

ICELAND – 2002

10th International Symposium on Vulcanospeleology

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ABSTRACT

The IUS Commission on Vulcanospeleology's 10th International Symposium held at Reykjavík, Iceland, September 2002, is reported on, including field trips to Leiðarendi lava cave, Tintron hornito, Geysir geothermal area, Árnahellir lava cave and Surtshellir, Stefánshellir and Viðgelmir in Hallmundarhraun lava flow. There was a cross-island post-conference excursion to the Myvatn region and the Krafla geothermal area (visiting the impressive ice-adorned Lofthellir), following which the author participated in a trip to lava caves of the Snæfellsnes peninsula which included visits to Borgarhellir and Vegamannahellir.



The 10th international meeting of people interested in lava tube caves and associated volcanic features was held on the north Atlantic island of Iceland, based in the capital, Reykjavík. (The name means 'smoky bay', reflecting the volcanic activity in the area when it was established in AD 874.) The meeting was hosted by the Hellarannsóknafélag Íslands (Icelandic Speleological Society, ISS), in cooperation with the Nordic Volcanological Institute, the National Energy Authority, the University of Iceland, the Icelandic Institute of Natural History, the Nature Conservation Agency – and the Icelandic Parliament! (or Alþing – pronounced 'Althing' – which proudly claims to be the world's oldest).

Attendance, at just over 30 (+ some spouses), was small, especially considering the closeness of the venue to continental Europe. Most remarkable was the overwhelming representation from Australia (John Brush, Marjorie Coggan, John and Jeanette Dunkley, Ken and Janeen Grimes, Julia James, Ruth Lawrence, David Wools-Cobb and the author). There were 6 locals and 6 from the Azores (who had a particular interest because they proposed to host the next symposium), 3 from the UK and Japan, 2 from the USA and one each from Switzerland, Italy, Saudi Arabia and the Netherlands (Photo 1). The organisation was faultless and the weather, better than might have been expected. It goes without saying that prices were normal for Iceland: outrageously high, though the impact on us was minimised thanks to the local organisers.

THE SYMPOSIUM

The meeting commenced on 10 September with an excursion around the local Reykjanes Peninsula (see below), the first presentation of papers occurring on 11th, following the opening by Sigurður Jónsson ('Siggi'), chair of the ISS. Dr Kristján Sæmundsson, an eminent authority on Icelandic geology, gave the opening presentation on the volcanic geology of the island. Other papers were by Dr Bill Halliday - What is a lava tube?, on the caves of the Great Crack of Kilauea and (for D. & H. Medville) on the lava caves of the north flank of Mauna Loa; Dr Julia James, on air quality in lava caves; Ruth Lawrence, on vulcanospeleology as tourism in Samoa; Arni Stefánsson, on the history of lava cave preservation in Iceland, the topography of the lower Hallmundarhraun and on five vertical conduits in Iceland (including Þríhnúkagígur, the world's deepest); Chris Wood reported on his remote-sensing of lava tubes in the Hallmundarhraun and recent successful expeditions to the Laki flow field of south Iceland (see Middleton & Kiernan 2002); Tsutomu Honda, on lava stalactite formation in hollow tree moulds of Mt Fuji and discharge mechanisms of lava tubes; John Pint presented Mahmoud Alshanti's paper on geology of Harrat Kishb, Saudi Arabia, in relation to formation of lava tubes and his own on the lava tubes of Harrat Kishb; Ken Grimes on subcrustal drainage lava caves in Victoria and a small cave in a basalt dyke at Mt Fyans, Victoria; Francesco Petralia on the submarine growth of a lava tube at Ustica Island and on



Fig. 1 – Iceland, showing places visited during Xth International Symposium.

Mt Etna's Grotta dei Rotoli; João Nunes on education at Carvão Cave, Azores; Paulino Costa on the opening of the Gruta des Torres, Pico I., for tourism; João Constância on a database and classification system for Azorean volcanic caves and (with others) on ranking Azorean caves based on geological, biological and conservation attributes; James Begley on a new database on Icelandic caves; Jakob Guðbjartsson on "hyalocaves", a new type of small volcanic cave; Sigurður Jónsson on the history of the mapping of the Surtshellir/ Stefánshellir system.

Among less formal presentations, Arni Stefánsson gave a highly personal and moving side show "Iceland, above and below"; Chris Wood spoke on his assessment of the possible World Heritage nomination of the volcanic landforms and lava tube caves of Jeju Island, South Korea; Gérald Favre showed a couple of his professional videos on lava-caving in Hawaii and pushing the Kverkfjöll ice caves in Iceland; and I showed digital images of the lava caves I had recently been documenting in Samoa.

COMMISSION MEETING

The IUS Commission on Volcanic Caves met on 14 September under the slightly reluctant chairmanship of Jan Paul van der Pas (who had advised he wished to stand down but agreed to continue until replaced). Matters discussed included the as yet unpublished proceedings of the 9th Symposium, the future of the Commission newsletter (JP will continue to produce), the possibility of an e-mail list (Siggi to investigate), the unreasonable US\$3 impost by IUS on commission meetings, the need to clarify the meanings of "lava tube" and "lava tube cave". It was agreed that the next Symposium would take place in the Azores Islands in September 2004.

THE EXCURSIONS – see Fig. 1

The opening excursion on 10 September took us around the Reykjanes Peninsula. Guided by Dr Sæmundsson and Siggi, we were given a thorough grounding in the local geology, most of which seems to be Holocene, or at least Quaternary – often they know the year

particular mountains and valleys formed! Our first Icelandic lave tube cave of the trip was **Leiðarendi** (which, incidentally, means “path end” – as, of course, it eventually does, after 800 m). The cave contains many black lava stalactites and stalagmites (Photo 2), and the skeleton of a sheep that must have wandered in and couldn’t find the way out. A feature of particular interest is the fact that a younger lava has flowed into collapses of the underlying tube and partially blocked the passage at one point – see Fig. 2.

Next we visited a geothermal power station near Grindavík where an enthusiastic PR man described its operation. A very high quality series of displays in the basement explains the geology and geothermal processes, complete with a powerful low-frequency recording of an earthquake converted into the audible range. We were then given the opportunity to enjoy what the Lonely Planet guidebook (Swaney 1997) describes (accurately) as a “chemical waste dump” – “a pale blue pool of effluent from the Svartsengi power plant (which is fuelled by seawater that has been heated after seeping beneath the lava). Algae thrives in the 70°C, 18% saline water that emerges from the pipes but, as the water cools in the air, the algae dies, leaving a sort of organic soup.” Some people passed up the opportunity, but most enthusiastically plunged in and apparently enjoyed it. No adverse reactions have been reported.

The second excursion (13 September), around south-west Iceland, took us via another geothermal power site (Nesjavellir) to the lake Þingvallavatn (Iceland’s largest) and the ancient site of the Alþing, which just happened to be located right on the boundary between the North American and European plates, reflected in shear basalt cliffs which formed a backdrop for the meetings. Then to the **Tintron hornito***, a small, spatter-formed volcano about 4 metres high with a hollow central shaft (Photo 3). A brief visit was made to the geysers and hot springs of Geysir, followed by the impressive Gullfoss (“Golden fall”). After lunch we drove south via Selfoss to the coast and to Ölfus, near Þorlákshöfn. We then walked up the moss

and low shrub-covered Leitarhraun flow to **Árnahellir** where ISS had set up a generator to illuminate the remarkable stalagmite chamber. A couple of months prior to our visit this cave had been declared a national monument, ISS has installed a gate and, with the Nature Conservation Agency, carefully controls access. This cave is probably only in the order of 200 m long but its best decorated chamber is truly remarkable, with an unrivalled density of large stalagmites (there are numerous stalactites, too, but they are overshadowed by the ‘mites’) (Photo 4). More photos were snapped in this chamber than on any other scene we had beheld in Iceland to that time. The group then returned to Reykjavík.

The third excursion, the longest, was to the Hallmundarhraun lava flow in central western Iceland where part of the time had been spent on the Laki 2000 Expedition (Middleton & Kiernan 2002; Wood et al. 2001). We drove straight to **Surtshellir** where we had a packed lunch before entering the downflow part of the cave. Here a number of us took up the challenge of photographing the ice formations, somewhat the worse for the (relative) warmth of the recent summer (Photo 5) and made a brief visit to the upflow section. Others explored more of the cave and some even reached **Stepháshellir**, the cave which Chris Wood and associates have shown by remote sensing continues on beyond its lava seal (Wood et al. 2001; Wood et al. 2002). We then moved over to **Viðgelmir** (pronounced ‘Vith-gelmeer’), the privately-owned cave on Fljótstunga farm which is about 1.5 km long. It features wall-to-wall ice in the entrance sections, some ice formations, a tube of huge dimensions (in places over 15 m high) and numerous lava stalactites and stalagmites (Photo 6). Some members of the party made it to the far end where there is a massive collapse (though the cave seems to end just past this, in a lava seal). The party returned to Reykjavík, dining at Borgarnes on the way.

* Larson (1993) defines a hornito as “A conical structure built up by clots of fluid lava ejected through an opening in the crust of a lava flow; usually retains the central conduit. Aka (inter alia): dribble cone, rootless volcano, spatter cone.

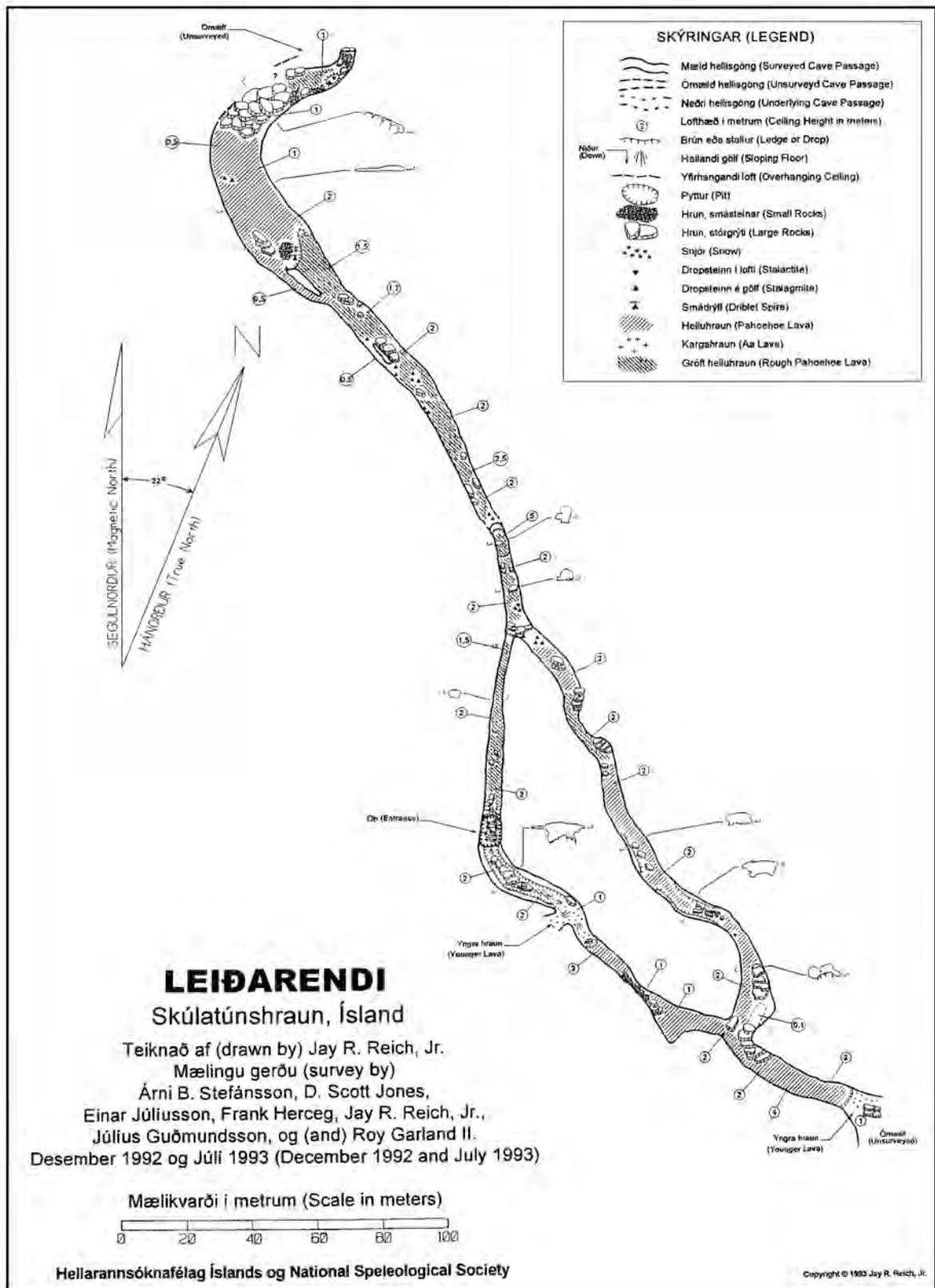


Fig. 2. Plan of Leiðarendi ('Path End') Cave, Skúlatúnshraun, south-west Iceland

POST-SYMPOSIUM FIELD TRIP

While some of us would have preferred to return to Laki, the majority favoured a cross-island trip to the Myvatn-Krafla area. We departed Reykjavík early on 16 September with Siggi driving a 16-seater minibus and Jakob and Bibi in Siggi's 4x4 with the luggage. The party comprised Bill Halliday, Chris Wood, John & Jeanette Dunkley, Marg Coggan, John Brush, Julia James, Ruth Lawrence, Harry Marinakis, David Wools-Cobb, Yuzo Kobori, Ogawa Takanori and the author. We travelled via Selfoss, Rt. 30, Arnes, Rt. 32 and 26 to Hrauneyjafossstöð [yes, that's 3 Ss!] where we paused for a coffee break. Beyond this we took the gravel road F26 to the north-east, past Þórisvatn (lake) and up a long valley between the ice caps Vatnajökull to the east and the much smaller Hofsjökull to the west (Photo 7). From here the only vegetation is the occasional patch of moss and most of the surface is black sand created by ice grinding over the lava. At one point we crossed a deep narrow gorge with a small river but generally the landscape was gently undulating. We stopped for lunch at a public shelter at Nyidalur, the only structure in a vast area of black sand with white glacial backdrops. It is remarkable only because it is about at the watershed between south and north drainage. A cold wind was blowing but at least the light rain had stopped.

From there we continued on F26 through the Sprengisandur, which Siggi informed us meant "exhausted sandsheet", though there seemed to be plenty of sand. For a long way we followed a ridge to the west of the river Skjálfandafljót and then made a short detour, plus a bit of a walk to view the spectacular waterfall Aldeyjarfoss. This tumbles over a band of very striking columnar basalt (Photo 8). Smaller seepages could be seen at lower levels, demonstrating how water can flow at depth between basalt layers. From there it was a gentle descent to Fosshóll on highway 1 where we stopped for another charge of caffeine and to view the Goðafoss fall.

Reaching the lake Myvatn, we walked around the trail at Skutustaðir which crosses a number of rootless vents, formed when the lava flowed over boggy ground and the steam resulting from the water boiling burst up through the lava to build a

mini-volcano. At the large black scoria cone, Hverfjall, we took a rough track east to **Grjotagja** – literally "rocky fissure" – a cleft in the lava partially filled with hot water. At about 45°C it is too hot for swimming. Siggi served afternoon tea of smoked salmon on dark rye bread. We drove on north to the Krafla geothermal power station where we were comfortably accommodated in the staff quarters and dined at their mess.

That evening there was a choice of two thermal relaxations: a sauna heated by natural hot water or a hot cave pool. The pool in **Vogagja** is a few degrees cooler than Grjotagja; entry to it requires a walk across a lava field and negotiation of a couple of steep, rough ladders to a wooden platform perched above the pool. It's hot enough to take your breath away at first but becomes quite tolerable. The water is remarkably clear, at least 3 m deep and the cleft is swimmable for about 20 m either side of the platform. Bibi kindly brought some cold beer along to share (Photo 9). Every caving area should have such a facility.

On 17th we left our quarters about 8am, drove back to the lake, past Hverfjall and followed a very rough track over the Ludentarborgir, north of Hvannfell into the Burfellshraun lava-field. From the end of the 'track' we walked for about 30 minutes to the large pit entrance to **Lofthellir** ("air cave"). The name derives from the fact that Siggi spotted the gaping hole from a plane a few years ago. We descended a fixed ladder about 10 m into the collapse pit. The ladder has been installed by an adventure tourism group which brings the occasional adventurous tourist to this cave. Climbing around a large pool in the entrance, we reached a squeeze which the tour group has conveniently lined with tough sleeping mats, making it relatively easy to haul oneself up through the restriction. Almost immediately one encounters a steep ice slope but a rope makes it possible to ascend this to an ice-floored chamber about 2.5 m high. In the centre is a large mound of ice reaching right to the roof. The visitors all stopped to photograph this impressive feature but the locals were eager to push on. A further icy ascent brought us to some thinner ice columns and a wall of ice almost blocking the passage. Passing to the right, one entered the really specky ice chamber.

The walls were dripping with icicles, the floor was solid ice with sparkling ice-mites rising from the floor here and there and the mass of ice which almost blocked the passage appeared like a great ice castle looking back from below (Photo 10). This is a chamber Austria's great Eisriesenwelt would be proud to host. The photographers immediately went into overdrive, lighting from every possible angle, including from behind. Bibi carried a super-torch which lit up the features remarkably well.

We eventually dragged ourselves away from this remarkable chamber, slithered our way out of the cave and ambled back to the mini-van where a packed lunch was consumed. At this point Bill performed a solemn ceremony, handing Siggí his knee pads, well-worn undersuit and overalls which he didn't intend to take home with him. We drove back to the main road and south to Dimmuborgir, a fascinating region of lava towers, stacks, arches, windows and caves, all adorned with birch trees. A group of us walked through to **Kirkjuhringur** ("Church Cave"), a very short, but intriguing cave with a somewhat church-like entrance (Photo 11). Collapse has revealed a section through the passage which shows a lava bed perhaps half a metre thick conforming to the shape of the passage in contrast to the surrounding more-or-less horizontally layered lava.

Next stop was Reykjahlið where we dropped Ruth who was to catch a bus to Akureyri, then fly to London and home via South Korea. We then visited the 1974 Krafla flow-field which featured the small Viti lake, hot springs, steam vents, hornitos and extensive lava flows. This was followed by a visit to the obsidian mountain east of the powerstation.

On the final day we departed Krafla about 8 am and drove to Akureyri, Iceland's second city, where we dropped Bill Halliday to fly back to the States. We then drove south-west along highway 1 through spectacular valleys to Varmahlið and west to road 731, then south to 35 (gravel) and by it back into the central sand plains. We paused for a picnic lunch at Hveravellir between the Hofsjökull and Langjökull ice caps. Here there were hot springs (some people couldn't resist a swim) and a steaming fumarole. Then continuing south through more spectacular scenery of glaciers and

lakes, eventually reaching Geysir (coffee) and on to Reykjavík where the field trip wound up.

SNÆFELLSNES PENINSULA

For a bit of extra lava caving Chris Wood, James Begley (a British caver working in Iceland) and I rented a car and drove north to the Snæfellsnes* (which actually means 'Snæfell' or 'snow mountain' peninsula) pausing on the way at Borgarnes for the obligatory coffee and to buy supplies. A veteran of many Iceland trips, Chris wanted to show us some impressive caves so we turned off the main road onto 55 and drove into Hnappadalur. On the way we passed the photogenic monogenetic shield volcano Eldborg, the source of some of the lava in this valley. We had a picnic lunch by the car and then set off across the Gullborgarhraun towards the cone, Gullborg. Although the ground was very uneven the going was made easier by the layer of moss over everything. In places we could walk in c. 4m deep channels that were probably collapsed tubes (though they could have been open lava channels). In due course Chris located **Borgarhellir**, the identity of which was kindly verified by an official sign. We descended quite steeply through breakdown sections and areas with clear floors, generally of aa lava – very rough and jagged. A feature of the cave is the very clear abrupt end of an intrusive lava flow. Presumably a later surge of lava flowed into the already partly cooled tube but stopped flowing before it could fill the tube, or even reach its end. There are many lava stalactites festooning the walls (Photo 12) and ceiling in places and at the end (a lava seal) a large number of lava stalagmites, 'protected' by a strategically placed chain. We signed the visitors' book, placed by ISS, and returned, taking a few photos on the way.

* Immortalised by Jules Verne when he placed the entry point to the underworld in the *Journey to the Centre of the Earth* on the summit of Snæfell. The mountain has a permanent ice cap.



Photo 1. Attendees at the 10th International Symposium on Vulcanospeleology, September 2002



Photo 2. Guide 'Siggi' and large solitary lava stalagmite in Leiðarendi lava cave



Photo 3. The Tintron hornito, a small, spatter-formed volcano about 4 metres high



Photo 4. The remarkable assemblage of lava stalagmites, and a few 'tites, in Arnahellir.



Photo 5. David with ice stalagmites in Surtshellir.

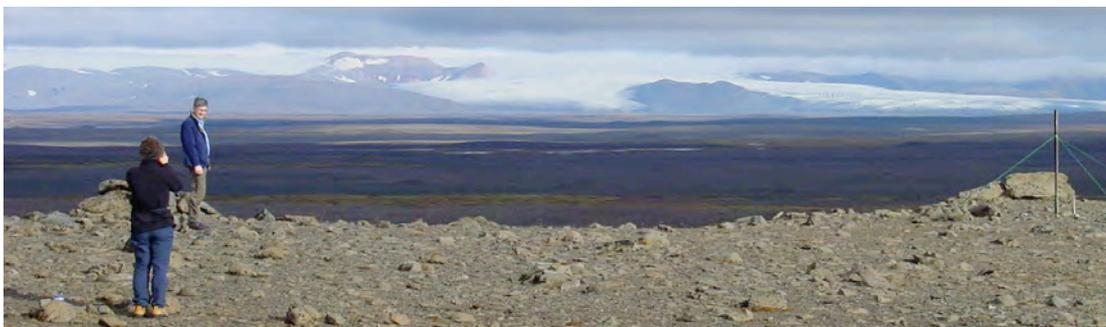


Photo 7. The Brush view of Hofsjökull and its glaciers, central Iceland.



Photo 6. James and a few of the undamaged lava stalagmites towards the end of Viðgelmir.



Photo 8. Aldeyjarfoss falls over a massive band of columnar basalt, central Iceland.



Photo 9. Hot pool, Vogagja



Phot 12. Megastal, Borgarhellir



Photo 13. Pumice passage



Photo 10. Ice formation, Lofthellir



Photo 11. Church Cave, Kirkjuhringur

Nearby was **Vegghellir** ('wall cave'); its features of interest were a near-vertical shaft up to daylight near the end and, about 70 m in from the entrance, an obvious wall of rocks (the origin of the cave's name). Perhaps this was built to stop sheep straying far into the cave. (I had noted a similar structure in Surtshellir and in lava tubes in the Comoros.) The rock in parts of Vegghellir is very colourful: red, orange, yellow, purple and blue – and, of course, grey, black and white – these are reflected in the wall. A section of lining has broken away from the wall nearby and revealed the contrast between the smooth, consolidated nature of the lava forming the cave wall and the tortured, irregularly layered rock behind it, normally out of place.

We returned to the car and drove to Hellnar where we located the guesthouse 'Brekkuþaer' where we arranged 'sleeping bag accommodation' – bunks in an old barn fitted with a kitchen, showers, etc. That evening we drove around the coast to Ólafsvík where we dined on overpriced fish and chips. We returned by a road over the ridge of the peninsula (54) through driving rain, high winds and fog – a touch of real Arctic weather.

On 20th Arni Stefánsson had agreed to come and show us some caves, hornitos and other features of the peninsula. We met him on the road and drove up the cross-peninsula road to **Vegamannahellir** – a cave right beside the road which, not surprisingly, had been found by road workers and was named after them. It comprises a complex of small tubes on two or three levels but the unusual feature of it is the large quantities of pumice (a light, cellular, glassy lava generally composed of rhyolite) which floor some passages (Photo 13). This may have been washed into the cave from an adjacent deposit as it floats

The next feature Arni showed us was **Holuborg**, a spatter cone (or hornito?*) with a complex multi-level cave inside – an unusual occurrence in my experience. Then to **Vatnshellir** ('lake cave'), entered via an impressive pit, with the aid of a fixed rope.

* Larson (1993) describes a 'spatter cone' as "A steep-sided cone of agglutinated spatter built up on a fissure or vent. Cf: hornito, open vertical conduit. Aka: agglutinate cone, blow hole, blowout, chimney, pneumatogenic explosive cave, spatter vent, volcanello, vulcancito.

A passage of large dimensions led to an impressive pit, the bottom of which we could not see. I found it impossible to photograph this pit. Going up-flow we had to cross a snow/ice drift below the entrance; this led to a high chamber and a lava seal. Next we visited **Grasholshellir** (meaning, much as it sounds, 'grassy hill cave') through an opening at the base of a volcanic vent. The main feature was a shaft at the rear, down which had poured cindery chunks of material of bright orange and black colour. We didn't try to ascend. We then had look at **Barhki Cave** (named after its German discoverer). Our enthusiasm faded on finding it largely comprised low passages (<1m) with very rough aa floor; Barhki was obviously a very keen caver.

Arni then took us on a long walk across the lava field near the coast, visiting various small caves and a number of hornitos, two of them of impressive proportions. It was 7pm by the time we got back to the car and drove around to Hellissandur for dinner. Arni returned to Reykjavík.

Jakob Guðbjartsson, a young and enthusiastic member of ISS joined us on 21st. He was keen to 'prospect' the Purkholarhraun flow field, so we all went along to assist. We started near the coast at a volcanic vent called Purkholar and spread out in line, moving north-west and investigating any holes we came across. I found only a few small surface features with no enterable tubes. After a couple of hours of trudging through light rain, James (using his GPS) led us to **Perkhellir**. It has an impressive (5 m high) entrance but appeared to go only about 100 m. Most notable features were a couple of fair-sized lava stalagmites.

Walking back towards the car we ran into Jakob who was enthusiastically investigating any little hole he found, determined to break into a vast tube. We had lunch with him in the shelter of a small surface tube. While he continued prospecting, we returned to the car and drove part way up Snæfell – actually on the mountain Stapafell - to have a look at **Songhellir** – The Singing Cave. This cave, probably because it is close to the road, rates a mention in the *Lonely Planet* guide (Swaney 1997): "it contains some old inscriptions". That it does, but as an interpretive sign nearby tells us, there's

more to the story:

In the Saga of Bardur Snæfellsas it is said that Bardur stayed in The Singing Cave for a while with his people while he built his houses at Laugarbrekka. The cave was full of echoes (dwarf talk) but Bardur didn't mind that as he was brought up among dwarfs. After his houses were built he used the cave for councils with his men and continued to do so while he lived.

It is believed that The Singing Cave is the first place name in Icelandic with reference to singing. In later ages people used the cave as a shelter on their travels and one can find many initials and dates which people carved into the cave walls while they stayed there.

The cave is really only a single chamber and it is hard to imagine many people actually living in it but it does have remarkable acoustics. It is not a lava tube, but is formed in a tuffaceous breccia, perhaps by erosion by groundwater.

We drove to the hamlet of Arnarstapi and checked that its restaurant was open. Finding it was, we returned to Hellnar to rest and clean up. On Jakob's return we went back to the restaurant for dinner. Jakob had had a successful afternoon,

finding an interesting cave with a 2.5 m drop which halted his explorations.

On the morning of 22nd James went with Jakob to further explore the new cave, while Chris and I walked down to the sea and along the cliffs. At the small fishing 'port' there is a large sea cave, **Baðstofa**, said to be home to large numbers of birds; we didn't see many.

Jakob and James returned at 11:30, not having significantly extended the new cave. We left at 11:45 for Reykjavik, arriving at the (internal) airport at 3:15. I had booked a flight to Heimaey, Vestmannaeyjar (Westman Islands), hoping to spend a couple of days looking around the main island which had been largely remodelled by an eruption in 1973. A third of the village on the island was buried under lava but Heimaey survived. Unfortunately bad weather on the island prevented the plane from landing there that day and the next. I checked into the youth hostel and spent a couple of days getting to know Reykjavik better.

NEXT SYMPOSIUM

The XIth symposium on Vulcano-speleology will be held in the Azores Islands (Portugal) in September 2004. An interesting time is assured!

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