15th INTERNATIONAL SYMPOSIUM on VULCANOSPELEOLOGY AMMAN, JORDAN.

John Brush

A small and dedicated group of lava tube enthusiasts* met in Jordan during March this year for the 15th International Symposium on Vulcanospeleology.

There were just 14 foreigners who took part in all the formal symposium sessions and excursion activities but they were supported by a strong contingent of locals. Australia was well represented with 4 participants (Julia James, Greg Middleton, Marjorie Coggan and John Brush).

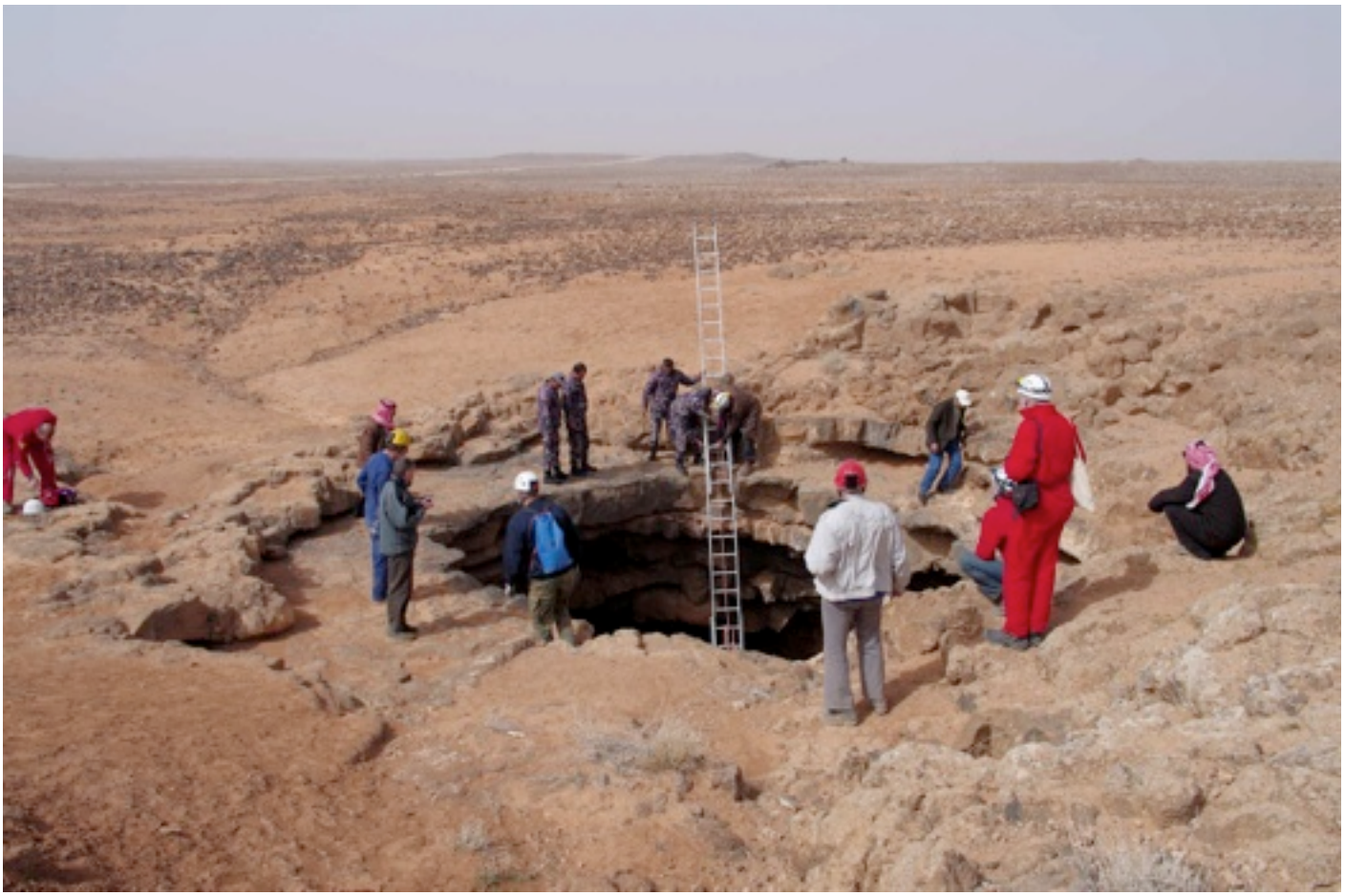
Despite initial communication headaches – and even concerns about whether the Symposium would actually take place, participants were somewhat relieved to discover upon arrival in Jordan that there was indeed a symposium, that there would be a day excursion to northern Jordan, that the promised four day field trip had been organised, that superb meals were covered by the registration fee and that accommodation bookings had been made, even if wasn't at the location or price that had been agreed on a couple of weeks earlier. Putting aside a few frustrations, everyone appeared to have an interesting and enjoyable time and just about everything that the organisers said would happen, eventually did - and then some.

The Symposium venue was on the campus of the Hashemite University near the city of Zarqa to the northeast of Amman and a 40 minute journey from our accommodation in Amman. Over the 3 days of presentations, participants gained new insights into lava caves - and their use by humans and other animals - from areas as diverse as Jordan and other Middle Eastern countries, Hawaii, Kamchatka, Japan, Korea and continental USA. There were also a couple of interesting papers on the Yarmouk-Decapolis water supply tunnels of northern Jordan. The tunnels, totalling some 140km in length, were excavated by the Romans about 2000 years ago to supply a number of cities in the area.

Left: Auditorium filling for opening session of Symposium.
Right top & bottom: Harry Marinakis (USA) in the Roman-built Yarmouk-Decapolis water tunnel system.

Each day the formal sessions ended with a (very) late lunch and afterwards, everyone hopped onto the bus for some late afternoon/ early evening sightseeing en-route to dinner or our hotel. The day excursion to northern Jordan provided an opportunity to explore a short section of the Yarmouk-Decapolis water supply tunnel system. These tunnels were excavated through chalk and soft limestone and originally had inclined access shafts every 30 to 100 metres. Many of the access shafts are now blocked, or have collapsed, thus breaking the system into sections and in places damming seepage waters to create long lakes. The tunnels contour around valley sides 5 to 15 metres below the surface and are generally 1-1.5 metres wide and 2-2.5 metres high. In cross section, the shape of the tunnel varies frequently, apparently reflecting the preferences or whims of the original digging teams. Their pick marks remain to this day on the roof and walls. In the section of tunnel we visited, secondary calcite speleothems are common and range from small straws, stalactites and flowstone wall coatings deposited sub-aerially to layers of crystalline calcite that precipitated from the water as it flowed along the tunnel.

For the four day field trip we squeezed into five twin-cab 4WD utes and bounced around in the rocky lava deserts of the Harrat in eastern Jordan. The Jordanian Harrat covers an area of approximately 12,000km^2 and makes up roughly 25% of the Harrat Al-Shaam, the largest volcanic plateau on the northwest Arabian plate, which extends from Syria across Jordan and into Saudi Arabia. The lavas apparently result from three major volcanic events dating back to the Oligocene (26 Million years - Ma). The most recent event (7 Ma - 0.4Ma) is the one of most interest to vulcanospeleologists. To date, 23 lava tubes (or pyroducts, as some would prefer to call them) have been explored, the longest of which is about 1 km. During the field trip, participants visited about 6 caves, including the three longest. Most of the caves that we visited contained significant amounts of sediment – the result of loess (wind-blown silt) being washed into the caves. This meant that exploration often involved a lot of crawling along low, dusty passages. In only one cave (Hashemite University Cave) did we see extensive areas of the original lava floor. On the other hand, small lava speleothems were reasonably common, and in two caves, there were deposits of secondary calcite and gypsum.



Local Civil Defence staff using their long extension ladder to help delegates gain access to Al Badia Cave.

Clockwise from above:
Enduring the dust in Azzam Cave.
Ambling along in Al Badia Cave, the second longest and most spacious lava tube in Jordan.
Max Dornseif (Germany) admiring calcite and gypsum encrustations in Kempe Cave
Walking across the barren basaltic landscape of the Jordanian Harrat.
Marjorie Coggan with a selection of camel bones in Al Fahda Cave.
A high-roofed section of low passage in Al Fahda Cave, the longest known lava tube in Jordan.

In our first cave we were given a practical demonstration on how to use a "Bedouin light" which we were informed is commonly used by the locals. Step 1, from the rubbish in the cave, select a convenient length of black polythene irrigation pipe; Step 2, apply heat to one end of the pipe from the cigarette lighter that is always in your pocket; Step 3, upon ignition, hold the pipe aloft making sure it is angled to avoid molten plastic dropping onto your hand; Step 4, cough your way into the cave as you peer through the acrid cloud of black smoke.

Many of the caves in Jordan have been modified by human activity or by animals. Some caves are used by Bedouin shepherds for storage or as shelter for sheep and goats. One cave contains what appears to be an ancient monument, or perhaps an altar. However, perhaps the most striking modification of the caves has been by hyenas (the Arabian Striped Hyena, *Hyena*

hyena, which is now quite uncommon in Jordan). In one cave (Al Fahda) we saw hyena dens, or sleeping hollows, excavated into the silt floor and at one end of the cave it looked like hyenas had burrowed into the silt fill as if attempting to extend the length of the cave. At that point it is about 300m of low crawling from the nearest entrance. Mammal bones, and especially camel bones, are common and most of these are thought to result from hyenas dragging food into caves so that they could consume it at their leisure. The number of camel skulls, leg bones and vertebrae lying a considerable distance along low passages was quite astounding. The thought of a small hyena dragging a dead camel along a 40-50cm high passage is mind boggling, and only slightly less so if one thinks in terms of the camel carcase first being chomped into pieces. Hyenas also appear to navigate their way across boulder piles in complete darkness as we saw scent marking stains at regular intervals across the rocks. Perhaps it could be claimed that hyenas are the supreme cavers of the animal world.

Back on the surface, we found the time to look at Jawa, the ruins of a bronze-age city built from large basalt boulders; Qasr Burqu, the most easterly known Roman fort, constructed from expertly shaped basalt blocks; and at a 'desert kite'.

Kites are long converging lines of piled stones with circular stone structures at or near the convergent end. They were first observed from aircraft in 1925 and have in recent times been studied in detail by a number of archaeologists and also by eminent German geological researcher and keen vulcanospeleologist, Professor Stephan Kempe, who was one of the participants in the Jordanian symposium. The structures have been called kites because when observed from above, they look like kites with a long tails. Using Google Earth, Stephen has identified well over 500 kites in the Jordanian Harrat, plus a couple hundred more in Saudi Arabia. A further 400-odd were recently identified in Syria by another researcher. Most kites are oriented so that the narrow end, or apex, is to the northwest and many kites appear to be linked across the landscape. They are thought to be animal herding and trapping structures. Stephen postulates that they were most likely built in early Neolithic times to intercept gazelle as they migrated north towards Syria and the Mediterranean coast. A typical kite has several guiding walls each several hundred metres long and a circular structure at the apex 50-150m across. He has estimated the total length of wall structures in Jordan as being as much as 3780 km, representing a stone volume equal to about half that of the pyramid of Cheops, and in aggregate, making them one of the largest ever man-made structures.

After the field trip we returned to Amman and the following day most delegates made their way to the justifiably-famous Petra and a few of us then went on to the superb desert landscapes of Wadi Rum in southern Jordan. It was a fitting end to our brief Jordanian sojourn.

* Read members and supporters of the International Union of Speleology Commission on Volcanic Caves

Top: Google Earth Image of a desert kite.
Bottom: View along the remains of a wall of a desert kite.