

Ario Caves Project Expedition Report 2022

30th July - 27th August 2022



El Gran Abisu, Pozu Cabeza Muxa, by Mark Burkey

To facilitate and further the exploration of caves associated in the region of Vega de Ario and the hydrology of Cueva Culiembro.

To investigate the potential for a hydrologically integrated, 'super deep' (over 1500m) system in the Massif Occidental of the Picos de Europa.

To provide a central point for organising access and collating information to these ends.

Expedition Members

PDB - Phil Baker
PTB - Petie Barry
BB - Bartek Biela
PB - Paulina Biela
MB - Mike Bottomley
MJB - Mark Burkey
VC - Vlad Catanea
TC - Tom Chapman
KC - Keith Chatterton
PD - Peter Dennis
SD - Shane Diffley
SMD - Steph Dwyer
PH - Phil Hawcroft
MJH - Martin Hoff
MH - Martin Holroyd
RH - Rich Hudson
CJ - Chris Jewell
SL - Sam Lee
KM - Keith Mason
GN - Graham Naylor
TS - Tony Seddon
MS - Mark Sims
VT - Vlad Turcuman
SW - Stu Weston
LW - Lisa Wooton
AW - Andrew 'Sandy' Wright
FZ - Fiona Zhang

Acknowledgements:

Spanset

UK Caving

Petzl

Mountain Fuel



1. Background

The main objective of this year's Ario expedition was to re-bolt and re-explore Cabeza Muxa, a ~930m deep cave first explored in the late 70s and early 80s by a group of Catalanian cavers from the SIE club. Unlike many alpine cave entrances, Muxa is found in a huge 100m wide doline, at the bottom of which a series of shafts drop away to a depth of 600m before reaching a dramatic stream passage. The stream can be followed for almost two kilometres, dropping another 300m and ending at a sump. In 1988 this sump was dived by Rick Stanton to a depth of 30m (*BCRA Caves and Caving 44 1989*)

Since then Muxa has remained unvisited and unexplored. Later exploration on this side of the Ario plateau focused on the cave Asopladeru La Texa, which filled in much of the distance between the Muxa sump and the resurgence at Cueva Culiembro. The plan this year was for Chris Jewell to dive the sump. Equipped with more substantial diving equipment enabling long and deep dives it was hoped he would be able to pass the sump and explore beyond towards the nearby Asopladeru La Texa.



Entrance to Pozu Cabeza Muxa, by Mark Burkey

2. Expedition Diary

On Saturday the 30th July the first eight members of the expedition came together at the Refugio de Ario. First up were a group of three Oxford Uni cavers (VT, VC, and FZ), keeping alive the sixty year long tradition of OUCC participation in the expedition. Following behind were CJ, MJB, MH, KC and PTB.

The latter five stayed at the Hotel Torrecerredo, where they were treated to Jim Thompson's fine cuisine. After a good breakfast they set about filling up several 25 litre drums of water and headed off to the meeting point for the helicopter pick up.

Helicopter

With low cloud cover hampering things, it took longer than hoped to get the 2.5 kilometres of rope, dive gear, camera, water and other kit on its way, but the pilot did a sterling job flying around the weather, and by the afternoon everything was up on the mountain.

KC and MH elected to walk in from the helicopter point, whilst CJ and MJB drove around to the car park at the lakes above Covadonga, where they met PTB for the 3 hour hike up to the Refugio to set up camp and settle in for the first of many spectacular sunsets.

Sunday 31st

Using the helicopter to transport the kit meant that the following day the team were ready to begin rigging the cave. Over 400m of rope was moved to the entrance of Muxa which is about 40 minutes walk from the Refugio following a network of cow paths leading down the mountain.

We clearly had a lot of rigging ahead of us, but with a strong team we were hopeful of quick progress. While MH, MJB and KC drilled and hammered in Muxa, the rest returned to the Refugio to get another 400m of rope to feed the cave's insatiable desire for 9mm Spanset.

Monday 1st August

MH, MJB, CJ and PTB headed underground to continue down. From the initial entrance shaft of 35m a series of small to medium pitches drop down a tall sonorous canyon like the steps of a staircase, all linked with short loose scree slopes.

At every pitch head there were rusted spits, eccentrically placed and often protruding from the rock. It was clear that the cave would need re-bolting to modern standards using stainless steel through bolts right to the bottom. This would provide future cavers with a safe route down this spectacular pothole.

Today saw CJ take over rigging duties. From the end of yesterday's rope he bolted down a short gully that took us out over the top of El Gran Abisu. The rest of the team bunched up in the gully, having portered down a stash of gear. CJ dropped down away out of sight, the sound of drilling becoming ever more distant, his light ever more faint. After nearly two hours of inactivity the rest of the team were called to

action as an echoing cry of ROPE FREE sounded around them. Cold and stiff they started down the rope. While the posted depth of the shaft was 250m, the gully drops you in about 50m below the roof of the shaft, so it's really closer to about 300m. Underneath the shaft plunged into darkness, beyond even the range of a powerful modern headlamp. PTB abseiled down some 70m and found CJ tucked into an alcove, rope and rigging gear exhausted.



Keith Chatterton rigging in Muxa, by Mark Burkey

MH and MJB joined us, and with hardly a minute's hesitation MH was back in the rigging saddle. MH was quickly over the lip of the alcove and out of sight, with MJB following behind. Below the alcove the shaft soon belled out dramatically and became supremely impressive. Once the floor loomed into sight MH decided to disregard the 5pm turnaround and risk missing the 8pm dinner at the Refugio. By 5:30 the team assembled at the base of the vast shaft and began the mad dash to make it up 500m of cave and across the surface to the Refugio in time for their tea.

Tuesday 2nd August

Once the 250m Grand Abyss was rigged, the next stage was to drop the final 107m shaft, at the foot of which we would establish our underground camp and continue rigging from there. CJ, MH, MJB and KC headed in for an expected two-night camp.

Whilst MH headed to the front to tackle the last 100m of rigging, CJ, MJB and KC spent some time trying to capture photographically the sheer scale of the main shaft. For this they needed to switch from using strobes to more traditional flash bulbs as the volume of light required would be more than the newer technology could handle. Eventually, once they had burnt through the £200 worth of bulbs MJB had brought with him, they continued on to drop to the camp at -600m.

Wednesday 3rd August

After a good night's sleep, the four cavers set off down the streamway. Approximately two kilometres and a further twenty-six pitches stood between them and the terminal sump. MH rigged pitch after pitch, often dropping into clear turquoise pools which MJB took full advantage of, grabbing shots whenever he could whilst waiting for the next pitch to be rigged.

A dozen pitches in, it became obvious that they would run out of bolts and rope. KC volunteered to head back to the surface with a plan to return first thing in the morning with more kit to finish the job. The three others continued on, reaching just over half way before they finally could do no more. On the way back MJB grabbed a few more quick shots before they headed back to camp to get warmed up, fed and had some well-deserved rest.

Thursday 4th August

The camp could only accommodate a maximum of 4 and so the plan was for MJB to head out to recharge camera gear with KC and PTB coming in with more rigging gear. We expected the guys to arrive fairly promptly, as KC knew we would be waiting for the bolting kit. 11 o'clock came and went, then 12, 1....as 2 o'clock approached we decided there must be a problem and we would all exit the cave. We pulled on our cold, wet caving kit and packed up the camp. We were about to start out when we heard someone heading down from above. PTB arrived with a bag of kit, blissfully unaware that we had been waiting for his arrival. CJ and MH grabbed the bag from him and off they went. PB thought KC was just behind, so, not wanting to meet him on the pitches, MJB waited around. After an hour or so and getting pretty cold, MJB decided to start up anyway. At the top of the first 100m pitch MJB could still not hear anything from above. The nature of the cave meant it was impossible to communicate so MJB hunkered down at the base of the big shaft and waited for KC to arrive.



Martin Holroyd rigging in the Muxa streamway, by Mark Burkey

Almost an hour later KC landed, he had hurt his hand on the entrance pitches and had considered turning around, but he had PTB's camp kit and more rope, so thought he had better continue. KC had left 100m of rope and 10 bolts/hangers at the entrance, we'd have to pray that the gear in the cave would get us to the sump. Leaving KC at camp, PTB took his 100m rope bag and carried on down to catch-up with the others. After just under 3 hours, MJB emerged to a misty drizzling sky.

One short rope pitch below camp and PTB met the first of many wet bits. This was knee deep, but there were waist deep sections further on. The short splashy pitches follow in quick succession, with turquoise pools at their bases. The passage soars high above, 50m tall or more and 4/5 m wide. Some bigger pitches and then noisy traverses over crashing waterfalls. Nearly two and a half hours of fast caving later PB caught up with the others as they were in the midst of rigging the last 15m pitch before the sump. This

was well timed as they had just ran out of rope and were about to start packing to leave. The rope was quickly pressed into service, and fifteen minutes later they were down. One short climb later and they were on the last 150m stretch of streamway leading towards the sump. At a deep pool where the passage bent around a corner MH did some Spiderman moves, clinging against the wall to vanish around the bend and report back as eloquently as a northerner can - "There's the sump, and its fuckin' beau-tiful! Three hours later they returned to camp where KC was waiting with a hot brew.

Friday 5th August

Despite two tarps and very dry surface conditions the camp was fairly drippy and some time was spent drying sleeping bags. MH kept making unfavourable comparisons between CJ and Ken Pearce, having apparently been denied a chocolate bar at one point and being told to keep rigging. Despite this grievance the campsite was fairly cordial. Packing up and starting the prusik out, the first two 50m free-hangs were a bit of a pig on the way up, but above this the climbing was fairly smooth. Around 3 hours later the four surfaced to baking afternoon heat. Phase 1 was complete, on to Phase 2, the diving.

PD and MJH arrive at Ario.

Saturday 6th August

CJ and MH leave Ario and stay the night at Jim's hotel. GN set-up the surface Nicola radio at the Muxa entrance tent. GN, VT, VC, FZ and PD all do acclimatisation trips into Muxa.

Sunday 7th August

RH, SL, TC and YSS team arrive. CJ hikes back up to Ario.

Monday 8th August

RH, TC, KM, PDB, SL and SD entered the cave with 6 bags of diving equipment plus personal camping kit. GN descended to set up the Nicola radio at Sala Los Calcos (underground camp). At the surface, PH, CJ and PD tried without success to establish communications throughout the time window for the radio checks that had been agreed earlier. In the early evening the surface team packed up and walked back over to the Refugio for supper. There they met the rest of the YSS party that had arrived at the Refugio during the day. By 21:00 GN had still not appeared, so SW and PD set off on the Muxa path to look for him. After witnessing a spectacular crimson sunset while crossing the saddle behind the Refugio, they met RH and TC on their way back who told them that GN was out and making his way back. It had taken longer to set up the Nicola 2 underground than anticipated so test transmissions had not been attempted until long after everyone had departed from the surface camp. 4 bags of diving kit had made it to the sump that day and 2 bags were dropped off part way, KM, PDB, SL and SD camped underground.

MB and SMD arrive at Ario.

Tuesday 9th August

CJ, LW, SW and MJB entered the cave with a plan for CJ to dive the sump.

After some delays passing the exiting team the dive group reached the bottom of the shaft series and camp. Here comms to the surface were established on the newly installed Nicola radio. The dive team headed off along the 2km streamway which drops 300m via 26 pitches to the sump. About half-way down the additional kit was picked up and the four heavily laden cavers plodded on slowly. Unfortunately 20 minutes later disaster struck. MJB was approaching a pitchhead when he slipped and the belay the traverse rope was attached to broke. MJB fell forward onto his face with his nose taking the impact. A lot of blood followed and it was clear he'd broken his nose. Everyone fully expected the trip to be turned around then and there but MJB was determined that the dive would go ahead and that he'd be there to document it.

Several hours later the team arrived at the sump. CJ prepped his dive gear aided by SW and LW whilst MJB prepared to photograph the effort. However when he unpacked his camera he discovered to his horror that his fall had damaged the case and caused it to leak. The precious camera was flooded and no photos would be possible.

Whilst the team kept warm in a storm shelter making hot drinks CJ entered the water and began his underwater exploration. The excellent visibility he'd expected was reduced by the moon milk sediment that kitting up had disturbed. Underwater large moon milk deposits clung to the walls in lumps. With little else to belay the dive line to CJ wrapped the string around these sending little puffs of sediment into the water. The floor and walls of the sump were strewn with old dive line from Rick's dive in '84. CJ dodged the hazardous old line and pushed into new territory at 30m depth. Visibility got better but the way on wasn't obvious as the passage twisted and turned going up then back down again. There were precious few places to belay the line in the clean-washed sump. After about 150m the sump began to trend upwards and 5m later CJ was at -15m and at the bottom of a steeply ascending shaft. With nothing to secure the line to, he spooled out line whilst rising up. At -8m depth the reflective surface above became visible. Taking it nice and slowly he reached the surface where a tall slim passage led away from a circular sump pool.



Traverses in the Muxa streamway, by Mark Burkey

After dekitting CJ headed along the new cave passage. However, only 15m from the sump pool the next obstacle was found. A short pitch with the whole streamway crashing down filled the passage. Although the pitch wasn't more than 2m, the floor and walls were smooth moon milk with absolutely no foot or hand holds. Knowing there was no safe way down CJ turned back. He surveyed back through the sump and returned to the waiting cavers.

The rest of the team had kept warm and well fed but everyone was getting tired at the end of a long day. After packing everything away the team finally left the sump around midnight. A very, very slow return to camp with heavy bags was made with CJ and MJB reaching camp at 4.30am and SW and LW at 6.30am.

On the surface, VT, VC, FZ, MB, SMD, TC did sterling work in bringing more water from Bobias up to camp....around 130-140 litres in total, due to water shortages. PD collected water from the Texa spring and manned the surface Nicola radio all night, attempting to establish communication at intervals but without success..

Wednesday 10th August

As the dive team were lying in their sleeping bags another team of four were headed down the cave to take over bringing gear up from the sump. RH, PD, VT and PH were making a two night camp with plans to move all the gear back from the sump to camp.

After meeting with the newcomers at camp, CJ, LW, MJB and SW got ready to exit the cave. Before they left SW and LW managed to locate a break in the Nicola radio aerial wire which proved to have been the cause of the previous communications issues. Once restored the Nicola would prove to be extremely useful in the forthcoming days.

Thursday 11th August

MB and SMD did a bounce trip to the sump and collected two bags on the way out.

RH, PD, VT and PH moved equipment from the bottom of Muxa to camp.

Friday 12th August

SL, LW, TS, SD and CJ headed down to camp to collect the 5 bags of diving kit and bring them to the surface so that the four campers could just carry their personal kit out. PDB was also going to come down but had 'technical issues' with his descender on the 180m pitch when the front plate of his stop parted company with the rest of the device.

Saturday 13th August

Kit carried down the mountain by many people, CJ and MJB leave Ario. MB and PTB went to C4. The cave had previously been re-rigged down to the top of The Monster. MB and PTB did some further replacing of old rope between the entrance and the top of the Monster with an extra 100m of rope. From here they rigged down to the bottom of the shaft with new rope and replaced around 12 of the galvanised through-bolts with stainless steel ones all the way down. On the way out they packed up three bags of old rope and removed them back to the refugio.

BB and PB arrive.

VT, VC and FZ had a bolting lesson with RH

Sunday 14th August

Building concern amongst those at the Refugio that the weather was forecast to change to thunderstorms and torrential rain. PDB and TS planned to descend to the sump and strip out ropes from the streamway pitches back to the camp. PB and BB undertook a photographic trip down the main shaft, staying at the underground camp overnight. LW would assist as model caver for the day and will climb out later that evening.

MB and SMD leave Ario.

VT, VC and FZ leave Ario.

PD and MJH spend the day exploring leads on the complex limestone outcrops of the slopes below C4. They returned to the Refugio in the afternoon so PD could assume the role of surface cave radio operator at the Muxa surface camp. Weather updates by this point were being provided by Paul Mckrill. Successful comms were achieved at 21:00 and PD delivered the weather forecast, he then settled in to stay the night at the Muxa surface camp.

Monday 15th August

07:00 comms successful, TS, PDB, BB and PB are to begin to exit at 08:30 and expect to be at the surface by lunchtime. RH, SL, SD, SW, PH wait for TS and PDB to surface before heading down to begin derigging from the camp upwards.

BB and PB reach the surface mid-afternoon, SL, SW and PH are next out with bags of camp gear. RH and SD ambitiously aim to complete the de-rig of the entrance shafts but after a heroic effort they decide not to miss dinner at the Refugio and leave in ropes above the Great Abyss.

PTB leaves Ario, AW and MS walk up.

Tuesday 16th August

Expecting rain later in the day MS, AW, BB and PB walk over to 27/9 with bolting gear and hangers, 100 m of new rope and survey kit. At the bottom of the old cave MS and AW begin surveying through the 2019 dig 'Psychospeleogenesis' while BB and PB start back up taking photos on the way. AW and MS put a couple more bolts in at the head of 'Foot Hang', the 50m pitch just on the far side of the dig and re-do the rigging. They then surveyed down to the base of the pitch and back up to the start of the 'Ario Reality', the narrow rift which is the way on where the only part large enough to enter is 10m off the floor.

As they began heading out they became conscious of a steadily increasing rumble that soon arrived as a rapid increase in water flow. The small stream in 27/9 disappears into the floor at the base of the 'Final Pitch' and re-emerges as a waterfall onto a shelf about 20m down 'Foot Hang', AW saw the water flow rapidly increase here to several times the original level but this was far enough from the rope to have minimal impact on the caver, who could still remain dry. By the time AW and MS were both at the top of 'Foot Hang' the water level had stabilised and was perhaps slightly decreasing. The cave was then exited without difficulty, the upper pitches merely being more drippy than on the way down. By the time the four met up again at the surface it had stopped raining and it appeared that those underground had been drier than those above.

RH, SL, MJH and PD leave Ario.



Paulina Biela on the 'Final Pitch' in 27/9, by Bartek Biela

Wednesday 17th August

Heavy rain all day, Team YSS go home, those remaining hide in the Refugio all day.

Thursday 18th August

TS with help from PB completes the derigging and stashing of ropes on the upper pitches of Pozu Cabeza Muxa.

MS, AW and BB return to 27/9. At the 'Ario Reality' AW went ahead with a hammer to try and ease progress through the narrow rifts, MS and BB continued to survey. At the end of the rift they squeezed through to the head of 'The Sound of Silence', the last pitch descended in 2019. At the bottom of this pitch AW's memory failed and some time was taken to first find and then survey to the head of 'Darkness my

old friend', the undescended pitch left last time. MS rigged a spectacular Tri-Hang and the pitch was descended, surveyed and found to be 22m deep. At the bottom a narrow rift is cut into the floor and a muddy slope can be climbed back up to about half the height of the pitch just descended to reach a col where the floor slopes down until it meets the edge of a drop that will need rigging. From the col the cave looks to be opening up into a steeply angled hading rift dipping away from the passage by which it was entered and with the clear sound of a stream ahead. BB took a few snaps during an uneventful exit.

Friday 19th August

TS, BB, PB, MS and AW all go shaftbashing in Area E. Several caves without position data located with GPS, a few previously recorded as blocked by snow are investigated and some previously unrecorded entrances are noted, see sections 3 and 4.

Saturday 20th August

TS, BB, PB and MS head to C4, AW carry-down to Los Lagos and surface cover.

Upon reaching the bottom of 'The Monster' the team were stopped by missing metalwork on 'Growing Up'. Not having taken any spares and expecting to find hangers and maillons in-situ they were forced to call it a day early. BB takes the opportunity to photograph 'The Monster' on the way out.

Sunday 21st August

TS visited the Xitu gear stash and carried gear down to Los Lagos.

BB, PB, AW and MS spend the afternoon GPS locating Area 5 entrances around the Ario bowl. BB descends 11/5, previously described as ending in snow, see section 4 for description.



'The Monster', C4, by Bartek Biela

Monday 22nd August

TS, AW and MS return to C4 armed with hangers and maillons. They find that the three hangers from the top of 'Growing Up' are the only ones in the cave to have been removed and once these are replaced they are able to carry on down to Bugger Bognor without problems, only needing to replace the short rope immediately above the camp. After a brew they carry on down, finding they only need to replace the rope on 'Cat o'Nine Tails' but otherwise reaching the base of 'Here be Dragons' without incident. Turning around here they are back at the entrance by around 10:30 and back to camp at around midnight.

BB and PB carry down to Los Lagos and surface cover.

Tuesday 23rd August

TS leaves Ario

BB and PB shaft bash and take photos in Area 5, AW and MS have a day off.

Wednesday 24th August

BB, PB, MS and AW go to have a look at 53/5 with the aim of following the strong outward draft described in the 1991 Expedition Report. "The strong wind encountered in the entrance passage is lost at the head of Pterodactyl pitch, and so it is possible that there is a lot of passage still waiting to be found". This sounded interesting so taking a drill, bolt climbing gear, rope and a bright torch they were expecting to look for high passages in Pterodactyl Chamber that might have been missed before as they were too difficult to get to.

After passing the 'Coffin Lid' squeeze just inside the entrance and descending the pitch MS and AW went for a look downstream to the head of the next pitch where they were confident that they could still feel a light draft. Returning upstream they met BB who had brought his camera gear through the squeeze while PB had decided to wait outside. At the upstream end of the Pterodactyl Chamber a climb with an in-situ rope was found, from the top of which, behind some calcite formations a crawl led off in the top of a narrow rift. The draft could clearly be felt here blowing out of the passage. Following the crawl BB passed a squeeze to find a pitch beyond that had no sign of previously being descended. BB then returned to collect his camera gear while MS rigged the pitch. This proved to be blind with a small stream entering from one side and exiting from the other via rift passages much too narrow to enter. Returning up the pitch MS converted the y-hang to a traverse line to reach a phreatic tube on the far side of the pit, the floor of which was covered in untouched sandy sediment. Confident now that they were in unexplored cave they dekked and left their SRT gear behind.

The passage trended gently uphill and followed a small watercourse upstream along a rift. This sometimes became narrow and in several places slippery up and down climbs were necessary in order to find a passable level. A further squeeze towards the limit of exploration had to have a nubble knocked off using a rock as a hammer in order to get through. Passing this squeeze reached the bottom of a horrible pile of loose choss that had to be climbed one at a time with great care. At the top there were several possible ways on, the only one explored being a continuation of the rift that they had entered by, the other leads were left for another time. Traversing over pure white calcite formations soon led to a chamber around 7-8m wide by 10-12m long and at least 10m tall. The stream that had been followed through the extensions so far was running down a wall at the far end. There was a possibility of climbing up one wall, but they were both starting to feel a bit nervous about being far from home and the slippery and loose climbs and so decided to head back.

Part-way back through the new extensions they met up with BB who took some photos on the way out and again on the entrance pitch with the pterodactyl. Immediately after exiting the cave AW realised he had left behind his first aid kit/lunch box at the photography site so had to do a quick repeat of the coffin-lid and re-rig the first pitch to fetch it.



Mark Sims on Pterodactyl Pitch, 53/5, by Bartek Biela

Thursday 25th August

PB and BB leave Ario, AW and MS porter expo-kit down and walk back up again, all in pouring rain.

Friday 26th August

MS and AW tidy and pack-up remaining camp gear and stash it in Xitu.

Saturday 27th August

MS and AW leave Ario.



78/5 in the Ario Bowl, by Bartek Biela

3. Diary extracts from Peter Dennis

Selected diary extracts of Peter Dennis, that include reference to Nicola radio set up and communications and some images

Friday 5 August – Walk with Martin Hoff from Los Lagos to Refugio Vega de Ario. Pitched tent at campsite.

Saturday 6 August – Graham Naylor setting up Nicola radios at surface camp of Pozu Cabeza Muxa.

Lunched at the Refugio Vega de Ario campsite, then packed basic caving gear before heading off alone to find Cabeza Muxa, where Graham and the students, Vlad, Vlad and Fiona had set off towards earlier in the day, aiming to descend towards Gran Abisu (the Great Abyss). Successfully located the group at the camp above the Cabeza Muxa aperture after they had re-emerged. Graham was unwinding aerial cable down the access gulley from the surface Nicola location, positioned under a protective tarpaulin, whilst

the students sat around, packed caving gear before departure for the Refugio campsite. I helped Graham to position the Nicola 3 aerial cable above the gully, threading the cable behind flakes of limestone above the walking route to avoid snags that could break the cable. Once back up slope, I changed and descended several of the Muxa entrance pitches to the rubble gully, by way of an introduction. Impressed to see how Graham had suspended the downhill wire to one side of the rigged ropes of the first pitch to avoid the possibility of snags. This achieved the long separation of earths to improve chances of successful communication with the underground camp. Descended a few pitches but turned back on account of the time and the need to walk back over to the Refugio for 20:00h, when supper was to be served.

Monday, 8 August

Groups set off to trailblaze the rigged shaft of Cabeza Muxa and to take essential equipment and supplies to the underground campsite (Sala Los Calcos). The plan was for Chris to attempt the sump dive of the terminal sump on Tuesday. Stu and I joined the procession to Muxa surface camp and went off in search of water. Passed some small, prospective caves and ended up circling the hill, trending south and meeting a distinct footpath. Walked into a large, grass meadow with cattle grazing and an abandoned summer farm, which I later identified as Texa.

Stu and I found three separate springs, which allowed us to fill several water bottles before return to the Muxa camp, to those waiting in the sun. I kitted up and descended several of the entrance pitches. One landed on a broad, curved ledge with water seeping down the back wall, accessible to drink from the rope. I drank long realising how dehydrated I had become during the water collection. Descended a couple further pitches before turning back, partly because I thought I heard Graham climbing the pitches below and wanted to clear the way for his exit. I did not see Graham nor establish voice contact and I learnt later that he was still busy setting out aerial cable at the time I left, having taken much longer than anticipated. Graham had descended to set up the Nicola radio at Sala Los Calcos (underground camp). At the surface, neither Phil H nor Chris had been able to establish communications with Graham at the underground camp, using the Nicola radio under the tarpaulin. Since it was after the agreed time window for the radio checks, Chris, Stu, Phil, Sam and I packed up and walked back over to the Refugio for supper. There we met the rest of the YSS party that had arrived at the Refugio campsite during the day. Graham had not appeared after 21:00 hours, so Stu and I set off on the Muxa path to find if he was delayed but at least walking along the path heading back to camp. Witnessed a spectacular, crimson sunset on crossing the saddle behind the Refugio. We did not expect Richard Hudson and Tom to return until 23:00 hours or later. Not far down the slope beyond the saddle, Tom appeared setting a good pace, and heading for the Refugio and supper. Tom reassured us that Graham was out of Muxa, walking back, accompanied by Rich. We then met Rich, who said Graham had asked him to head on because he knew the route well. Stu and I continued and found Graham quite a long way further on, so walked and chatted to him for the return. Graham had taken longer to set up the Nicola 2 underground than anticipated so had attempted test transmissions long after everyone had departed from the surface camp. He was clearly very tired. Both he and Rich sat down to supper, that had been kept warm, wrapped in foil by our kind hosts. Chris announced that the dive would take place the next day.

Tuesday, 9 August

Chris's big day with a large party heading into Muxa to porter diving kit to the sump in support of Chris for his dive attempt. I went up to camp with Phil and Graham and spent the day walking, to collect water from the springs found with Stu the previous day. This was to build up a stock of water for those emerging from the cave later. Two of the team were 'bouncing' the cave to emerge later in the day. I walked over from the Refugio to the Muxa camp with camping gear to stay overnight on the Nicola radio

for surface to underground communications. Rich Hudson arrived later and Graham Naylor departed after showing me the setup for the Nicola system, both with Nicola 3 (which I know) and the prototype N4Z (new to me), and how to operate the Bluetooth headphone and microphone with N4Z.

After the final water collection from Texa spring, the task I carried out much of the day, I sat with Phil and Rich in the shade of the limestone scar at the surface. During the afternoon heat, the pastor and his dog appeared on the skyline of the Cabeza Muxa doline and bounded down to us using a single, long staff for balance as he stepped between limestone paving and boulders. Rich knew sufficient Spanish to hold a basic conversation with the pastor for a few minutes. The pastor knew of the Inglés cavers that had visited in previous years. He declined offers of water, both for him and his hairy, hot and panting sheepdog. I was impressed by his slip-on boots with slick soles for negotiating the limestone. As evening set in, and the others departed, I cooked a meal of vegetables with pulses and set up a watch to contact the underground camp for updates on progress made towards Chris' dive and safe return to the underground camp of all the support party and Chris. Visited by Steph and Mike later that evening but could offer no news because all attempts with the Nicola radio at the agreed times had failed to forge contact.

Wednesday 10 August

Tried the Nicola radio again several times overnight, swapping between N3 and N4Z, to be certain. No reply received on any occasion. Steph asked me to return to camp once news was received that Chris was fine and that the full party had reached the relative safety of the underground camp. Without successful communications, I kept trying but remained all night and resumed attempts in the morning. Eventually, Mike Bottomley arrived to check on progress and I packed to return to the Refugio campsite. I met Richard Hudson with Phil and big Vlad on their way to Muxa to embark on a full descent. Rich said there was a place for me if I could swap over gear at the Refugio, and return within one and a half hours. I was keen to do so and head back to camp swiftly, explained the lack of radio comms and therefore, the lack of news from the underground camp and rapidly sorted SRT and basic personal kit for the full Cabeza Muxa descent. Mike returned and offered to catch me up to help carry my caving kit across to the Muxa campsite but I actually arrived there a few minutes ahead of him! Rich had kindly waited and so we kitted up with SRT kit and overnight food and equipment. We made our way down the rubble gully onto the initial traverse to begin the first pitch. There, Phil had completed adjustment of the rebelay to make the first pitch less bouncy. I followed Rich through the entrance pitches to the U-shaped groove that was the limit of my previous descents, a couple days earlier. Slightly daunted, I progressed but was very happy to follow Rich and was buoyed by his confidence and wise and reassuring guidance. Down the canyon, the Y-hang was not as technical as it first appeared and I was soon descending the fine pitches of the main shaft, leading down to the Eagle's nest, leading on to the open pothole (Great Abyss) with free hangs. Most impressed with the enormity of the pothole during the succession of pitches. Closing in on the last big pitches, could see Rich's light and also Chris's at the landing below the camp. Far away below! Glad to meet everyone and see all was fine, including news of a successful dive. Chris, Stu, Lisa and Mark Burkey were in camp, resting and waiting to start their ascent. Lisa explained that Stu had found a break in the downstream aerial cable, now spliced and fixed. That may have accounted for the failure to communicate earlier.

Phil, Vlad, Rich and I dropped off overnight kit before rapidly heading downstream to explore the streamway with the objective to reach the sump and retrieve tackle stacks of Chris's diving equipment. The aerial cable was unwound a long way downstream and we were impressed by the work put in by Graham to pin the wire away from hands and footfall of passing cavers. The combination of technical pitches, sporting streamway and boulder chokes made for a fantastic streamway route. We had a lot of fun negotiating the pitch renamed "It's a Knockout". Finally, waded around the last bend to wade into the

sump pool before turning about. There were four of us to share the tackle bags, stashed in a dry alcove not far back from the sump. Some were very heavy. Great effort then to reverse all pitches and streamway sections with this payload, although Vlad was clearly fading before the pickup. Pushed on and brought the tackle sacks 2/3 of the way back towards the underground camp. Then shared one heavy and one lighter tackle sack for return to the camp, with the prospect of collecting those stashed above the streamway, the next morning. Arrived back at 01:30 hours, an extremely long and gruelling day. Despite that, we all prepared meals after changing out of wet kit to make the most of the opportunity to replenish energy. I slept in bouts due to the rocky nature of the sleeping area and the sloped angle but felt reasonably refreshed on waking.

Thursday, 11 August

Enjoyed a lie in to compensate for the previous long day. Attempts to contact surface with Nicola 2 failed, probably because no-one was on station, listening in at the surface camp. After breakfast, refitted wet caving kit for the return downstream to retrieve remaining tackle sacks. Vlad was again slow but we reached the bags without incident and steadily climbed and reversed the various pitches. We were by now well-rehearsed in the combined tactics necessary to pull bags and SRT kit uphill through the boulder choke. Vlad emerged more easily from the choke having remembered the combination of positions to pass the awkward shelf and push up through the exit aperture. Returned to underground camp by evening time and prepared a good meal, albeit in my case, experimenting with stock cubes and dinner mix which was bland but filling. Instant custard and sultanas made a good dessert and antidote to the dinner mix! A great job of teamwork was achieved to bring all the kit to the underground camp and the base of the first big pitches. Steph and Mike appeared late in the day and were a welcome sight, amazingly they then went on to complete the streamway trip as far as the sump and climbed out after a further brief visit much later that evening. They even hauled the first tackle bags out of the cave after their farewells. Experienced a further night of broken sleep, conscious of a greater drip rate and of wet feet. To mitigate, I pushed my feet into my personal tackle sack, so warmth returned. On waking in the morning, we anticipated first news either from the first cavers arriving or via the Nicola 2 radio during transmission attempts on each hour throughout the morning.

Friday, 12 August

Very relieved to achieve audible/ discernible Nicola comms at the agreed hour in the morning. It was Chris at the surface, and he told us to prepare to exit and was concerned about our food stocks, having received an update from Steph during breakfast at the Refugio, that stocks were depleted. We reassured Chris that we had food, just very little variety of food! Then we waited for the first arrivals. Chris and Lisa arrived with mountain food packs, which were very welcome. I had by then changed into wet caving gear in anticipation of the rapid arrival of Phil, Shane and Tony but there was no light or sound high above for some time afterwards. The hot meal served the purpose to warm my belly outside whilst it hydrated in the pack and was good nourishment before the long climb out. Shane and then Tony arrived and with alarming news the delay was due to the plate on Phil's Stop falling apart, mid pitch! Phil's significant experience was clearly critical and he recovered the situation and had exited on his jammers. Since I was getting chilled, Phil "The Hawk" gave his place to me and so I started the long climb out, up the big initial pitches. I was pleased to achieve a good rhythm once the initial bounces eased on the first 58 metre pitch. Perseverance and a steady pace brought me to the cobbled bay as a welcome break from hanging in the harness. Next, followed the further series of pitches, most rather shorter between rebelay and with contact with the moonmilk coated wall, until I had reached the Eagle's nest, a significant milestone towards the exit. Phil was on my heels the whole ascent and joined me at the Eagle's nest soon afterwards. Chris had set out a bottle to catch water drops during his descent, to provide a refreshing couple of gulps of water before swinging out to ascend another large pitch. Then the rate of pitches

increased to the familiar rubble-filled gully, which I had reached on earlier, exploratory descents. Slight moment experienced during the changeover to the traverse, swing pitch, with the Croll not threaded cleanly, so ended up on the safety line of the foot jammer with back-and feet braced across the chimney to rectify the situation. This was the single, dodgy moment experienced during the whole trip. From there, just ticked off walks up the rubble slope and short pitches to emerge to a welcome from Keith, Phil, Steph, Petie, Stu and others on the surface. Phil handed me a cup of water, very gratefully accepted and consumed. The afternoon was scorching, and we waited for Phil, then Rich to appear. Rich shared a celebratory whisky from his caving hip flask. I decided to head down to the Texa spring for water whilst we waited for Vlad to emerge but mainly to have a full flannel wash and completely rinse my caving clothes. They had a strong odour of stale urine after I had slumped onto the pee slope adjacent to the campsite on one of the descents to collect water and visit the latrine. Very refreshing strip wash indeed in the cool, spring water, with the cattle looking on, bemused. I rinsed all the kit and spread it over boulders to drain and dry in the warm, late afternoon sunshine. Rolled the damp clothes back up into the tackle sack and trudged up the long steep, grassy couloir to where it intersected the path back to the Refugio. By chance, Keith, Rich, Petie and Tom had just reached that point on the path. Petie kindly took my tackle sack and Rich my overnight food bag, to ease the load for the walk back to the Refugio. The supper tasted superb after the period living off the bland food at underground camp.

Saturday, 13 August

A rest day, sorting and drying caving gear. Walked the sods to Los Lagos with electrical kit and chargers for Chris, who left the expedition on this day, burdened with a large pack with camping and diving kit. Bartek and Paulina arrived and there was substantial photographic kit to share amongst the group for the return walk, for Martin and I that was from where they caught up with us whilst we rested at Bobias spring.

Sunday 14 August

There was building concern amongst those at the Refugio camp that the weather was forecast to change to thunderstorms and torrential rain. Phil B, Tony, Paulina, Bartek and Lisa were about to descend Cabeza Muxa; Bartek and Paulina for a photographic trip down the main shaft, staying at the underground camp overnight. Lisa would assist, as model caver for the day and was expecting to climb out later the same day. Phil and Tony planned to strip out ropes from the streamway pitches, also planning to overnight in the "Chalk Lounge" (underground camp). Phil asked me if I would maintain a vigil at the Muxa surface campsite. The aim was to provide updates on the status of the low pressure system developing over the Bay of Biscay, using the Nicola cave radio to relay weather forecasts received from Paul Mackrill.

Spent the day with Martin, exploring leads on the complex limestone outcrops of the slopes below C4. Returned to the Refugio in the afternoon to assume my role as surface cave radio communications at the Muxa surface camp.

17:15h Arrived Muxa surface camp.

17:25h Changed 18650 Li-ion cells of Nicola 3 set with fully charged ones from my caving lamp.

17:26h Connected in aerial leads after crimping broken wire contacts.

17:45h Attempt phone call to Paul McKrill from cairn on crest of path, where there was mobile network coverage. No answer – left voicemail message.

18:00h Return to Nicola 3. Checked aerial lead in both directions for snags/ breaks and double checked connections and earth of top cable. Wetted electric fence tape of top earth.

19:00h Attempted contact from Nicola 3 to underground camp Nicola 2. No reply.

19:45h Successful weather update received from Paul via WhatsApp, on return up the hill to the cairn.

19:55 to 20:00h Returned down the hill. Attempted contact with Nicola 3 then swapped in Nicola 4Z to aerial cables but no discernible reply. Read weather forecast in case I could be heard on the underground Nicola 2.

20:50 to 21:10h N4Z attempted contact successful. Paulina advised that Lisa was climbing out, having set off at 18:30h. Able to communicate the current, dry weather and the outlook from Paul's report. Read line by line with read back to be confident it was correctly received. Paulina explained that Phil and Tony had stripped back the rope of many of the streamway pitches. Reported that both were safely at camp changing out of wet clothing. Requested news when Lisa was out of the cave.

21:25h Walked up to cairn and sent a WhatsApp update of information received from underground camp. Stu replied he was walking over to accompany Lisa back to camp. Hasty return to heat water to prepare Lisa's mountain meal and hot chocolate.

21:30h Gully rope twitching followed by Lisa's appearance at surface camp!

21:30-21:50h Lisa enjoyed meal at camp and Stu appeared.

21:50h N4Z attempted contact with underground camp successful. Informed underground camp that Lisa was safely back at the surface. Agreed next Nicola communications attempt at 07:00h.

22:45h Lisa and Stu departed. Walked up hill to send WhatsApp update that all was well at Muxa camp, that Lisa was safely on the surface and fed. Also, that Lisa and Stu should appear back at the Refugio campsite shortly.

23:00h Slept well under the flysheet of the Muxa surface tent. Stared briefly at the fine disc of stars visible directly above the cone of the campsite.

Monday 15 August

07:00h N4Z attempted contact with underground camp successful (Tony, Phil, Paulina and Bartek). Tony explained that they would begin ascent at 08:30h. Expected time at surface 11:00-12:20h. I explained that a bounce party was expected to start down at 11:00h to continue derigging and to bring out full tackle sacks. Agreed next communication at 08:30h to confirm start of ascent, as anticipated.

Cow bells announced the arrival of a procession of cattle around the lip of the doline. Shortly afterwards, several vultures soared overhead on the early morning thermal.

08:30h N4Z attempted contact with underground camp successful. Question from Tony, which tackle bags to come out and what to do with three empty tackle sacks. Also, when to close Nicola communications. Agreed to leave cave radio and aerial wires in place for the bounce party.

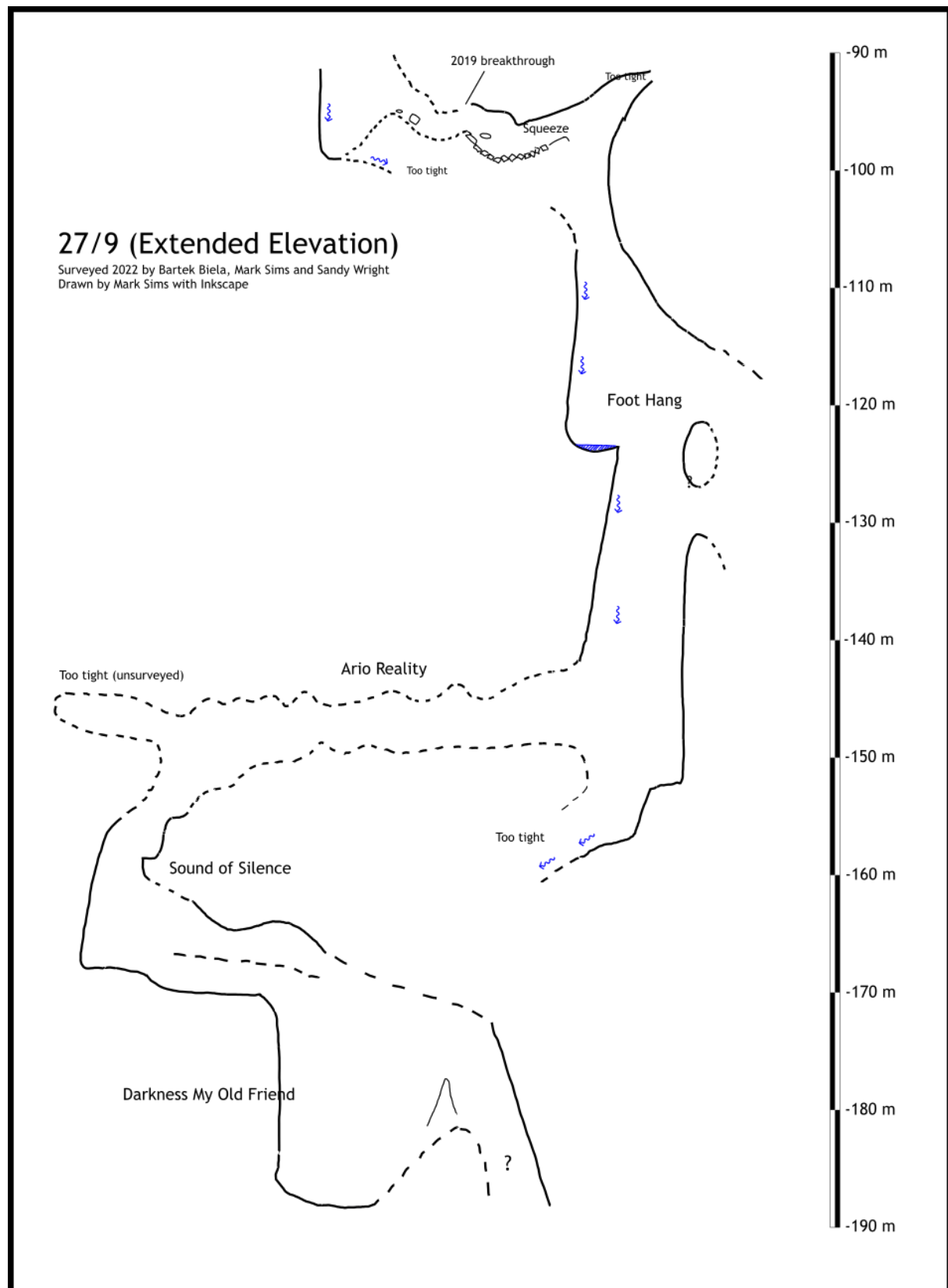
Rich, Tom, Phil, Stu and Shane arrived, they were keen to descend, so patiently waited for Phil and Tony to emerge. All but Tom set off in the knowledge Paulina was some way behind. Waited around all day for

Bartek and Paulina to appear (5 ½ hour ascent), then for Stu and all to emerge with the tackle bags. Phil said Rich and Shane would be late because Rich was keen to complete derigging. We head back for supper. Rich and Shane arrived later, Rich disappointed that I had not been on station for Nicola comms earlier on. Back at the Refugio campsite, I began to pack and decided I could not carry everything down as one load, in the morning. So I embarked on a busy evening. First, returned to the Muxa campsite to dismantle and collect Nicola kit and aerals. I managed to collect Nicola and wind in the top aerial before supper, when Stu appeared with the underground Nicola and aerial cables. Immediately on eating supper at the Refugio camp, walked all caving gear and underground comforts Darren drum down the sods to Los Lagos. Fog had descended and in the twilight, I had difficulty seeing the path in such poor visibility, especially with the glare of reflected light from my head torch. Made the decision to unpack gear into the car, sleep in the spare sleeping bag on the levelled seat and to set off for the Refugio at 05:30 hours, to return at 07:50h, in time for a final porridge, then egg, cheese and bread breakfast.

Tuesday 16 August

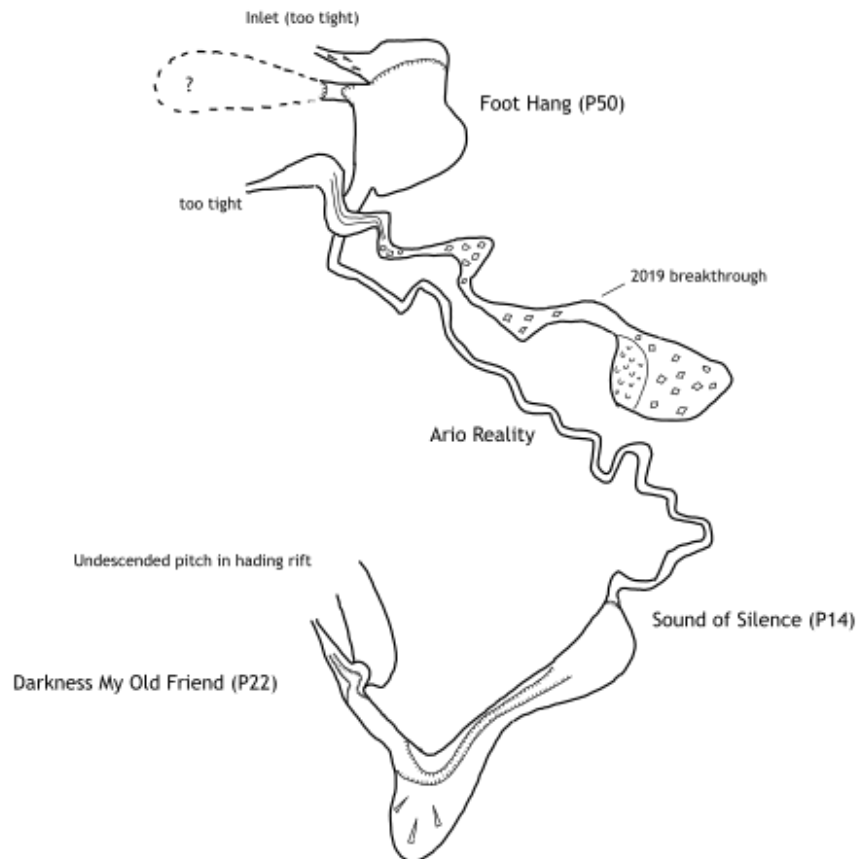
Packed tent and remaining food after breakfast. Agreed to carry the Nicola equipment off the hill to return to the UK. This was still a large rucksack to yomp and the walking pole was an asset, given the heavy additional tackle sack slung over one shoulder and held under my arm. Martin had left earlier and had returned unburdened to the "No camping" sign across from the top car park, to offload the tackle sack from me. Most grateful. He returned up the hill because Tony was walking down with his last bag. I had time to unpack and change into fresh clothes prior to the drive off the mountain. Martin returned complete with bag, so we carefully descended the Covadonga road, negotiating the frequent buses shuttling visitors up hill, and swinging around the sharp bends. We reached Cangas to encounter heavy rain, the predicted change in weather that we were so concerned about in preceding days. End of a magical few days as my introduction to the Ario caves.

4. Survey and Description of 2019 Extensions to 27/9



27/9

Surveyed 2022 by Bartek Biela, Mark Sims and Sandy Wright
Drawn by Mark Sims with Inkscape



At the bottom of the 'Final Pitch' (see OUCC Expedition Reports 1998 and 2000) a narrow rift may be entered by climbing 3m up on the left hand side. Descending obliquely leads to a sharp right hand bend where the way on is a crawl at chest height, this is the start of the 2019 dig 'Psychospeleogenesis'. A few metres along the blasted section you are forced to go down feet-first into a tiny space where there is just enough room to turn around. Head-first over a block leads to a narrow 2m long squeeze to reach a right hand bend where the passage enlarges. Soon a deep rift opens up underneath which is traversed on wide ledges until a gap

large enough to enter is reached. This leads via a slightly exposed traverse to the head of a 50m pitch 'Foot Hang'. The pitch has two rebelay and a deep parallel shaft is visible which has not been explored. Following the tiny stream at the bottom of 'Foot Hang' soon becomes too narrow, the way on is to climb back up for 10m to find the only part of the rift wide enough to enter. Here a small ledge provides just enough space to remove SRT gear before beginning an awkward thrutch along the only navigable level in the rift. This continues for around 40m past several sharp bends until the rift suddenly widens to a more comfortable size. An ascending traverse here leads to a roof tunnel which becomes too narrow somewhere above the next pitch. The way on is to squeeze downwards and thrutch sideways until you reach a spot just large enough to put your SRT kit back on. With the rope tied round a stal column, a further squeeze leads to the head of 'Sound of Silence', a 15m pitch rigged from two bolts and with a rebelay.

From here the cave increases in size, and there are some nice formations. A brief stroll and a short section of rift lead to the head of 'Darkness My Old Friend' a 22m free-hanging pitch down a fine shaft with three bolts at the head. At the base a narrow rift in the floor or a 45 degree traverse up broad muddy ledges to a col offering a view into a wide steeply hading rift are the present limit of exploration.

5. Small Caves Revisited in 2022

Area 5

X	2/5		43.23754 N, -4.92015 E
X	6/5		43.23730 N, -4.92031 E
X	9/5	Colin's Calamity	43.23788 N, -4.91961 E
X	10/5		43.23851 N, -4.91986 E
X	11/5		43.02381 N, -4.91878 E

Open pot descended via ledge with rebelay at depth of 12m, all rigged from naturals, gravel choked floor met at depth of 28m, no snow remaining on the bottom. Floor slopes steeply away from the bottom of the neighbouring depression (E-ish) where voice connection was made. Rocky slope changes to a flatter mix of hard gravel and sand floor. Small inlet from a possible parallel shaft visible through narrow rift (needs widening) towards the uphill side (W-ish).

/	19/5		43.23425 N, -4.92852 E
X	21/5		43.23720 N, -4.92182 E
X	25/5		43.23865 N, -4.92199 E
/	78/5		43.24230 N, -4.92139 E

Accessed via the Eastern of the two shafts, approx. 20m deep, lands at the bottom of a very steep loose slope. Snow reached after a few metres sloping steeply towards the midpoint between the two shafts.

/ 79/5 43.24174 N, -4.92093 E

X 5/8 43.23593 N, -4.93429 E
10 m walk-in rift with solid walls. filled in at bottom. Rift continues upwards but gets too tight.

? E1 Could not be found at the location in the Shaftbashing Guide

? E17 Could not be found at the location in the Shaftbashing Guide

X	E24	43.23158 N, -4.94053 E
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X E27 43.23030 N, -4.94071 E
Shakehole no longer has any snow but is fully choked.

Area 5

O 86/5 43.23431 N, -4.92597 E
At base of sheer limestone approx. 6 m high. Black hole. Entrance approx. 30 cm x 75cm and probably just large enough to enter. Looks to widen below. rocks fall about 10 m. part of a larger surface feature. worth a descent.

X 87/5 43.23431 N, -4.92694 E
Two obvious large connected shakeholes. Can either climb down the connection or the eastern of the two. Approx. 5m deep and choked in all directions.

X 88/5 43.24181 N, -4.92072 E
Shakehole from which snow was collected during Ario camps up until around 2010. Climb down a couple of metres to a choked floor with a small remnant of the snowplug.

Area 9

/ 45/9 43.23257 N, -4.93419 E

6 m wide, 2m high entrance with large boulder wedged across in the centre. Walking passage funnels down steep muddy loose slope 2m X 2m that continues approx. 15 m to a small drop (3 or 4 m). Looks choked below, but can't confirm without descending.

Area E

X E39 43.23161 N, -4.93998 E

5m deep rift, choked at bottom

X E40 43.22955 N, -4.94136 E

Holes down under natural arch. floor visible 2 m below, rocks rattle a bit. Solid roof meets boulder floor approx. 3 m down. diggable. no draught. some space beneath boulders but probably more boulders than space.

O E41 43.22912 N, -4.94184 E

Numerous modest shafts/rifts. Biggest sounds choked but hard to definitively see bottom at all sides. approx 8 m deep.



The Milky Way from the expedition food tent, by Bartek Biela

7. Expedition Final accounts

Income		Qty	Budget
	Income Exped Fees - deposit	25	£1,250.00
	Income Exped Fees - balance (students excluded)	22	£1,100.00
	Income GPF		£1,100.00
	Income GPF for students specifically		£200.00
	Income Other		£1,850.00
			£5,500.00
Costs			
	Rope / hangers / Mallions - Starless River		£2,064.01
	Camping mats		£359.55
	Daren Drums		£113.40
	Tents (surface)		£194.97
	Camping kit (gas etc)		£80.62
	Underground / Surface food		£459.08
	Helicopter		£1,390.00
	Electric Fence		£195.00
	Dry bags		£84.00
	Duffels for helicopter		£65.95
	Bosch Drill		£139.00
	Underground Tent		£250.00
	First Aid kit / survival stuff		£112.40
			£5,145.58
	Balance		£354.42

8. 2022 Summary and conclusions

2022 was a challenging and successful expedition on many fronts. Cabeza Muxa was successfully rigged and dived in under two weeks and the re-bolting will enable future expeditions to revisit the cave with much less effort. Exploration occurred elsewhere, in 27/9 and 53/5, these represent ongoing objectives for the project. Although recruitment was difficult, in the end a number of new participants joined the expedition for the first time and many long standing team members also returned. High quality photographs of the expedition were taken which will serve as an excellent record for the achievements, promotional material for our sponsors and should also assist with future recruitment.

The use of a helicopter was instrumental in being able to start caving and rigging very quickly with a small team rather than spend many days just setting up basecamp. As the demographic on this expedition has moved from students with long summer holidays to working professionals with less time off it has become important to maximise caving time, and minimise the effort required to set up and maintain base camp. The relationship with the refugio is particularly important in this respect. The majority of the team chose to eat in the refugio which minimised the amount of food and supplies which needed to be carried up the mountain.

The water shortage at Ario this year created some particularly acute issues. We flew in 250 litres of water at the start of the expedition which greatly helped minimise our demands on the refugio water supply. Later some resupply runs from Las Bobbias supplemented this but fear that the refugio might have to close for lack of water was very real.

The expedition ran over the customary four weeks but due to the spread of personnel there was a concentration in the central two weeks. As the demographic has changed, future expeditions might consider a shorter but more focused effort. This year the expedition took place in August which presented very good weather for the first two and a half weeks but had the downside that the refugio was extremely busy.

For future expeditions there remains the objective of connecting Cabeza Muxa to Asopladeru La Texa. Now that the sump's depth and length is known it will be much easier for a future expedition to complete the beyond sump exploration. The staged rope will enable the cave to be rigged quickly and the staged diving weights will minimise the weight of equipment which needs to be moved.

All ropes, anchors and rigging in C4 were checked and replaced where necessary down to the bottom of 'Here be Dragons' the last pitch of the shaft series before the streamway is reached. All rigging is now in-situ and this should allow next year's expedition to quickly reach the pushing front at the bolt climbs that remain to be finished. Two trips into 27/9 resulted in the exploration of one new pitch and the surveying of the 2019 extensions up to the current limit of exploration. The cave continues wide open and was left at another pitch.

Low manpower during the second half of the expedition affected the amount of deep caving that could be done after work in Muxa had finished, instead focus shifted towards shaft-bashing and near surface projects. The most exciting result from this part of the expedition was the discovery of a significant upstream extension to 53/5, a cave that was previously thought to have been finished in 1991. This new series still requires surveying and several leads remain here for future expeditions.