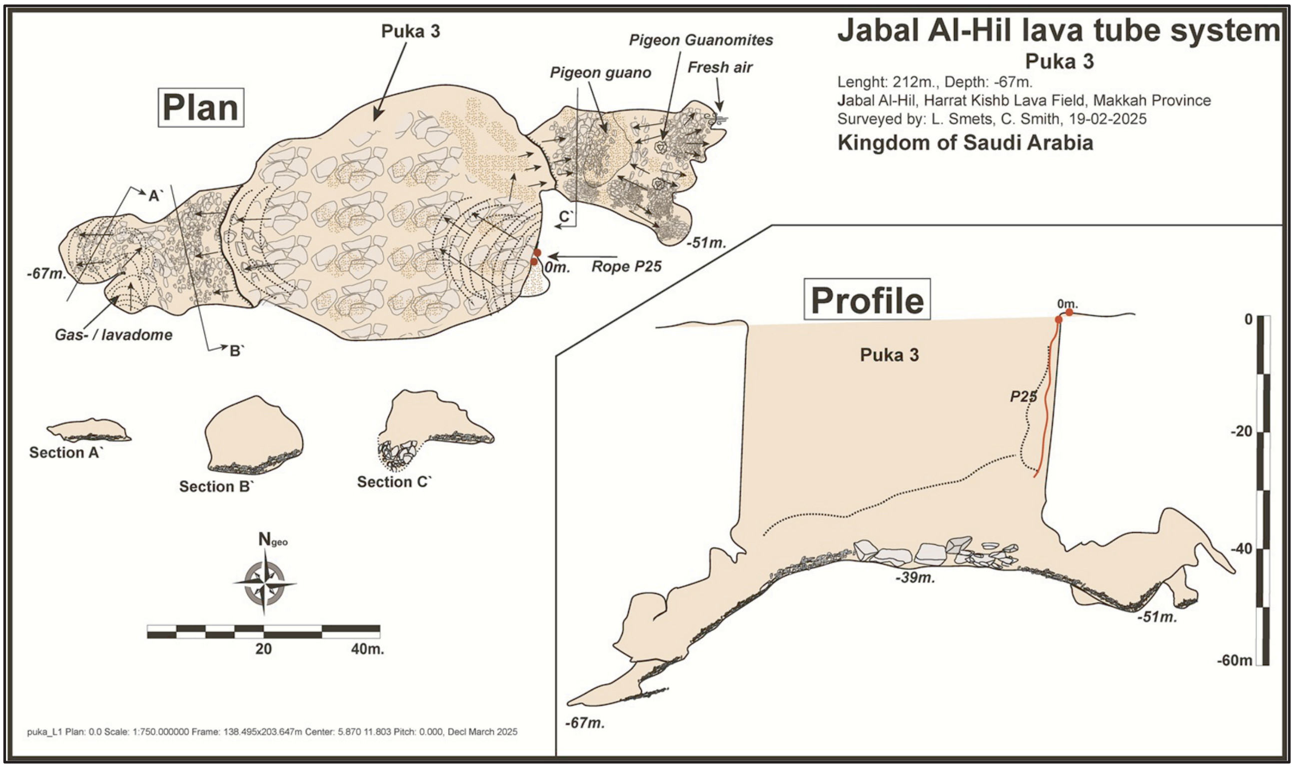


fig. 16: Survey of Jabal Al-Hil Puka 3 and its lava conduits

Cave Puka 4, 5, 6 and 7 are the entrances to the largest lava conduit (fig. 17 and fig. 31) at Jabal Al-Hil .

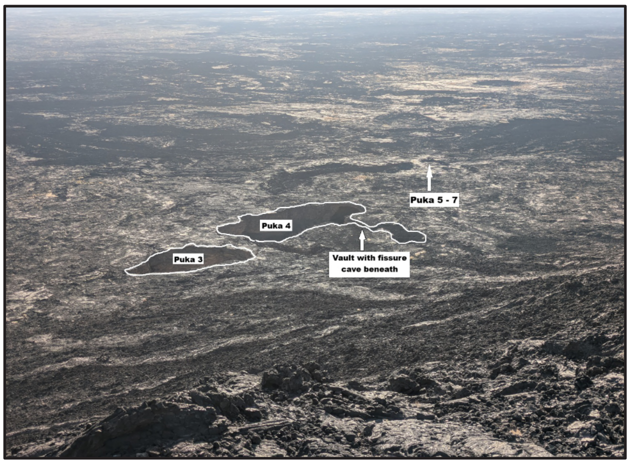


fig. 17: Aerial view of Puka 3 – 7; picture by M. Futrell

Puka 4 is apparently a cold puka (fig. 19), meaning that it is formed during a secondary stage of the cave's development. It consists of a massive collapse doline, measuring approximately 96 by 40 meters. On the north side, a vault is connected to the doline, visible on the surface for more than 20 meters in length. This vault covers a small, secondary fissure cave beneath, which extends about 10 meters underground and is small and unstable.

Through the vault, one can climb down into the doline (fig. 18), which leads westward over large collapse rocks into the largest lava conduit we have found at Jabal Al-Hil.

This massive, impressive conduit features a large entrance and a big tunnel that extends as an inflationary conduit into the volcanic rock below.

fig. 18: Doline and entrance of puka 4; picture by B. Langford

This part of the hypothetical Jabal Al Hil lava tube consists of a total of three cold pukas (Puka 4, 5 and 6), which are secondary developments characterized by large collapses underneath, and one warm puka, namely Puka 7, representing the primary development. For clarification: a warm puka is a vertical entrance to a lava conduit formed during the primary phase of volcanic activity.

The lava conduit extends for approximately 225 meters, with enormous dimensions - at some points measuring more than 30 meters wide and 20 meters high (fig. 23 and fig. 25) . From Puka 7 onward, which is the last entrance of this monotrunk conduit, the tunnel narrows but still maintains a height of over 20 meters. At around 225 meters from the entrance of Puka 4, the ceiling starts to come down and the cave ends a little beyond 400 meters in a warm, humid crawl way sealed by lava.

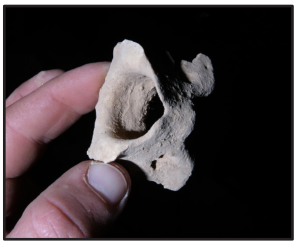
fig. 19: Entrance of Puka 4; picture by R. Haemers

Remarkably, no bats were observed in this cave. In a collapse at the entrance, within a void in the slope, dozens of mud nests can be found attached to the roof - likely built by the solitary blackmud-dauber wasp (Sceliphron. ref. Boaz Langford) (fig. 20).

fig. 20: Blackmud-dauber wasps near entrance of puka 4; picture by C. Smith

As this is one of the few dolines at Jabal Al-Hil that can be climbed down without the use of a rope, signs of wildlife activity were also observed, including evidence of living striped hyenas (fig. 22a,b,c). In addition, human activity has been detected inside the cave. A wooden stick, rounded and marked with cut marks, was observed respectfully left untouched in its original position. Nearby the entrance, several

wooden poles with artificially cut edges were also observed. In addition to the artificial cutting of the ends of the poles, their very presence indicates human activity, as there are no trees in the cave area, which requires the branches to be brought and inserted into the cave from a distance of hundreds of meters or even more than a kilometer.
A goat's head, without the rest of its skeleton, was found - likely brought into the cave by a shepherd (fig. 21).
More recently, pigeon hunters have been entering the doline, as indicated by spent cartridges scattered around the area.



Top left: fig. 21 Dominik holding a goat's skull at puka 4-7; picture by B. Langford
Top right and below: fig. 22a, b and c Remnant of striped hyenas in Puka 4; picture by B. Langford.

fig. 23:Rene in the tunnel Puka 3-7; picture by B. Langford

fig. 24a: The lowering of the tunnel Puka 6-7, viewed across the flat, lava-stagnating floor; picture by D. Verbruggen

fig. 24b: The lowering of the tunnel Puka 6-7; picture by B. Langford.

fig. 25: At the left Puka 6, at the right puka 5; picture by B. Langford

The reason for the tunnel ending so abruptly in a low crawl fig. 24a and 24b) must be sought in the blockage of the lava conduit. The last 100 meter of the tunnel features a smooth, flat floor with almost no slope, while the roof gradually dips downward at an angle of approximately 3 to 5 degrees, matching the surface slope angle outside. This suggests that the conduit became blocked during the last eruption - either by lava balls or simply by the cooling and solidification of lava at the tunnel's end. Puka 7 (fig. 27) appears to have functioned as an overflow vent (warm Puka) for some time as can be seen by the presence of a lava lake and several dykes surrounding the entrance.

fig. 26: Entrance of puka 7 with surrounding lava lake; picture by B. Langford

fig. 27: Shaft of warm puka 7; picture by B. Langford).

fig. 28: Feeders and drainage channels at lava lake feature 8 and 9; picture by M. Futrell

Lava lake/doline 8 and 9

The complexity of lava discharge from the volcano is evident in several features: the vertical shaft of Puka 1, the lavafall on the south to southwest flank of the volcano, and the lava lakes found on top of the inflationary conduit, aligned between several open cave remnants.

Several small caves, up to about 6 meters in length, can be found within the area. The vertical walls of the dolines show remnants of flowing lava in underground conduits as well as vertical movements of lava during the primary formation stage (ref. Stephan Kempe, oral sources).

fig. 29: Jabal Al-Hil main lava flow and north-south side flows caused by warm pukas-lava lakes, google earth, ref. S.Kempe

An example is Feature 8 and 9 (fig. 30) , a collapse of the remnants of lava conduits, feeders, drainage channels, and distributional pyroducts (fig. 28). These dolines are partly formed as a secondary collapse and partly as a primary sunken pāhoehoe lava lake caused by drainage of lava beneath the crust.

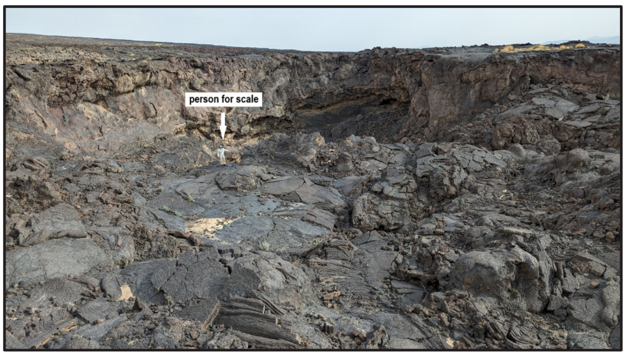


fig. 30: Andrea at the lava lake collapse feature 8 and 9; picture by M. Futrell

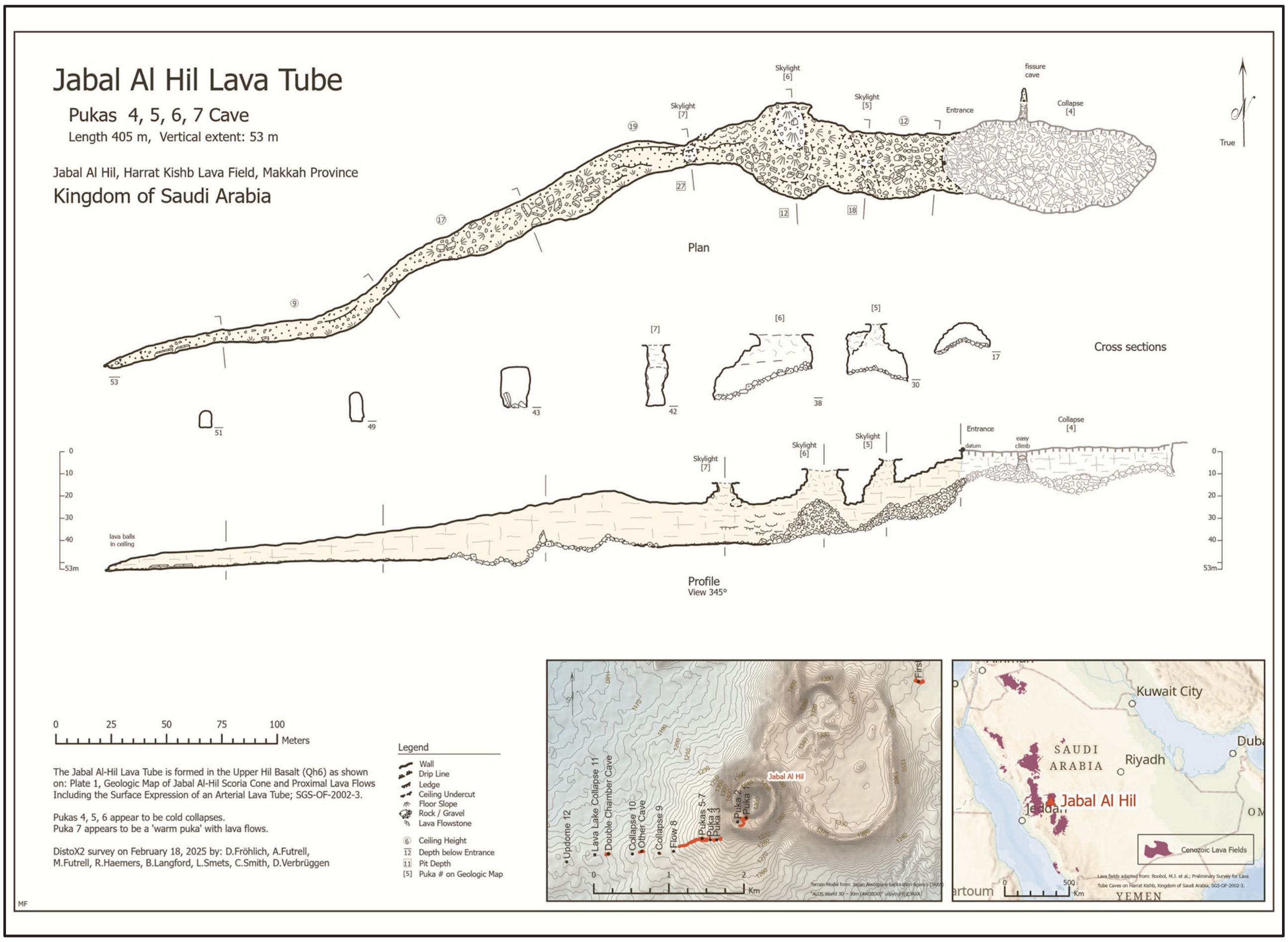


fig. 31: Survey of Jabal Al-Hil Lava Cave 3-7

Satellite images show us that at Feature 8 and 9, a lava overflow occurred from the underlying lava conduit. From the location of the dolines onward, pāhoehoe lava flowed downwards both north and south, in directions inconsistent (fig. 29) with the main lava flow, which is oriented east to west. Most likely, the lava lake functioned as a warm puka, where ponded lava from the conduit below flowed upward into the open air (ref. Stephen Kempe, oral sources).

The Other Cave

The Other Cave is likely a remnant of a larger lava conduit located deeper underground. This cave (fig. 32 and fig. 35) has a total length of 83 meters, including its doline, and reaches a maximum depth of 12 meters. Galleries can be found in east direction as well as in southwest direction. The floor throughout the cave is covered with large rocks, and the entire cave essentially consists of a massive collapse with remaining open spaces above. Inside the cave, a few bats from the family Rhinolophidae (horseshoe bats) (fig. 33) were observed. Additionally, some ibex horns - most likely from the Nubian ibex (fig. 34) - were found within the cave (ref. Boaz Langford).

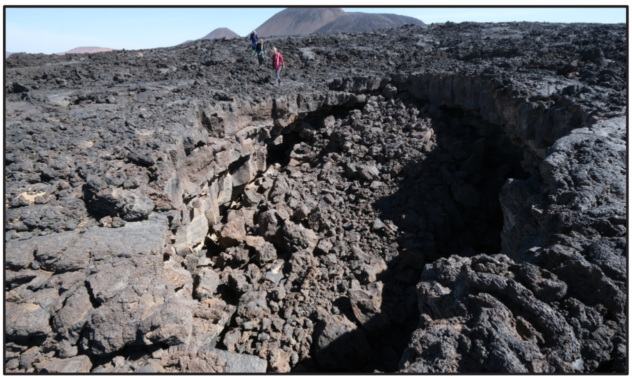


fig. 32: The Other Cave; picture by B. Langford

fig. 33: Horseshoe bat in The Other Cave; picture by B. Langford

fig. 34: Horns from a Nubian Ibex the Other Cave, picture by B. Langford.

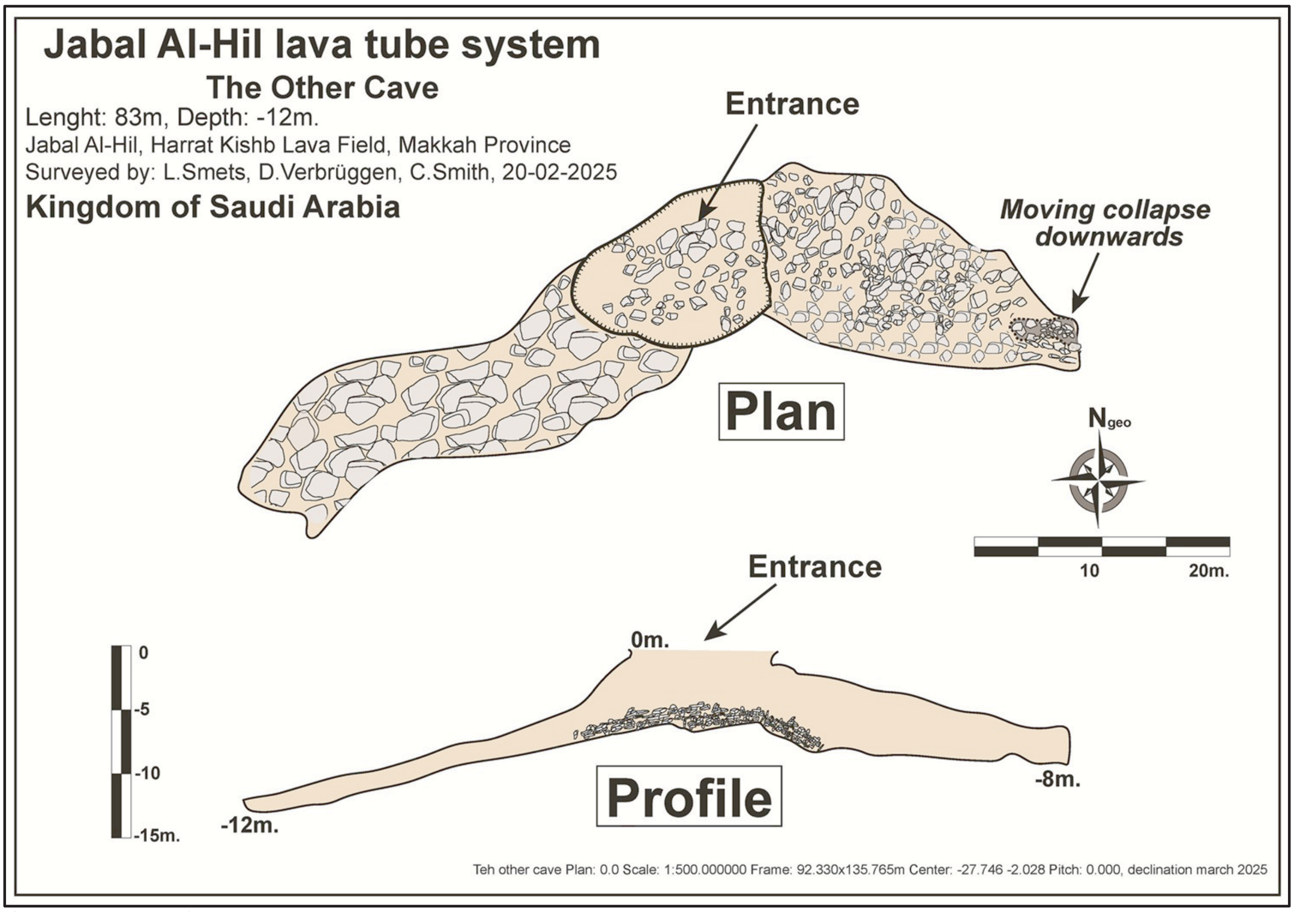


fig. 35: Survey of The Other Cave

Lava Lake 10

Feature 10 is another collapsed lava lake with enormous dimensions, approximately 65 by 80 meters (fig. 36).

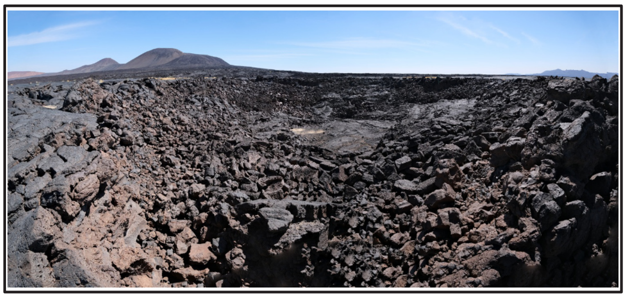


fig. 36: Lava Lake 10; picture by B. Langford

The center of the lake consists of sunken pāhoehoe lava, formed by the drainage of lava beneath the surface. This lake was most likely a former warm puka, functioning as an overflow vent from the large lava conduits below. Typical for this lake are the uplifted dykes (fig. 37) surrounding it. In some places, as is typical for drained lava lakes of this type, small low caves can be found following the circular pattern of the dykes However, it is unlikely that these caves have any (open) connection to the main conduit system underground.

fig. 37: Typical uplifted dykes at lava lake 10; picture by L. Smets

Double Chamber cave

Double Chamber Cave (fig. 38a) consists of two large chambers. The entrance chamber measures approximately 22 meters wide and 11 meters high, while the second chamber (fig. 41) is roughly 20 meters wide and 20 meters high. Like Feature 10, this puka was most likely a former warm puka that functioned as an overflow vent from the large lava conduits below. In this case, the lava later retracted

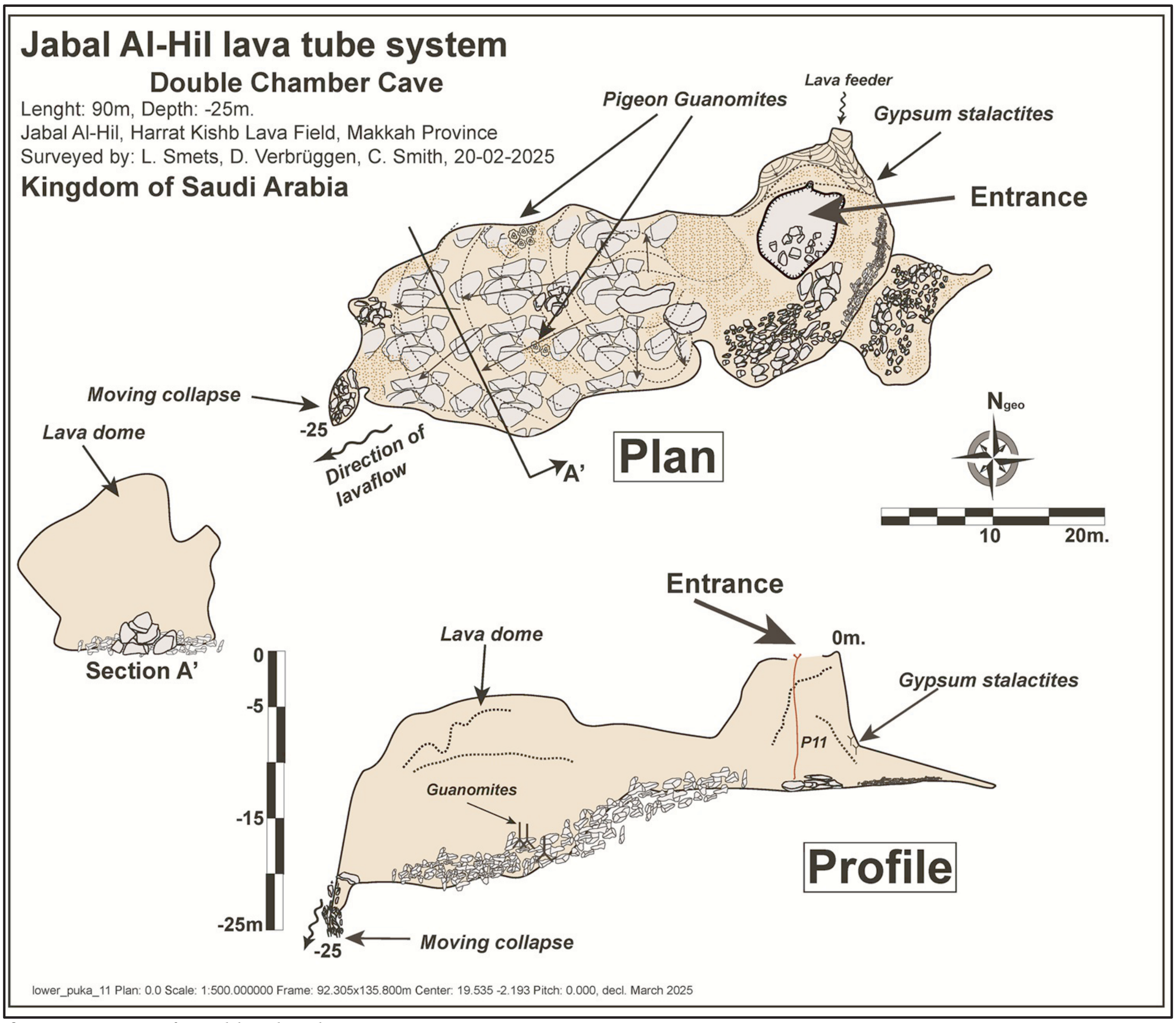


fig. 38a Survey of Double Chamber Cave

into the bigger lava flow beneath the cave. Subsequently, the roof and walls of the puka eroded and fractured, causing partial collapses. Double Chamber Cave extends for about 90 meters in length and reaches a total depth of 25 meters. A rope is required for a safe descent into the cave.

The entrance of the cave is surrounded by lava balls (fig. 38b and fig. 39), which normally are found at the base of the Jabal Al-Hil volcano. These lava balls were likely ejected during the overflow event from the large lava conduit beneath. The cave entrance is surrounded by pāhoehoe lava flows that clearly originated from this warm puka - flowing outward during the overflow stage and later flowing inward during the retracting stage of the underground lava flow. Satellite imagery shows a highly varied surface flow pattern in this area, inconsistent with the dominant east-west flow direction of the main lava field. Inside the cave, just beneath the entrance on the northeast side, a small lava feeder can be found entering from the surface. On its slope delicate white gypsum / calcite formations can be found, including stalactites.

fig. 38b: Double chamber cave including the Lava Balls; picture by Hejna

and a small pillar (fig. 43). Numerous black mud-dauber nests (fig. 42a and 42b) were also found inside the galleries, attached to the roof and walls. Additionally, several goat skulls (fig. 44) were found in the cave, likely animals that had fallen through the entrance shaft (fig. 40). These remains most likely belonged to male and female Nubian ibex.

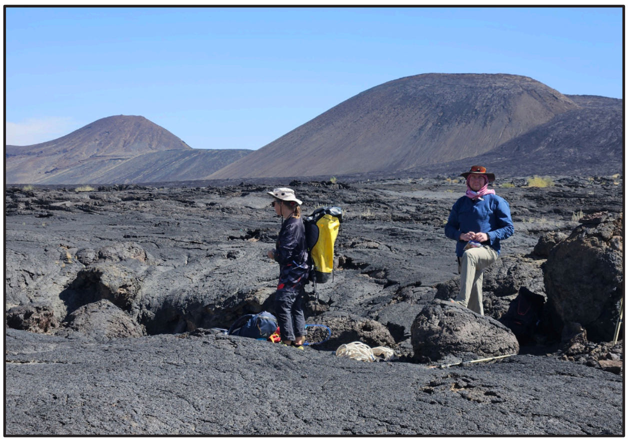


fig. 39: Entrance of Double Chamber Cave; picture by L. Smets

fig. 40: Double Chamber Cave, a probably warm Puka; picture by L. Smets.

fig. 41: The second dome of Double chamber cave; picture by B. Langford

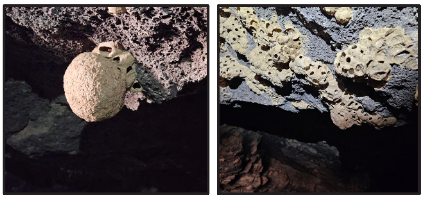


fig. 42a and 42b: Blackmud-dauber wasp nests in Double chamber cave; pictures by L. Smets

fig. 43: Pillar of gypsum-calcite picture by B. Langford

fig. 44: Male and female Nubian Ibex; picture by B Langford

Lava lake 11 and geological feature 12

Feature 11 (fig. 46) is one of the last obvious features that can be related to the subterranean lava conduit of the Jabal Al-Hil Volcano. It represents another collapsed lava lake, marked by a circular arrangement of uplifted/overflow dykes (fig. 46). In this particular case, the dyke is notably split open by a central fissure, giving it the appearance of a pressure ridge cave.

Some remnants of small, low caves can be found around the feature, but - as with similar features at other lava lakes - it is highly unlikely that these have any direct connection to the main underground lava conduit system. Like the others, this lava lake was most likely a former warm puka that served as an overflow vent from the larger conduits beneath. Satellite imagery reveals a clearly defined field of pāhoehoe lava extending both to the north and south, with flow

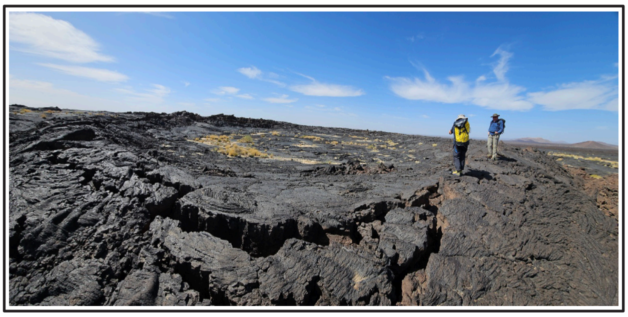


fig. 45: The fissure splitted dyke of Lava Lake 11; picture by L. Smets

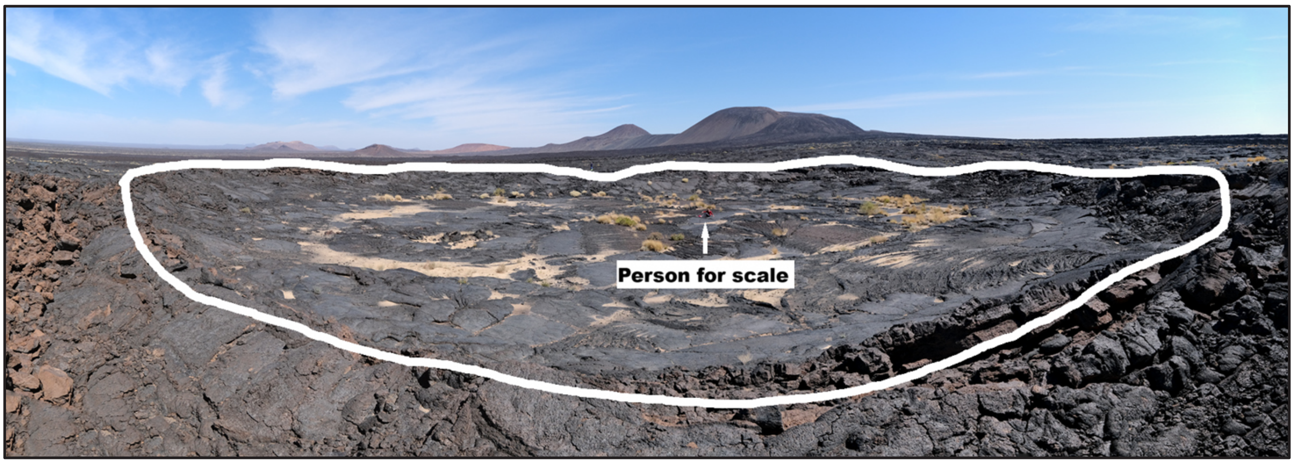


fig. 46: Lava Lake 11 with circular dyke; picture by B. Langford.

directions that are inconsistent with the dominant east–west flow direction of the main lava field. The dimensions of this lava lake are approximately 100 by 80 meters.

Geological feature 12 (fig. 47a) was also visited. The origin of this circular-shaped depression and collapse is likely related to activity within the subterranean lava conduit. Although it is not as clearly defined as the other lava lakes, it appears that lava also erupted here from below the surface, disrupting the surface lava flow (fig. 47b).

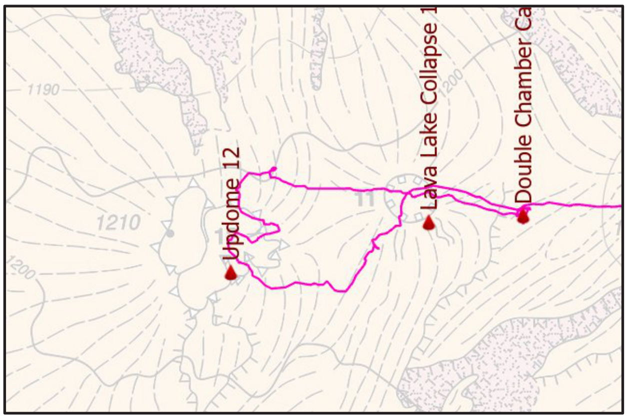


fig. 47a: Geological feature 12. The purple line shows one of the walking tracks, figure by M. Futrell.

fig. 47b: Feature 12 as a kind of updome with depression in the middle ; picture by M.Futrell

Conclusions

The eruption of the Jabal Al-Hil volcano was most likely a complex phenomenon. Initially, the crater developed as a classic shield volcano, where pāhoehoe lava accumulated in the crater before overflowing, creating a lavafall that cascaded from the top of the ash cone down into the valley. Subsequently, due to inflation, a conduit opened in the south-western flank - now known as the Jabal Al-Hil Lava Tunnel (fig 47c and fig 48) - causing the crater's lava lake to attain a new lowered level. (visible as a lava plateau-like rim within the crater, ref. Stephan Kempe oral sources).

The volcano appears to have erupted multiple times, as suggested by the extensive and long-lasting lava flows that resulted in substantial lava deposits (ref. Stephan Kempe, oral sources).

According to the hypothesis of Stephan Kempe (Oral Sources), at the final phase of the eruption a pit crater was formed named Puka 1, approximately 45 meters deep, most likely resulting from the collapse of the central magma vent. An immense pressure must have been exerted on the crater walls that can be observed on the surface between the doline of Puka 2 and the main Volcano crater. Here the pāhoehoe lava got uplifted and formed a dyke-like pressure ridge.

Notably, this ridge is situated precisely above the inflation tube that runs between the main crater and Puka 2.

The inflation conduit, formed on the southwestern flank of the Jabal Al-Hil volcano, gradually expanded its size and volume due to erosion, intense heat, and the pressure of lava flowing underground toward the valley. Further downslope, where the terrain becomes gentler, the high pressure of the subsurface inflationary lava from the summit caused the conduit to create surface outlets - known as warm pukas - through which lava was expelled. These outlets fed lava lakes that spread laterally across the flat terrain.

Eventually, the supply of lava through the intrusion conduit ceased, and the lava tunnel emptied out until the down-valley flow was blocked by collapses and lava balls. As a result, the section of the conduit between Puka 7 and Lava Lake 12 could not drain, causing the lava at the far end of Puka 7 to settle into a flat, stagnant lake.

The Other Cave and Double Chamber Cave are both likely remnants of collapses along the deeper sections of the main lava flow, the so called Jabal Al-Hil Lava tube.

The dolines and caves - some of which can be entered without the need of ropes - have been frequently visited in the past by both animals and humans. Notably, pigeon hunters seem to be active in the area, as evidenced by the large number of spent bullet cartridges scattered around and inside the dolines.

Animal skulls, bones, and wooden sticks likely used by humans have been observed during visits to the caves. Additionally, bats, geckos, and wasp nests have been sighted. These findings suggest that the cave sites may hold significant anthropological, archaeological, and paleontological value.

Notice: None of the artifacts were removed from the caves. Everything was left in place, and the evidence here is based solely on observations and photographs.

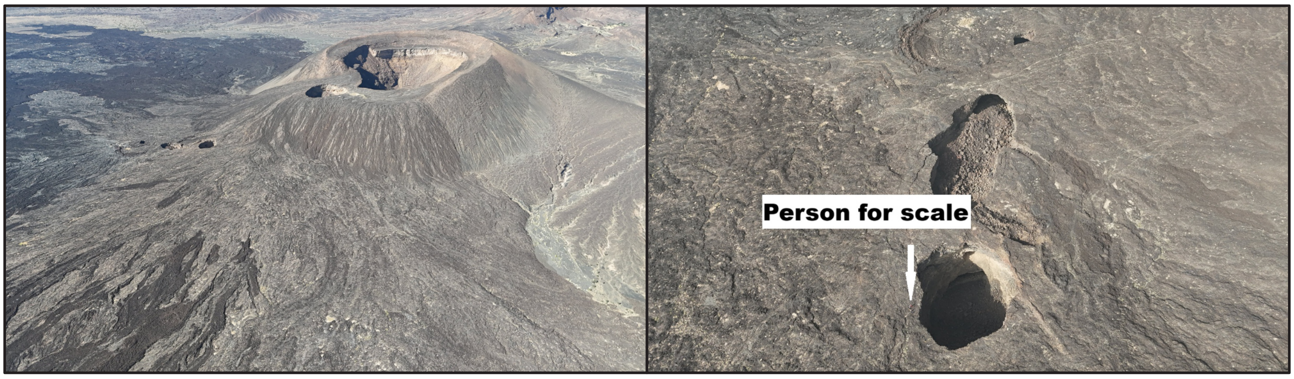


fig. 47c: Left, The Jabal Al-Hil Volcano; Right, one of the Puka's of the Jabal Al-Hill Lava Tube System; Drone Pictures by D. Fröhlich

fig. 47d: Picture of the 8 Team members and 3 guests 2025; picture by B. Langford

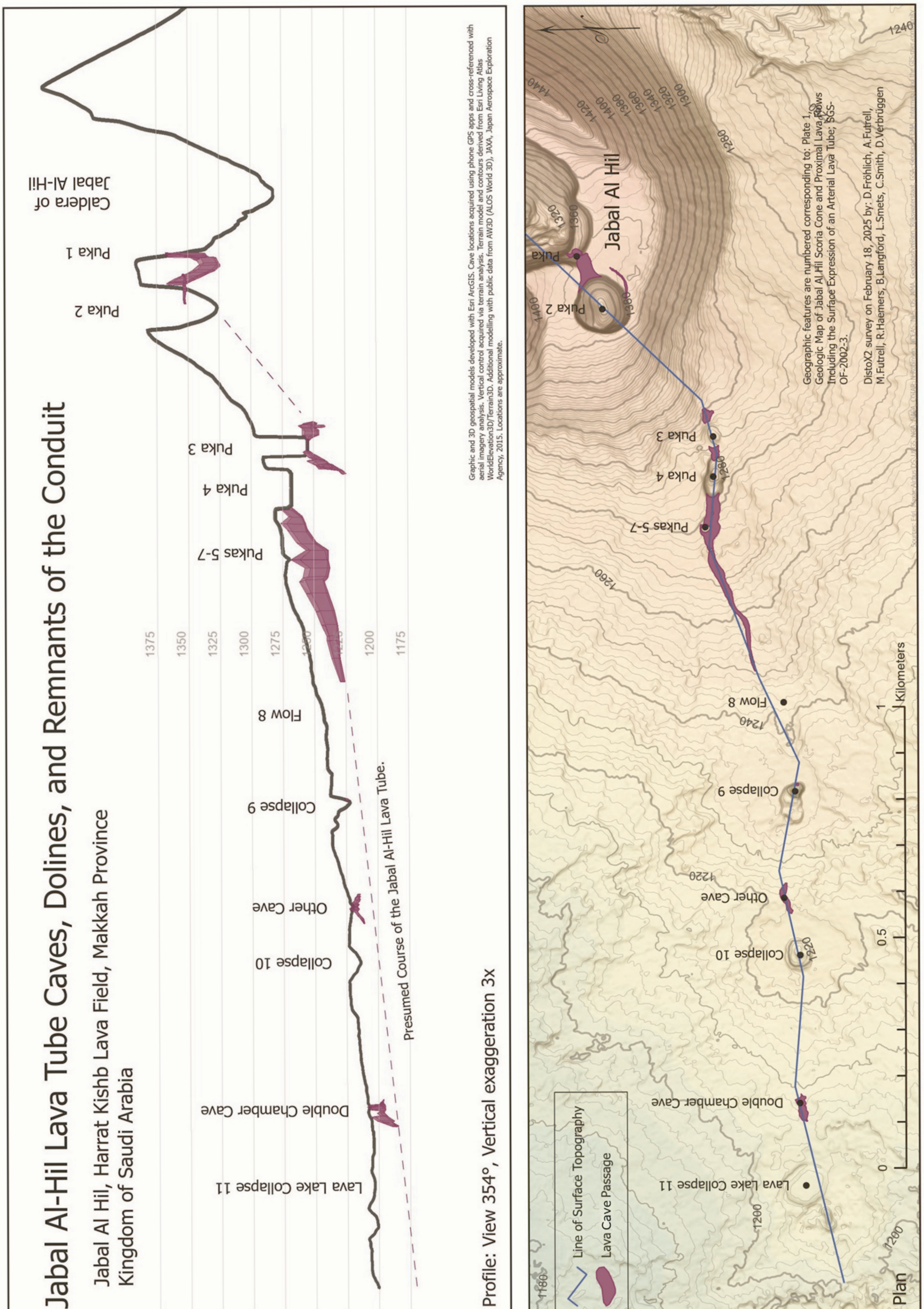


fig. 48: Profile of the volcanic caves at Jabal Al -Hil and the hypothetical course of the Jabal Al-Hil lava Tube

Jabal Al-Hil, the West to East lava flows

Harrat Kishb is a volcanic field characterized by numerous clustered volcanoes. To our knowledge, not all these features have official names and are instead identified by categorical designations known as subunit numbers.

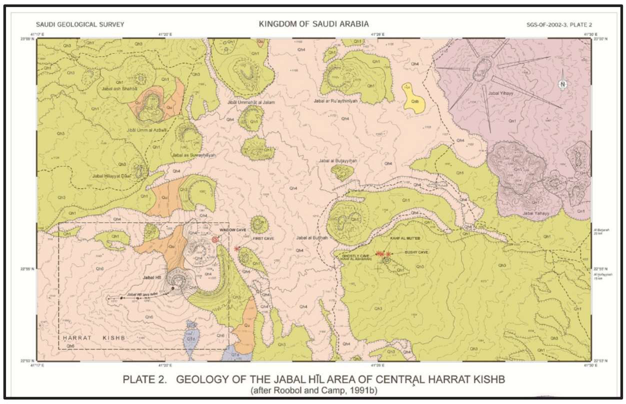


fig. 49: Subunit numbers of geological sections east of Jabal Al-Hil ref. Roobol and Camp 1991

East of the highest peak of the Jabal Al-Hil volcano another shield volcano can be found, designated subunit Qh4 (fig. 49). This feature consists of an enormous, broad, flat-floored structure enclosed by a dyke-like crater rim, with dimensions of approximately 1.9 km by 2 km. From this volcano a lava flow started flowing down into south-east direction partially developing subsurface voids and lava conduits. In these southeastern lava fields, at least five lava caves were documented by the team of John Pint and the Saudi Geological Survey (SGS). The first of these, located on the eastern slope of volcano subunit Qh4, is known as Window Cave - a very small erosional lava cave that was not visited by our team (Roobol et al., 2002; Pint and Pint, 2005).

First Cave

The second cave within subunit Qh4 is referred to by Roobol and Pint as “First Cave” (fig. 55). It is located on a locally steep slope of pāhoehoe basalt lava. At the time of its discovery, the cave was expected too dangerous to explore due to an unstable, overhanging entrance shaft approximately 13 meters deep (fig. 50a).
One of the objectives of the 2025 tour was to resolve the mystery surrounding this cave by making a survey and exploring its lava conduit

Access to the shaft is possible via a small feeder lava flow that pours into the main pit. From this point, a 12-meter free descent leads to the collapsed cave floor. The lava conduit extends

fig. 50a: Entrance shaft of First Cave; picture by L. Smets

to 232 meters in length and reaches a total depth of 19 meters.

The cave interior is very dusty, with no clear lava flow features visible - likely due to extensive erosion and dust filling. Bats were observed at several locations, and bones were found scattered across the floor, indicating that the cave may act as a natural trap for animals falling through the entrance shaft.

fig. 50b: View on a gallery with Guanomites in First Cave; picture by B. Langford

In one of the galleries, at least six skulls were found, including those of a female and male Nubian Ibex and several smaller animals. The remains also include the skull and a mummified skeleton of a Caracal (Caracal caracal), a medium-sized wild cat, as well as the skull and partial skeleton of an Arabian Leopard (Panthera pardus nimr) (fig. 51 a - d).

Additionally, a beetle from the genus Sepidium - belonging to the Tenebrionidae family (darkling beetles) - was found within the cave (ref. B. Langford) (fig. 52).

The cave appears to be heavily used by pigeons,

Top and left: fig.51a-d, partial skeleton of an Arabian Leopard; pictures by B. Langford

Down right: fig. 52, view on a darkling beetle found in First Cave; picture by B. Langford

as can be observed by a thick layer of guano dust covering much of the floor and the widespread presence of Guanomites (guano-associated stalagmites) (fig. 50b and fig. 53).

Evidence of human interaction related to pigeon hunting is also present, particularly in the form of discarded shot gun cartridges (fig. 54) found outside the cave entrance.

Approximately 6 kilometers further southeast, more lava caves can be found within the lava flows that originated from the scoria cones in subunit Qh1 of the Jabal Al-Hil basalt lava field.

These caves are situated in subunit Qh3 and include three notable sites:

- Kahf Al Mut'eb (length: 150 meters, depth: 6.5 meters)
- Ghostly Cave, also known as Kahf Al Ashbaah (length 2025: 350 meters, depth: 8.5 meters)
- Bushy Cave (length: 13 meters)

All three caves were originally described in Roobol et al., 2002 and Pint & Pint, 2005.

fig. 53: Marketa aside of the Guanomites in First cave; picture by B. Langford

fig. 54: Discarded cartridges near the cave entrance of First cave; picture by B. Langford

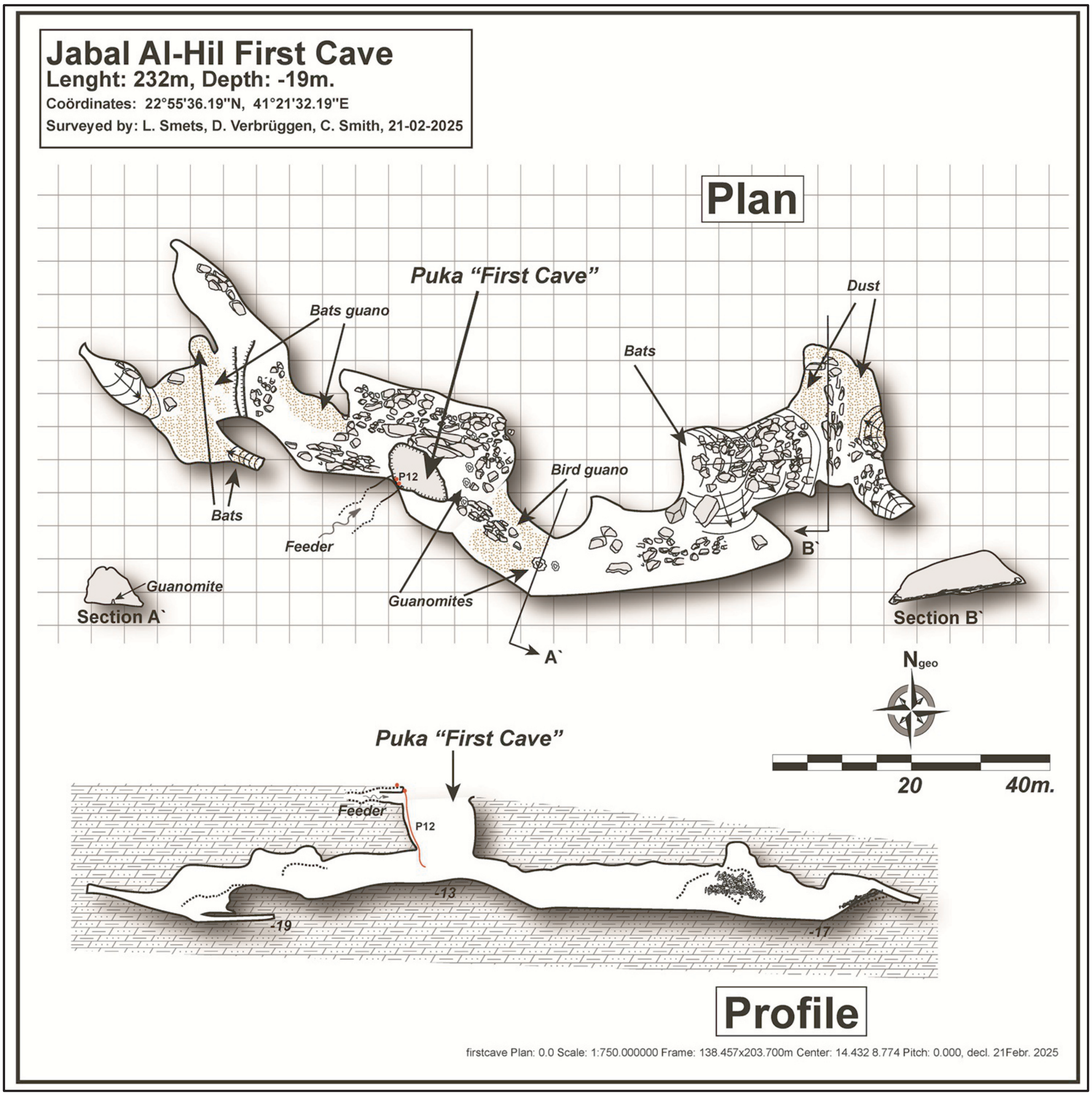


fig. 55: Survey of First Cave

Ghostly cave or Kahf Al Ashbaah

In Ghostly cave (fig 56a and 57) an unexplored gallery was left behind according to the publications, 3m. high up in the roof, residence of a bat colony (fig. 58). During the 2025 expedition, this gallery was accessed and surveyed while the bats were out early evening, revealing an additional 30 meters of passage. This discovery extends the total known length of Ghostly Cave from 320 to 350 meters (fig. 56b).

Notably, the floor of the bat roost was covered in 20 to 30 centimeters of dense, bats guano dust.

fig. 56a: Entrance of Ghostly Cave; picture by L. Smets

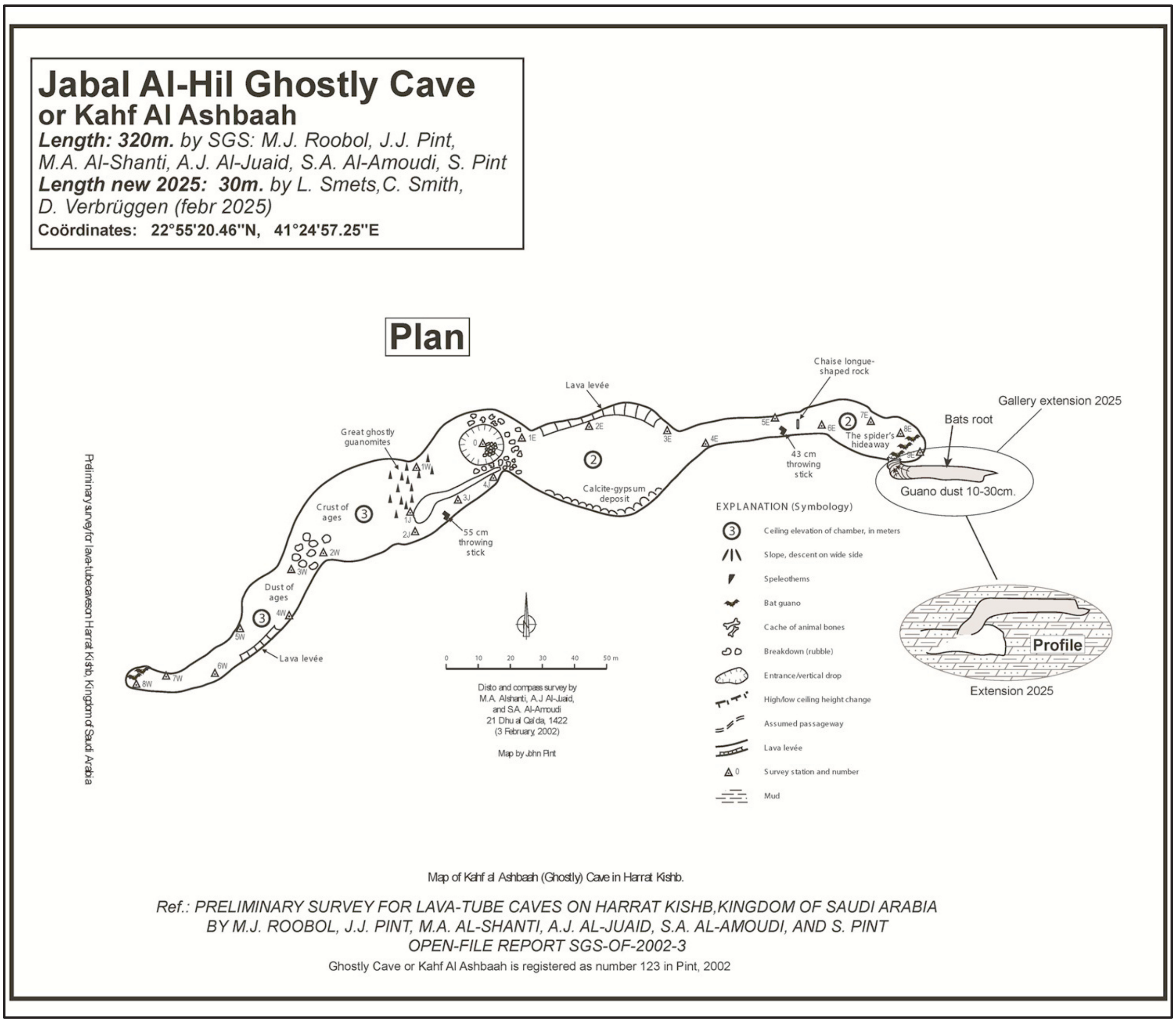


fig. 56b: Survey of Ghostly Cave showing the new gallery 2025

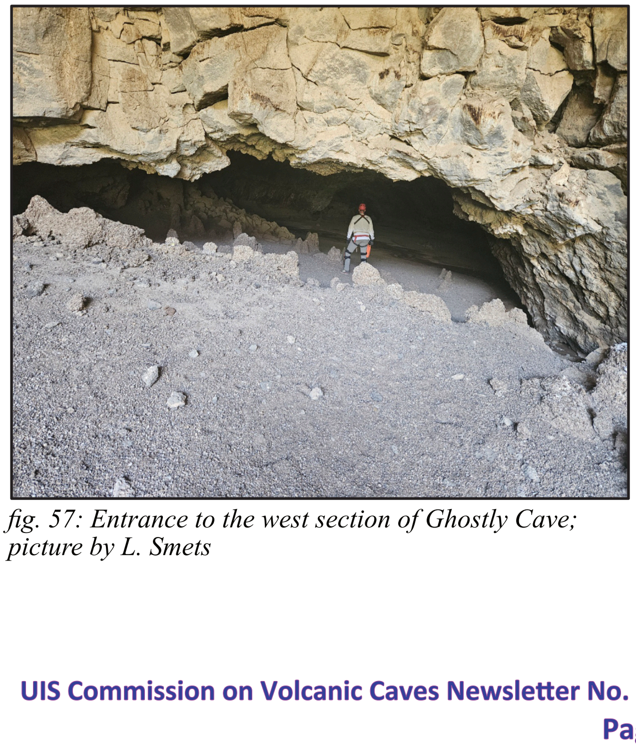


fig. 57: Entrance to the west section of Ghostly Cave; picture by L. Smets

fig. 58: Balcony into the 30-meter extension gallery of Ghostly Cave; picture by L. Smets

Kahf Al Mut'eb

Water collection cave in the dessert
(length: 150 meters, depth: 6.5 meters)

This cave is not surveyed during the reconnaissance trip in 2025.

John Pint and SGS offered allready in 2002 a detailed account of this cave in their publication: "Preliminary survey for lava-trube caves on Harrat Kishb, Kingdom of Saudi Arabia, 2002, by M.J. Roobol, J.J. Pint, M.A. Al-Shanti , A.J. Al-Juaid." .

The reason this cave is highlighted in this report is that an important fact was previously overlooked: it is actively used for collecting water.

For most of the year, pools of water can be found at the end of the cave, and these are used as a water source. Throughout the cave, empty plastic water bottles are scattered, indicating that the site is still regularly visited for this purpose.

Unlike other volcanic desert areas in Saudi Arabia, water is very rarely found in the Harrat Kish volcanic region. To the best of current knowledge, this is the only cave where water can be found almost year-round.

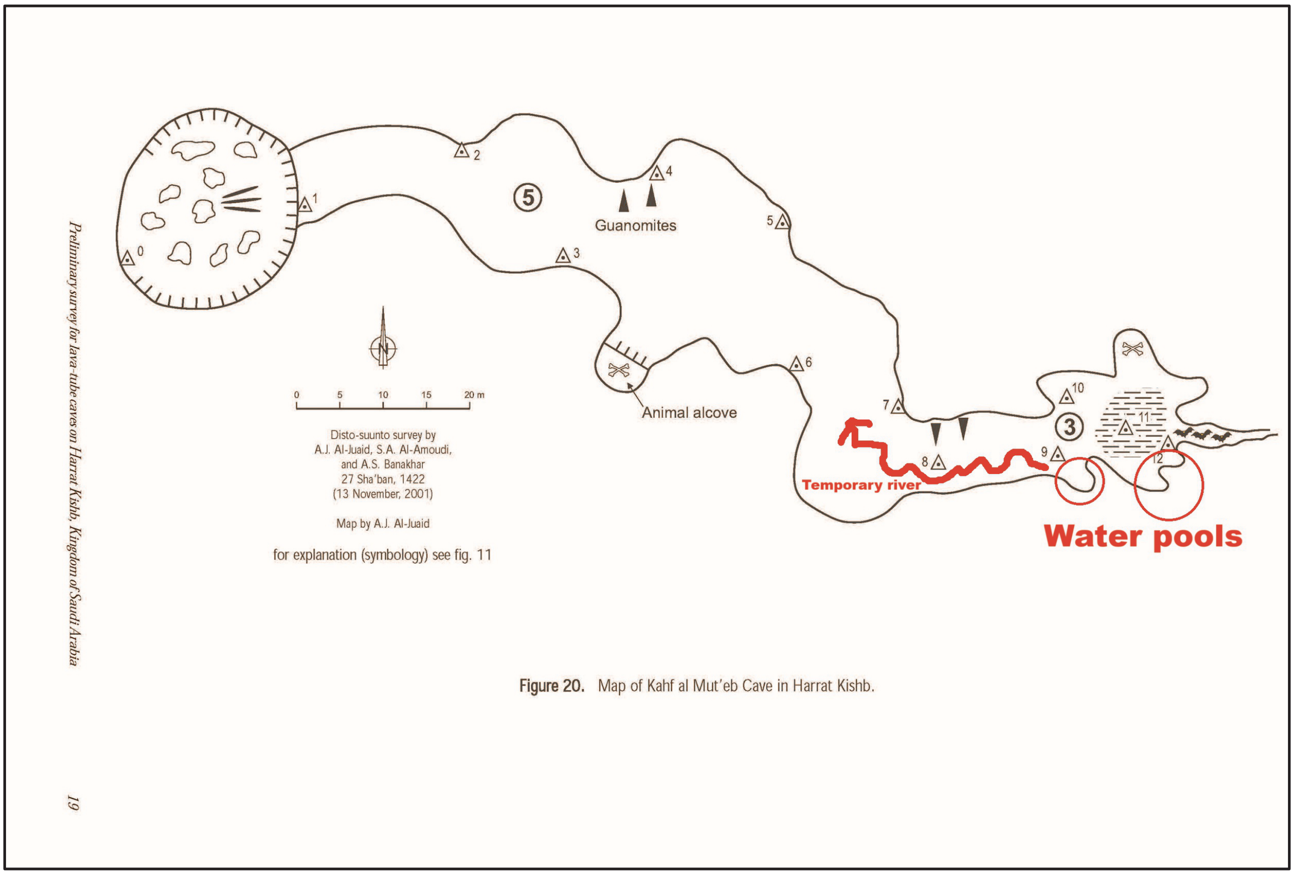


fig. 59: Survey of Kahf Al Mut'eb showing the water pools

fig. 60: The end gallery of Kahf Al Mut'eb with a small waterbed on the left; picture L. Smets

fig. 61: The water pools at the mud-blocked end of Kahf Al Mut'eb; picture by L. Smets

SURVEYED CAVES DURING THE 2025 INTERNATIONAL TOUR TO HARRAT KISHB, SAUDI ARABIA				
NAME	**VOLCANIC AREA**	**PROVINCE**	**LENGTH (meters)**	**DEPTH (meters)**
Jabal Hill lava Caves:				
First Cave	Harrat Kishb	Makkah	232	19
Gohstly cave extension	Harrat Kishb	Makkah	30	5
Jabal Al-Hil Puka 4,5,6 and 7	Harrat Kishb	Makkah	405	53
Jabal Al-Hil Puka1 and 2	Harrat Kishb	Makkah	178	67
Jabal Al-Hil Double Chamber cave	Harrat Kishb	Makkah	90	25
Jabal Al-Hil The Other Cave	Harrat Kishb	Makkah	83	12
Jabal Al-Hil Puka 3	Harrat Kishb	Makkah	212	67
	Total		**1230**	

fig. 62: List of the caves surveyed in the Harrat Kishb Vulcanic area ,
Saudi Arabia 2025

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Fig. 63. 4 x overview in the area of Jabal Hil. . All pictures by B. Langford