

The Pico del Oro Plateau Caving Expedition in 2024

10th August – 13th September 2024

An International Expedition that is part of a wider series of North Perú Caving Expeditions organised by Espeleo Club Andino (Perú) and Groupe Spéléo Bagnols Marcoule (France)

Sponsored by the Mount Everest Foundation and the Ghar Parau Foundation, International Union of Speleology (UIS) and Speleological Union of Ireland (SUI) and supported by Adventure Nutrition dehydrated meals.



Summary

This 2024 expedition returned to explore caves on the high altitude (> 3,250-3,550m) Pico del Oro Plateau in North Perú. This high plateau has significant potential for deep caves, as it is potentially underlain by limestone units that may have up to 2,700 m of relief, and it is situated above a very large (~24 m³/s median up to 35 m³/s peak) resurgence of the Rio Negro River (Baby 2020, 2023). The 2024 expedition follows on from initial reconnaissance expeditions in 2018-2023, including a 10-person 2023 expedition that left two vertical caves open at a depth of -150 m (Lorenzo's Right and Left Eye Caves), and a major stream cave (Tragadero de la Soledad) that was 2.3 km long and -205 m deep. All of these expeditions, including the most recent 2024 expedition, form part of a wider series of GSBM-ECA expeditions across Perú (www.cuevasdelperu.org; Nord Perú 2018, 2019, 2022, 2023).

The 2024 expedition involved 27 cavers from 7 countries, who were organised into 3 groups. The first group of 8 cavers returned to the vertical pits of Lorenzo's Left and Right Eyes, using a new camp located close to their entrances. Exploration and rigging of both vertical caves proceeded well until a local storm (not predicted by satellite weather forecasts) caused a major flooding incident that detained caving teams underground overnight in both caves, despite careful rigging of pitches. Subsequently caving trips were only undertaken in periods of very settled weather, and pushed both vertical pitch series to perched sumps at depths of 265 and 275 m. Surface prospecting found a series of other pits and megadolines, including the 102m deep Pozo de las Orquideas, some of which are open.

The second group of 15 cavers significantly extended the beautiful Tragadero de la Soledad, so that this major stream cave is 4.2 km long, making it currently the longest cave in Peru. It has now reached a depth of -325m. The sump from 2023 was bypassed by a climb that led to a very large chamber (Triumph of the Matriarchy), and then a high-level series of very large passages and chambers, which occasionally also accessed the large active streamway underneath. Trips of the end of this world-class cave took 12-15 hours, and became a major undertaking. Eventually a climb from the final chamber (Darkest Peru) was found to be blocked, and the cave was derigged. No obvious leads remain, but only a few teams spent time at the far end of this cave, and it is not completely certain there is no viable way on (e.g. via bolts climbs). The focus of Group 2 then moved to finding a surface entrance beyond the end of the known cave, to act as a 'back door'. Towards the end of the trip a 120m deep surface pit was discovered, whose entrance is only 300 m above and 170 m horizontally from the end of Tragadero de la Soledad. The pit, called Tragadero de las Golondrinitas, leads to a large chamber, from which a small passage may provide a way to rejoin the Tragadero de la Soledad streamway. A major aim of future exploration is to find the underground confluence of the streamway from the Tragadero de la Soledad, and an even larger river that sinks 2.5 km away on surface. It is now clear there is no possible resurgence for this water on the plateau, and it could drain to the huge Rio Negro resurgence that is 2,700 m lower and ~25 km away.

Group 2 also explored a series of other river sinks, many of which were blocked. Sink 2 is still ongoing albeit in low cobble crawls, and the nearby Torridon View cave is 75 m deep and also ongoing. A narrow cave (Cave on the Col) was also left ongoing at -50m, and this is located directly above the upstream branch of the main streamway in Tragadero de la Soledad, and is thus in an exciting position.

Group 3 were a smaller (4 person) team, but they found an exciting second ~100m deep shaft on the surface (Tragadero de Abra del Arco), which may also provide a back door into the Tragadero de la Soledad system and streamway.

The ambitious and successful expedition thus extended the Tragadero de la Soledad streamway to become the longest cave in Peru. Deep shafts were found that can provide a back door into the continuation of this massive cave, and may lead to its confluence with even larger nearby river sinks.

Résumé

Une nouvelle expédition a été organisée en 2024, le but était de continuer l'exploration des gouffres du plateau du Pico del Oro (altitude > 3 250-3 550 m), situés à Granada dans le nord du Pérou. Ce haut plateau présente des cavités verticales à fort potentiel se développant dans des formations calcaires pouvant atteindre 2 700 m de puissance. Ce massif calcaire domine une très importante résurgence (d'un débit moyen de ~ 24 m³/s à 35 m³/s en crue). Cette puissante résurgence correspond à la source du Rio Negro (Baby 2020, 2023). L'expédition de 2024 s'inscrit dans la série d'expéditions de reconnaissance menées depuis 2018. En 2023, une expédition composée de 10 personnes avait permis d'explorer deux gouffres prometteurs, reconnus jusqu'à une profondeur de -150 m (Tragaderos del Ojo Derecho e Izquierdo de Lorenzo). En outre, l'exploration d'une cavité majeure, le Tragadero de la Soledad d'un développement de 2,3 km pour -205 m de profondeur, avait également mobilisé les équipes. Toutes ces expéditions, y compris la plus récente de 2024, font partie intégrante d'une plus large série d'expéditions GSBM-ECA à travers le Pérou (www.cuevasdelperu.org ; Nord Perú 2018, 2019, 2022, 2023).

L'expédition 2024 a impliqué 27 spéléologues de 7 pays, répartis en 3 groupes. Le premier groupe, composé de 8 spéléologues, est retourné aux Tragaderos del Ojo Derecho e Izquierdo de Lorenzo. Un camp a été installé à proximité des deux entrées. L'exploration et l'équipement de ces deux cavités verticales se sont bien déroulés jusqu'à ce qu'une tempête locale (non prévisible par la météorologie par satellite) provoque une crue majeure ayant bloqué deux équipes de spéléologues dans les deux cavités pendant une nuit. Par la suite, les incursions sous terre ont été programmées dans des périodes réputées plus calmes, notamment le matin. Des séries de puits verticaux ont mené les spéléologues jusqu'à des siphons perchés situés aux profondeurs de 265 et 275 m. En surface, la prospection a permis de découvrir une série d'autres gouffres et mégadolines, dont le Pozo de las Orquideas, profond de 102 m.

Un deuxième groupe de 15 spéléologues a poursuivi les explorations dans le magnifique Tragadero de la Soledad pour porter son développement à 4,2 km, actuellement c'est la plus longue cavité connue au Pérou. Cette cavité majeure atteint désormais une profondeur de -325 m. Un siphon atteint en 2023 a été contourné par une escalade ayant permis la découverte d'une très grande salle ("Triomphe du Matriarcat"), puis à une série de très vastes passages et salles de grande ampleur livrant parfois accès à un actif coulant en dessous. Les incursions, assez engagées, nécessitaient jusqu'à 12 à 15 heures passées sous terre. Enfin, une escalade dans la salle terminale ("Darkest Peru") n'a pas permis de découvrir de continuations, Le Tragadero de la Soledad a été entièrement déséquipé. Au fond, aucun passage n'était évident, mais seulement un petit nombre d'équipes a consacré son temps à la recherche de continuations ; il n'est pas donc tout à fait certain qu'il n'existe aucune voie possible (par exemple des escalades artificielles). Par la suite, le groupe 2 s'est attaché à découvrir d'autres entrées en surface situées au-delà du point extrême atteint dans la Soledad. L'objectif étant de découvrir une "back door", ou porte dérobée, permettant de contourner l'obstacle. Vers la fin du séjour, un puits de 120 m de profondeur a été découvert, dont l'entrée se situe à seulement 300 m verticalement et à 170 m horizontalement de l'extrémité atteinte dans le Tragadero de la Soledad. Ce puits, nommé Tragadero de las Golondrinitas, mène à une grande salle, à partir de laquelle un petit passage pourrait rejoindre la rivière du Tragadero de la Soledad. L'un des principaux objectifs des explorations futures est d'atteindre une confluence souterraine de la rivière du Tragadero de la Soledad. Cette confluence avec une rivière, plus importante encore, permettra peut-être de parcourir la dénivellation de 2,5 km qui sépare le plateau de la résurgence... Car il est clair qu'il n'y a pas de sorties possibles pour les eaux

du plateau autre que la puissante résurgence du Rio Negro, distante de 25 km et située 2 700 m plus bas.

Le groupe 2 a également exploré une série d'autres pertes ou gouffres, dont beaucoup étaient bouchés. La dépression dite "Sink 2" est toujours en cours d'exploration, même s'il est ponctué par d'étroits passages entre plafond et galets. La cavité voisine, dite "Torridon View", a une profondeur de 75 m et est également en cours d'exploration. Une cavité étroite (gouffre du Col) a aussi été explorée jusqu'à la profondeur de -50 m. Cette cavité est située pratiquement au-dessus de la branche amont du cours principal du Tragadero de la Soledad.

Enfin, le groupe 3 était plus réduit (4 personnes), mais contre toute attente un deuxième puits de plus de 100 m de profondeur a été découvert (Tragadero de Abra del Arco). Cette cavité verticale pourrait conduire à l'un des affluents de la rivière du Tragadero de la Soledad.

L'expédition 2024 a permis de prolonger la rivière du Tragadero de la Soledad pour en faire aujourd'hui la cavité la plus longue grotte du Pérou. En outre, des puits profonds ont été découverts, ils pourront peut-être livrer accès au Tragadero de la Soledad ou à d'autres rivières souterraines encore inconnues.

2024 Expedition Members

Group 1 (8 persons)

Martin Holroyd (UK) - *(MH)*
Andreas Klocker (Austria) - *(AK)*
José Antonio De Pomar Cáceres (Perú, ECA) – Expedition Co-Leader - *(TdPC)*
Jean-Yves Bigot (GSBM, France) - Expedition Co-Leader – *(JYB)*
Steve (Jock) Read (Ireland) – *(JR)*
Steve McCullagh (Ireland) – *(SM)*
Axel Hack (Germany) – *(AH)*
Julien Jeannin (France) – *(JJ)*

Group 2 (15 persons)

Pete Talling (UK) - Expedition Leader - *(PT)*
José Antonio De Pomar Cáceres (Perú, ECA) – Expedition Co-Leader - *(TdP)*
Jean-Yves Bigot (GSBM, France, Expedition Co-Leader) - *(JYB)*
Gareth Davies (UK) - *(GD)*
Rene Haemers (Netherlands) - *(RH)*
Fleur Loveridge (UK) – *(FL)*
Chris Jones (UK) – *(CJ)*
Hannah Moulton (UK) – *(HM)*
Aileen Brown (Ireland) – *(AB)*
Róisín Lindsay (Ireland) – *(RL)*
Petie Barry (Ireland) – *(PB)*
Brían MacCoitir (Ireland) – *(BM)*
Tony Seddon (UK) – *(ADS)*
Jules Carter (UK) – *(JC)*
Paul McCarron (Ireland) – *(PMc)*

Group 3 (4 persons)

José Antonio De Pomar Cáceres (Perú, ECA) – Expedition Co-Leader - *(TdP)*
Jean-Yves Bigot (GSBM, France, Expedition Co-Leader) – *(JYB)*

Raphaël Gueit (GSBM, France) – (RG)
Florian Richard (GSBM, France) – (FR)

We give a very large set of additional thanks to Liz Hidalgo (Perú - LH), Jean Loup Guyot (France - JLG), Antonio de Pomar (TdP) for helping to organise many aspects of logistic that include local permissions, horses and local guides in Granada, group travel, and equipment storage.

We also extend a very large set of thanks to Dario Labajos Conilla who again organised logistics, and provided food and the horses that carried much of the equipment onto the high plateau.

Timeline (Chronogram) of 2024 Expedition

Overall dates: 10th August to 13th September 2024

Group 1:

10th August: Advance part of Group 1 arrive in Chachapoyas

11th August: Shop and Rest of Group 1 arrive in Chachapoyas

12th August: Group 1 travels from Chacha to Granada on bus that needed a push once, met Mayor of Granada. Stayed in Granada

13th August: Group 1 walks up hill with horses to Calamina Camp.

14th August: Group 1 and horses goes from Calamina Camp to Scottish Loch Camp.

15th August: MH, JR, TdeP rigged (larger) Lorenzo's Right Eye to previous limit with 200m rope. AK, SM, AH started rigging (narrower) Lorenzo's Left Eye.

16th August: AH, SM, AK continued rigging Lorenzo's Left Eye, and find drier bypass to original route. JR, MH rig 2 more pitches in Lorenzo's Right Eye and JYB et JJ take some pictures in the entrance pitches.

17th August: AK, SM, AH continued rigging Lorenzo's Left Eye. JR, MH rigged 2 more pitches to large chamber in Lorenzo's Right Eye, and pass boulder choke below chamber. JYB goes to « *Cut Cave* » (*Cueva Cortada*), « *Cave of the Block* » (*Tragadero del Bloque*) et « *Sink 3* » (*Tragadero P3*).

18th August [day of major flood pulse]: MH, AH survey and explore further in Lorenzo's Left Eye, but encounter flood pulse in late afternoon and eventually exit cave at 04.00 on 19th. SM, JR surveyed Lorenzo's Big Eye to big chamber, and find small side passage off big chamber. Major flood pulse at 16.30pm also detains this team within the cave for 11 hours, as they shelter in small side passage and exited cave at 10.00 on 19th. AK on surface recovering from lung infection.

19th August: General recovery at camp from flood pulse incident.

20th August: TdP and JYB prospect for new entrances near camp, and find larger and smaller surface entrances that need a rope.

21st August: JYB solo attempts to reach P4 sinkhole, using a machete in places.

22nd August: TdP, SM, MH go to Lorenzo's Right Eye and survey through the choke and drop pitch below large chamber. Arrived at downstream sump and choked upstream inlet, and then derigged lower pitches. SM, AH, AK also explore flood prone leads lower down in Lorenzo's Left Eye. Wetter first lead was explored to an upstream inlet and downstream pitch. Drier second lead was followed and dug to reach chamber. A squeeze led to a too-tight squeeze. Both teams had very early starts (5-7 am) to minimise chance of flooding by afternoon rain.

23rd August: SM, MH derigged Lorenzo's Right Eye. SM and MH then descended a surface entrance on the south ridge from camp – to a large chamber (Hummingbird Pot). JR, JJ, JYB explore P4 and P7 sinkholes on surface, both occupied by dense rainforest. P4 needs a rope, but P7 is found to be choked after vertical grass climb down.

24th August: Rest day at camp.

25th August: JR, SM, and AH depart from Scottish Loch to Calamina Camp, with loads supported by rest of Group 1. Remaining 5 people stay at Scottish Loch.

26 August: AdP, AK, MH prospect in closed valley to SW of Scottish Loch Camp, and log 5 entrances. Features including a shaft with a 3-5 second rattle of rocks, whose entrance is near yellow orchids (hence Pot of the Orchids), and a clean-washed meander passage that needs a rope.

27th August: JYB, TdP, JJ rig and survey the 102 m deep Pot of the Orchids, but the meander at the bottom is blocked. AK, MH push the remaining dryer lead and then derig Lorenzo's Left Eye. 3 more small pitches reached a chamber and rift that led to the flood prone master streamway (Decision Tea Extensions). Unfortunately downstream in streamway led to a sump, and upstream end choked.

28th August: 5 horses and Dario's team helped to move all equipment from Scottish Loch to Calamina Camp, which was a very impressive effort. Met by PT from Group 2 at Calamina Camp.

29th August: 5 horses take rope and equipment from Calamina Camp to Sink 2 Camp with PT, TdP and JYB (who join Group 2).

30th August: MH, AK, JJ and 5 horses go down to Granada from Calamina Camp, and back to Chachapoyas.

Group 2

23rd August: Advance part of Group 2 arrive late in Chachapoyas, after overnight bus from Chiclayo.

24th August: Shopping in Chachapoyas, and rest of team arrive in Chachapoyas. Minivan to stay night with Dario in Granada.

25th August: Group 2 walked into Calamina Camp from Granada with Dario and 13 horses. Met Jock, Steve and Axel from Group 1 at Calamina Camp in evening.

26th August: Group 2 transfer equipment from Calamina Camp to establish new Sink 2 Camp (Inca Camp).

27th August: GD, RH and FL start rigging Tragadero de la Soledad (Bigger Sink). PT, ADS and BM push lead heading upstream in first streamway in Bigger Sink, which now needs thin person, and find the upstream part of Pisco and Codeine is now a choke (not duck). AB, RL, PB and PMc explored Sink 5 to a choke. CJ, HM and JC explore further away sinks 6 to 7, which choked.

28th August: GD, RH, PB, PMc continue rigging Tragadero de la Soledad (Bigger Sink). BM, ADS continue to push upstream lead at end of Bigger Sink entrance pitches. CJ, HM and JC explore line of sinks beyond sink 7. AB, RH and FL push Hummingbird Cave and Cave-on-the-Col. PT goes back to Calamina Camp to meet the remaining part of Group 1 to sort gear transfer to Group 2.

29th August: CJ, HM, JC explore sinks 8-11 and far eastern resurgence. RH and AB continue pushing the tight Cave-on-the-Col. GD, PMcC prospecting above the Sink 2 camp (Inca Camp). PT returns from Calamina Camp to Sink 2 camp, and JYB and TdP join Group 2.

30th August: GD, RL, PB, PMc tackle aid-climb above sump in Bigger Sink, and discover Matriarch chamber. PT, ADS, BM, FL explore left-hand branch of Sink 2 past pitch to low open crawls. RH, AB, JYB, TdP continue exploration of tight Cave-on-the-Col. HM, CJ and JC explore Torridon View and other caves found by GD/PMcC yesterday.

31st August: HM, CJ, JC, FL continue exploration in Bigger Sink beyond Matriarchy, including surveying up inlets to that chamber. BM, ADS, PT, RH survey and explore right branch of Sink 2 to a choke and derig.

1st September: GD, PMc, survey downstream from Matriarchy Chamber. PT, ADS and BM extend the downstream survey by another 400m. PB, RL finish surveying inlets from Matriarchy Chamber. AB and RH derig Cave-on-the-Col, and HM helps carry gear back. CJ and JC explore Torridon View cave. TdP and JYB prospect on the second hill visible from the Inca Camp. Many large sinkholes are inspected but none provide access to a gallery.

2nd September: FL, JYB, TdP take photos in Bigger Sink. JC, CJ, HM, AB continue exploration beyond sandy passages to final chamber and choke in Bigger Sink.

3rd September: GD, BM, TdP, JYB prospect and explore small holes, and PT finds big hole, in area on surface beyond end of Bigger Sink. RH, PMc, PB, RL dig Sink 17 in area near Tragadero del Planura del

Pico del Oro, but it chokes. FL, ADS do climb in Lamb and Fox Chamber, and explore on of small person leads at base of entrance. CJ, JC, HM continue to explore Torridon View Cave, assisted by AB.

4th September: AB, PT start rigging Wagtail Sink (Tragadero de las Golondrinitas), and AB had accident with loose rock. BM, JYB, PMc continue prospecting in this same area. JC, CJ, HM explore 'PT9' that is towards Wagtail Sink. GD, PB, RL, TdP, RH do big trip to end of Bigger Sink, do final climb, but find no further leads and start derig.

5th September: FL, ADS, CJ, HM, JC complete the derig back from Matriarch Chamber. PT, JYB prospect for caves beyond Wagtail Sink. BMc, PMc further rigging in Wagtail Sink, half way down big entrance pitch.

6th September: HM, CJ shuttle their gear to Calamina Camp. Very rainy day in camp. Some gear fettling and rope washing.

7th September: BM, PB, RL, AB, PMc, ADS rig Wagtail Sink down 120m entrance pitch to a big chamber, and possible small way on. PT, FL, CJ, HM stash gear inside entrance of Bigger Sink. JC, GD derig Torridon View. RH, TdP, JYB derig left branch of Sink 2. HM and CJ move to Calamina Camp and meet Group 3.

8th September: CJ, HM go down to Granada with 2 horses. 5 horses go from Calamina Camp to Sink 2 Camp with Group 3, whilst 6 more horses start early and come from Granada to Sink 2 Camp (Inca Camp) (1). Discussion in Group 3 about what to do, but both Group 2 and 3 eventually move to Calamina Camp.

9th September: Group 2 goes down to Granada with horses, and after wait, arrive back in Chachapoyas at 10pm for expedition dinner.

10th September: Most of Group 2 travel via minibus from Chachapoyas to Chiclayo, and then Lima. Tight connection for those going on to the Galapagos.

Group 3

7th September: Patrice Baby has medical issue, and J-Denis Klein has problems with his knee, so Liz Hidalgo goes back down with him from Calamina. Thus only 2 persons (RG and FR) stay at Calamina.

8th September: RG and FR go to Sink 2 Camp (Inca Camp), but Group 3 decide to go back to Calamina as safer base for such a small group of 4 persons. In addition it is more logistical and strategic.

9th September: Departure of Dario and the last participants of "group 2". The "Group 3" (TdP, FR, JYB, RG) decides to prospect and revisit sinkholes 2 and 3 recommended by Hannah (HM) and Chris (CJ), near the Tragadero de las Golondrinitas (Wagtail sink). Near a pass ("abra" in Peruvian language), the Pozo del Arco is discovered, it is topped by a beautiful stone arch, but its bottom seems blocked. Under the "abra", near the stone arch, the bottom of a grassy sinkhole provides access to one of the pitches. Around -25 m, RG and FR discover an opening which dominates a big shaft more than 100 m deep, it is the Tragadero de Abra del Arco.

10th September: De-rigging (FR, JYB, RG) of Bigger Sink (Tragadero de la Soledad). Tonio (TdP) stayed to rest at the camp because he felt a little ill.

11th September: Rigging (TdP, FR, JYB, RG) of the Tragadero de Abra del Arco and the big shaft estimated at 170 m. RG stops around -200 m, on a pitch estimated at around ten meters.

12th September: De-rigging of the Tragadero de Abra del Arco (FR, JYB, RG) and return to the camp where Tonio (TdP) is resting. Dario is there with 4 horses.

A good part of the ropes are removed and stretched on a rope at the top of the big shaft.

13th September: Folding and drying of the camp (ADP, FR, JYB, RG). Departure around 11:00 a.m. from the camp, fairly quick return to Granada. Then we reach Chachapoyas by taxi (4x4 pick-up) where we meet the Franco-Peruvian group from Soloco.

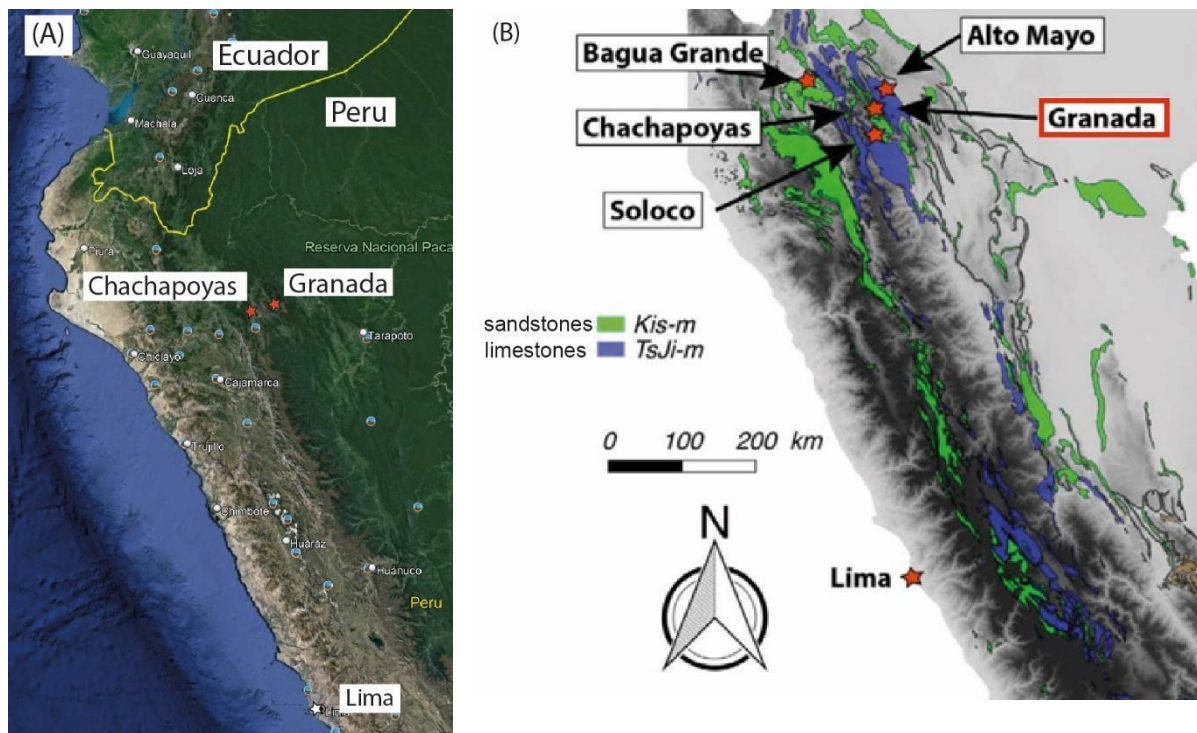


Figure 1. (A) Map showing location of Granada Plateau in northern Perú. **(B)** Geological map showing extend of limestone (blue) in northern Perú, with location of expedition area of Granada Plateau, as well as other major towns (e.g. Chachapoyas) and areas explored for caves in the past (e.g. Soloco). Figure from Baby (2020, 2023).



Figure 2. Map showing the expedition area on the Pico del Oro Plateau, above the village of Granada, to the east of Chachapoyas. Major caves, camps and the Rio Negro resurgence are also shown.

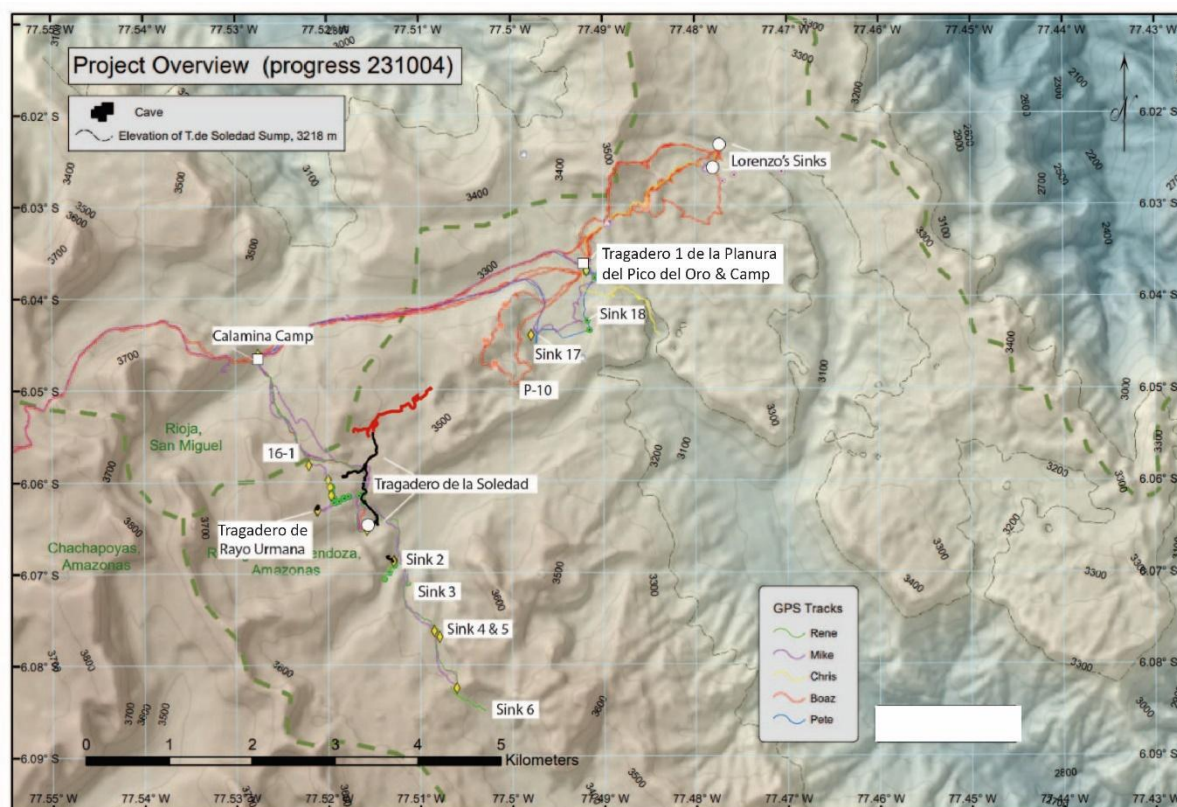


Figure 3. Detailed map of the expedition area on the Pico del Oro Plateau, showing major caves or sinks, GPS tracks and camps. Survey of Tragadero de la Soledad is also shown as a thick black line (2023) and a thick red line (2024 extensions).

Background to the Pico del Oro (Granada) Plateau

The expedition area was located in Northern Perú (Figs. 1 to 3). The area comprises a high (~3,300 to 3,700 m) plateau that is located to the east of the town of Granada, and bounded on its eastern side by a steep escarpment with over 2,500m of relief above the Moyobamba Plain (Fig. 4). The correct name for the plateau is the Pico del Oro Plateau, although the informal term ‘Granada Plateau’ was used in 2023 expedition planning. Granada is reached by a ~2 hour bus journey from the provincial capital of Chachapoyas (Fig. 2), which a hub for tourism within Northern Perú. Chachapoyas can be reached via bus from Jaen (4 hours), Tarapoto (9 hours), Chiclayo (10 hours), Lima (25 hours) or other major cities. We teamed up with local guides in Granada (Dario Labajos Conilla, Lorenzo Gebol Gomez, and Rosa Auristela Labajos, and Gilberto Gebol Gomez et al.), who provided horses to carry equipment, and we are very grateful for their hospitality in Granada.

The walk onto the plateau (Fig. 3) from Granada initially reaches the Siete Lagunas (Seven Lakes), which is being developed for tourism, with new huts built since 2022. The lakes are indeed very beautiful, and may make an attractive site for future tourism. The previously explored Tragadero de la Laguna Maria Gondolan is located shortly before the Siete Lagunas (Fig. 3; Nord Perú 2018, 2019, 2022; Bigot, 2019). The walk continues over a col at 3,750 m that marks a major watershed, and descends to the Jacinto Camp and carries on to the Calamina Camp, which is a further 2-3 hours (Figs. 2 & 3).

There were 3 groups of cavers in the 2024 expedition. The first Group of 8 cavers continued from Calamina Camp to camp at the good new ‘Scottish Loch’ campsite located next the entrance of Lorenzo’s Right and Left Eye caves. There is a route for horses to this campsite, and it takes 3-5 hours

from Calamina Camp, such that Dario and his colleagues needed to stay at Scottish Loch for one night. Group 2 (15 cavers) moved from Calamina Camp to new camp site (Inca Camp) next to Sink 2, which was also better and flatter, and where they could explore further to the east and south. Group 3 only comprised 4 cavers, and they chose to stay at Calamina Camp as this simplified some logistics.

The terrain on the plateau can be challenging and very tussocky, or with pinnacle karst in some areas. The weather on the plateau is highly variable, often with rain in the late afternoons, but also with some very sunny days, or thunder-storms. Group 1 found that some heavy rainstorms were not predicted by available satellite weather forecasts. In general, the ground was much dryer than in 2022 or 2023, which aided walking and horses. Temperatures can sometime dips below zero, with a light frost. There is no light pollution, so the stars and milky way are especially vivid.

Previous cave exploration: Four previous French-Peruvian caving expeditions has been to the karst areas around Granada, in 2018, 2019, 2022 and 2023 (Nord Perú 2018, 2019, 2022, 2023). Indeed, the ECA-GSBM group have been exploring for cave systems in Perú for over 20 years, with an excellent summary of that cave exploration history in Guyot (2019). Information on the previous expeditions across Perú is available at www.cuevasdelPeru.org, which is an incredibly detailed resource for caving in South America.

The initial 2018 ECA-GSBM expedition was linked to a karst conference in Chachapoyas, and was used to explore the intriguing Tragadero de la Laguna Maria Gondolan (Nord Perú, 2018). Then, in 2019, a camp was set up on the high plateau to explore the Tragadero 1 de la Planura del Pico del Oro (Nord Perú, 2019), and adjacent sinks (e.g. Sinks 17 and 18 that were also visited in 2023). An expedition in 2022 then found the entrances to Tragadero de la Soledad and Tragadero de Rayo Urmana, and confirmed the excellent potential of the area (Nord Perú, 2022). These expeditions also confirmed the challenging nature of the terrain, especially beyond Tragadero 1 de la Planura del Pico del Oro. The nature of the terrain meant that a larger team (with more horses) was needed in 2023, with self-sufficient satellite camps. This same model of lightweight satellite camps was used again in 2024, with an even larger team of 27 cavers, organised into three overlapping groups.

Geology and Hydrology of the Pico del Oro Plateau: The allure of the Pico del Oro is partly because of its large relief above the very large resurgence of the Rio Negro (Fig. 4 and 5; Baby, 2020, 2023). Indeed, there is up to 2,685 m of relief between the Rio Negro resurgence at 865 m, and cave entrances such as Tragadero de Rayo Urmana at 3,550 m, Tragadero de la Soledad at 3,420 m, and Lorenzo's Sinks at 3,290 m (Fig. 5). This resurgence has an average flow rate of $\sim 24 \text{ m}^3/\text{s}$, with much higher flow (up to $35 \text{ m}^3/\text{s}$) in floods (Grandjouan et al., 2017). Moreover, the water in this resurgence is also notably colder than other main resurgences along the mountain front, suggesting quick through-flow times, and its large discharge suggests a large underground catchment (Grandjouan et al., 2017). Analysis of the magnitude of the discharge is also consistent with a drainage area including the Pico del Oro (Grandjouan et al., 2017). It is possible that the major river-sinks on the high plateau drain to an as yet unknown resurgence located in the very densely forested area on the steep escarpment down to the plain, where satellite images cannot penetrate. But if these river sinks drain to the Rio Negro resurgence, the resulting cave system could exceed the depth of the current known deepest cave (i.e. 2,210 m). Moreover, such a cave system would have a remarkably long horizontal separation of $\sim 23 \text{ km}$ to Tragadero 1 de la Planura del Pico del Oro, or even 28 km if the cave system includes the Tragadero de la Soledad streamways. The furthest known point from a cave entrance is currently about $\sim 12\text{-}15 \text{ km}$, so this distance is also world class.

An excellent and detailed summary of the geology and hydrology of the Pico del Oro Plateau is provided by Baby (2023), setting out this world-class potential for deep caves (Figs 4 and 5; also see Baby et al., 2020; and Bigot et al., 2018). A brief summary of these previous publications follows (Figs

4 and 5), together with information from geological maps from the outstanding Peruvian Geological Survey website (Figs 6 and 7).

The stratigraphy of the Pico del Oro Plateau includes a series of Cretaceous-to-Jurassic sandstone units, which form resistant *cuestas* (ridge-lines) along the massif's main crest (K_{i-o} and J_{s-s} units in Fig. 6). These sandstones and underlying mudstone layers dip westwards, back towards Granada (Fig. 6). Underneath the sandstones and mudstones are a series of Jurassic units that contain thick limestone intervals (e.g. J_{i-a} and J_{i-c} in Fig. 6). These limestone rich units are underlain by Triassic units (T_{s-ch}) which are described contradictorily as either as limestone-rich (1:50,000 geology maps) or sandstone and mudstone rich (1:100,000 geology maps). But structural cross sections extending from river sinks on the Pico del Oro Plateau and to Rio Negro may suggest they are connected (Fig. 5).

Only one resurgence has been found actually on the high Pico del Oro Plateau, and it occurs at the far southern end of the line of sinks extending south and east from Calamina Camp (labelled 'main resurgence' on Fig. 7). This resurgence was visited in 2024, and found to be blocked. However, this resurgence (3320m) is higher than the sink at Tragadero 1 de la Planura del Pico del Oro, or indeed the lowest surveys points in Lorenzo's Right and Left Eye Caves, or the end of Tragadero de la Soledad, it cannot thus contain the water from these major river sinks and streamways. Originally, it was hypothesised that the water from Tragadero de la Soledad, and maybe all 12 other sinks along a SE-NW line (Figs. 3 and 7), drained to this 'main resurgence'. But this now known not to be the case, as both streamways in Tragadero de la Soledad head away from this resurgence (Fig. 7) and are too low.

The elevation above sea-level of the end of the streamway (~3,095 m) in Tragadero de la Soledad system is also much higher than any known sump on the plateau, and this water must also drain to a lower resurgence. It is also not clear where the water originates in that largest of the two streamways (Pisco and Codeine stream) in Tragadero de la Soledad, as this streamway heads NW back towards Granada (Fig. 7). It may yet collect water from along the line of sinks (i.e. sinks 2 to 6), which must then double back to flow first north and then south, but is unlikely to be connect to Tragadero de la Laguna Maria Gondolan that likely resurge nearer to Granada (Fig. 3). Understanding the origin of water in the Pisco and Codeine streamway is intriguing, and the 2024 expedition explored Cave on the Col that may provide a way into the continuation of the upstream passage. It is also important to find the underground confluence of the main stream in Tragadero de la Soledad and water from Tragadero 1 de la Planura del Pico del Oro, Sinks 17, and 18, possibly as well as Lorenzo's Right and Left Eyes; and the combined water then heads towards the Rio Negro Resurgence. This hypothesis may yet be thwarted by thick mudstone bands, as seen in caves explored in 2023, perched sumps, or by a paucity of limestone in the Triassic (e.g. T_{s-ch}) units. But there is potential for an exceptionally large underground drainage system that leads to the huge Rio Negro resurgence that is 2700m deeper than the entrance of Tragadero de la Soledad, and about 25 km away.

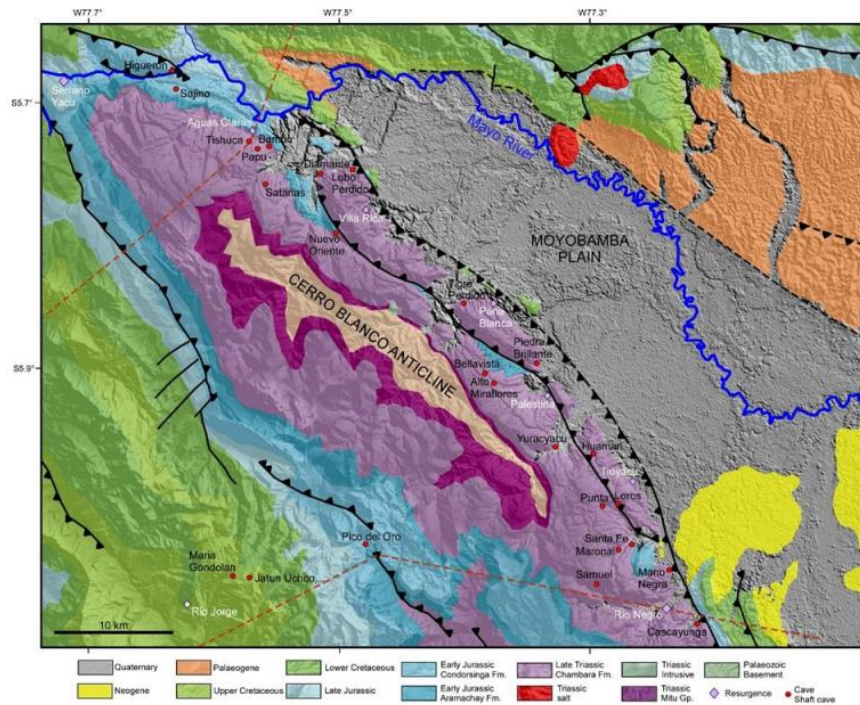


Figure 4: Geological map of the Cerro Blanco massif, showing the location of major caves and resurgences, which is reproduced from Baby et al. (2023). Pico del Oro label denotes Tragadero 1 de la Planura del Pico del Oro; the red dotted line shows the location of the cross section in Figure 5.

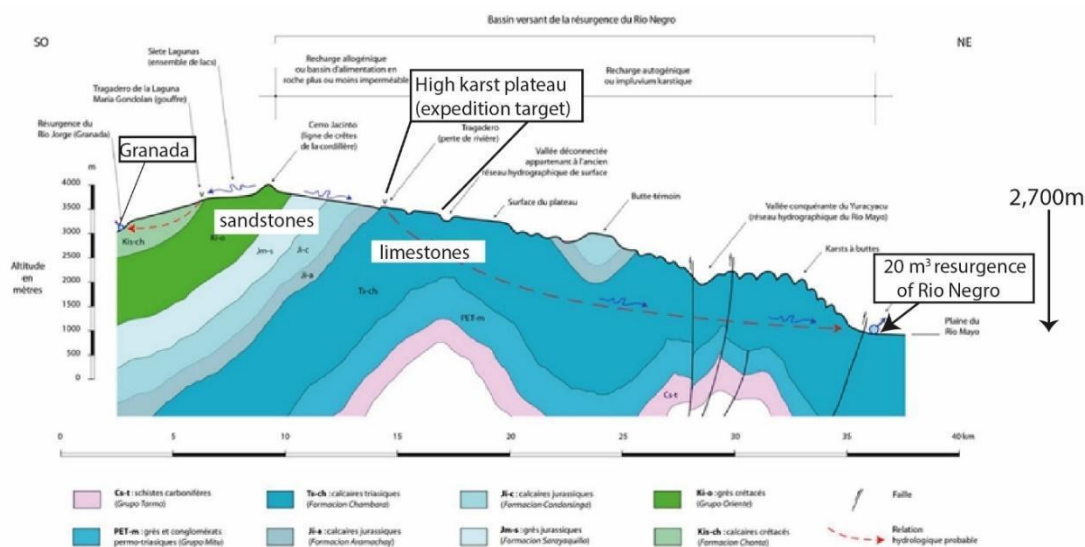


Figure 5. Geological cross section from Granada (left) to the massive resurgence of the Rio Negro (right). From Bigot (2019), and see Baby et al. (2020, 2023). Rivers flowing across sandstones sink when they reach limestones (in blue). The limestone units have a vertical elevation change of up to 2,700m, which exceed the depth of the deepest known cave. Dye test have not been performed, but it is hypothesised that rivers sinking on the high plateau drain to Rio Negro (red dotted line).

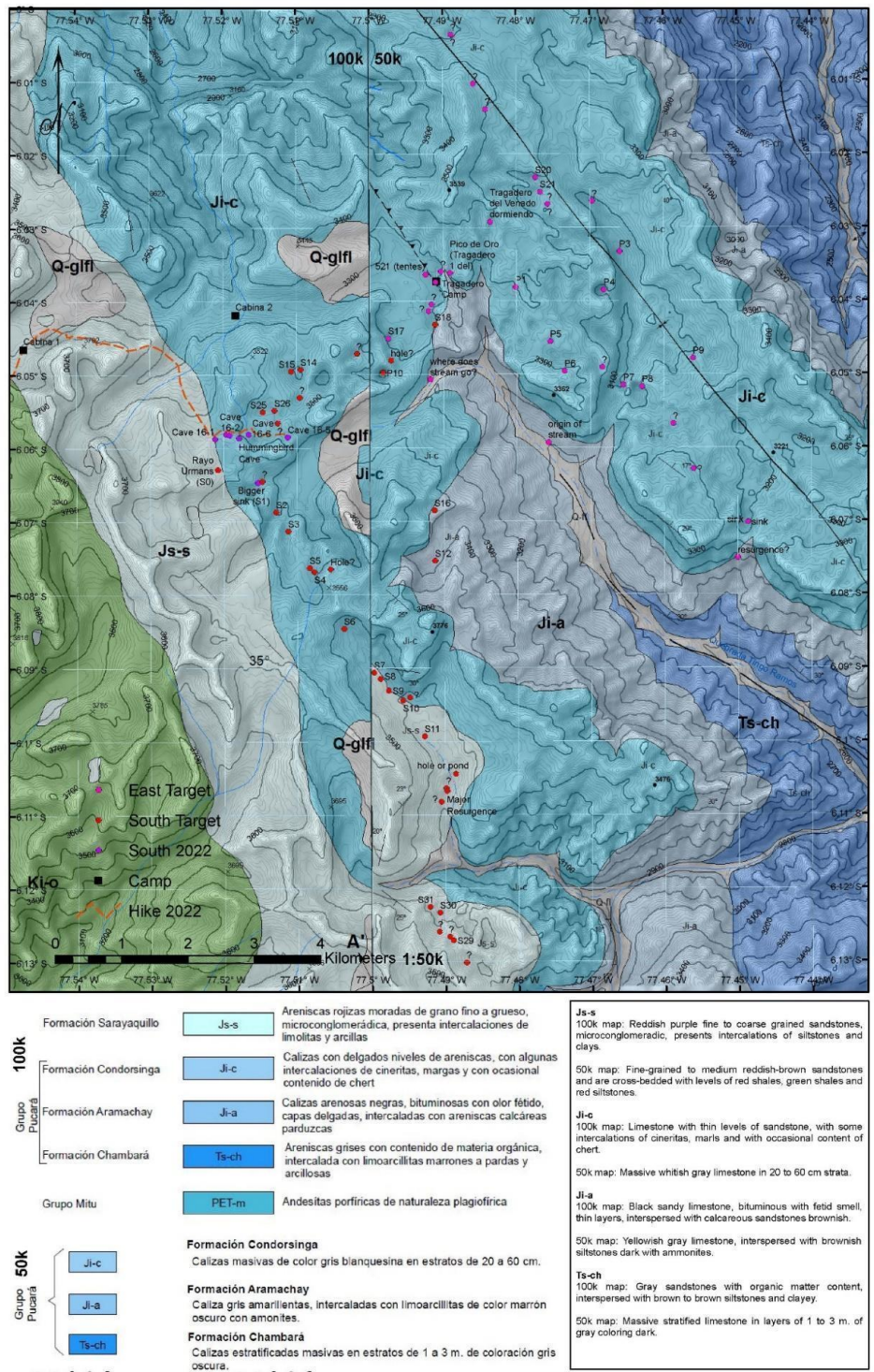


Figure 6. Geological map that combines information from 1:100,000 scale (left) and 1:50,000 scale geological maps, downloaded from the excellent Peruvian Geological Survey website.

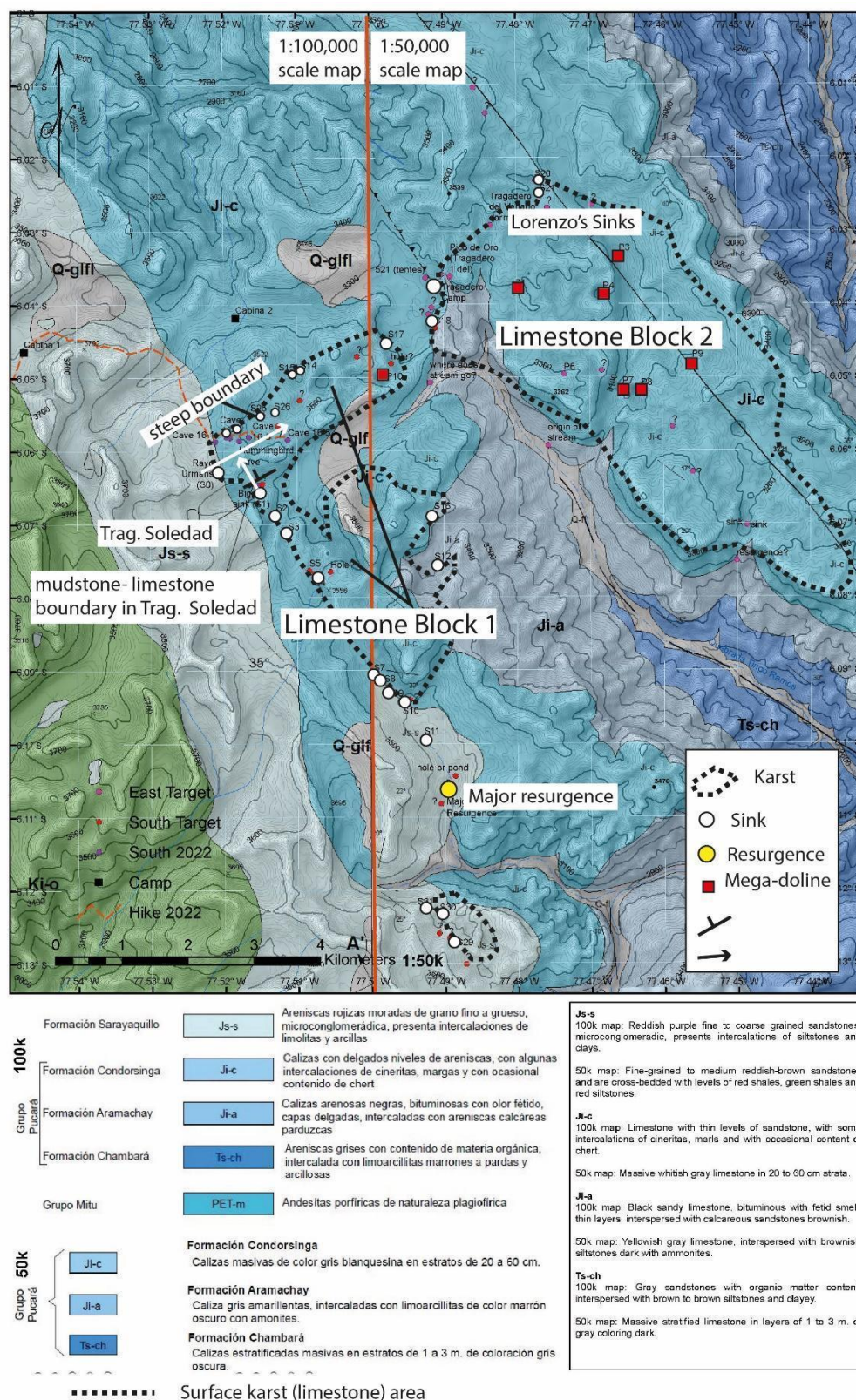


Figure 7. Geological map (as in Figure 6) with superimposed information from field observations in the 2023 expedition, including areas of surface limestone karst and other geological observations.

List of Caves Explored in 2024 Expedition

Caves Explored by Group 1

In 2023 the team were taken to two remote river sinks by our guide, whilst close together they were over 4 hours walk from the Calamina campsite over very difficult terrain. An advanced camp was set up at the impressive sink at Tragadero de la Planura del Pico del Oro. From here the walk was reduced to two hours, and all the exploration in 2023 was undertaken from this camp. As both sinks started to go deeper requiring longer trips of exploration a camp site was identified near to both sinks. This had a small pond and was nicknamed Scottish Loch Camp (Fig. 8). The exploration of Lorenzo's sinks in 2024 was undertaken from this camp site.



Figure 8. Sunrise over Scottish Loch Camp, with a cluster of tents just visible.

The naming of the sinks often caused confusion as they had been named looking up hill and upstream and named due to the features of the landscape resembling a face! For other the logical approach was from above and downstream and therefore the sinks are the opposite. Confused we were at times. In the end the sinks became known as the big sink (Right Eye) and little sink (Left Eye).



Figure 9. Entrance to Tragadero del Ojo Derecho de Lorenzo (Right Eye).

**Tragadero el Ojo Derecho de Lorenzo (Lorenzo's Right Eye): Coordinates -6.0232°S -77.4774° W
3286 m length = 433m depth = 265 m (last pitches were unsurveyed due to flood hazard).**

The larger of the two sinks, this cave starts with a very steep climb down the hillside to reach the river sink (Fig. 9). The entrance series requires a few small climbs and pitches to be rigged. Hand lines on the climbs were essential when water levels rose. Leading to a series of magnificent pitches broken part way down by a small alcove named the Eagles nest.

The end of the 2023 limit was reached in a single trip. The booming echo below had the team raving and keen to return the following day. Two short climbs and a short pitch were rigged to the head of a magnificent 45m pitch (caveman rave man). This was rigged down the left hand wall to try to stay out of the main water course and landed in a spray washed chamber with another short pitch below. Low on drill battery power the kit was left here to end a satisfying day of exploration.

Returning to the limit of exploration the pitch was quickly rigged into the short Meander passage section of passage with a few short drops that were rigged for ease. The passage passed through an area of breakdown and loose rocks and a small chamber above the stream. After an awkward pitch was descended, we found ourselves standing at the top of another deep pitch into a large chamber. Compared to the rest of the system this was of significant dimensions and aptly named Majasive chamber. After an imposing fifty metre drop, and with barely two metres of rope left, our feet touched the floor of the chamber. Our excitement was quickly dashed as the much hoped for cave passage did not materialise, however we were to find excitement in another way. The way on was a short six metre pitch. With no rope and a single bolt, exploration fever was still running high. What we still had was a 10m length of 6mm rope. After a quick coaching session on how to descend the rope the 'six mill thrill' was rigged and the pitch was descended. Below is a complex boulder choke with the stream passage difficult to follow in places. A way forward was found and the team was halted by what would be the terminal pitch.

Between the trips to explore the terminal pitch below the choke a survey trip was undertaken and if time allowed, they would drop the pitch below the choke. As the survey team were completing the final measurements of Majasive Chamber they were aware of a loud rumbling sound from above. Grabbing everything from the base of the pitch seconds before the flood pulse came crashing down turning the chamber into a maelstrom. Thankfully they had not descended into the choked area where the consequences were unthinkable. Finding a raised alcove in a high part of the chamber they endured a forced bivi. One attempt to exit the cave was stopped at 'caveman raveman' pitch due to the volume of water still crashing down and had also ripped out a deviation. They took refuge in the small chamber just downstream in the breakdown area. Wet, tired and cold they were able to make surface the following morning much to the relief of everyone.

There was an air of apprehension for the next pushing trip following the flood incidents and a very early start in case of more afternoon floods. Repairing damaged rigging on the way down and flood debris above the level of the ropes the power of the flood was clear to see. The pitch of 15m dropped into a small chamber and there were 'Mixed Emotions' to find a downstream sump. A small upstream inlet was forced a short distance before it became uncomfortable. With the survey complete the cave was de rigged back to cave man rave man.

The final trip was another early start and after a huge effort was completely derigged back to the surface.



Figure 10. A clean washed and water-worn pitch.



Figure 11. More clean washed and water worn pitches in Lorenzo's Eyes.



Figure 12. Majasive Chamber in Lorenzo's Right Eye

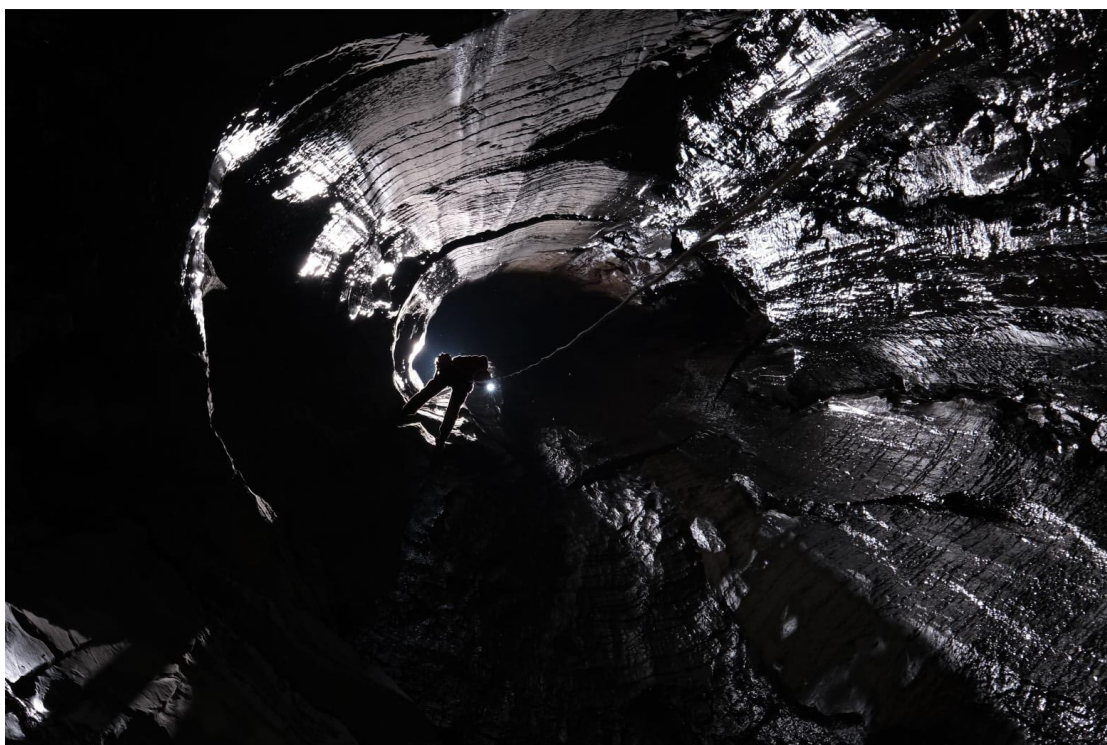


Figure 13. Shaft in Tragadero del Ojo Derecho de Lorenzo (Lorenzo's Right Eye).

Tragadero El Ojo Derecho De Lorenzo

6.0232" South, 77.4774" West; Elevation 3,256m

Scale 1 : 1000
0 20 40 60 80 100 m

Length: 433 m Depth: 265 m

2023 – 2024:

A. DePomar, J.A. DePomar.Ceceres, C. Densham, M. Holroyd, A. Klocker, B. Langford,
S. McCullagh, S. Read

October 2024

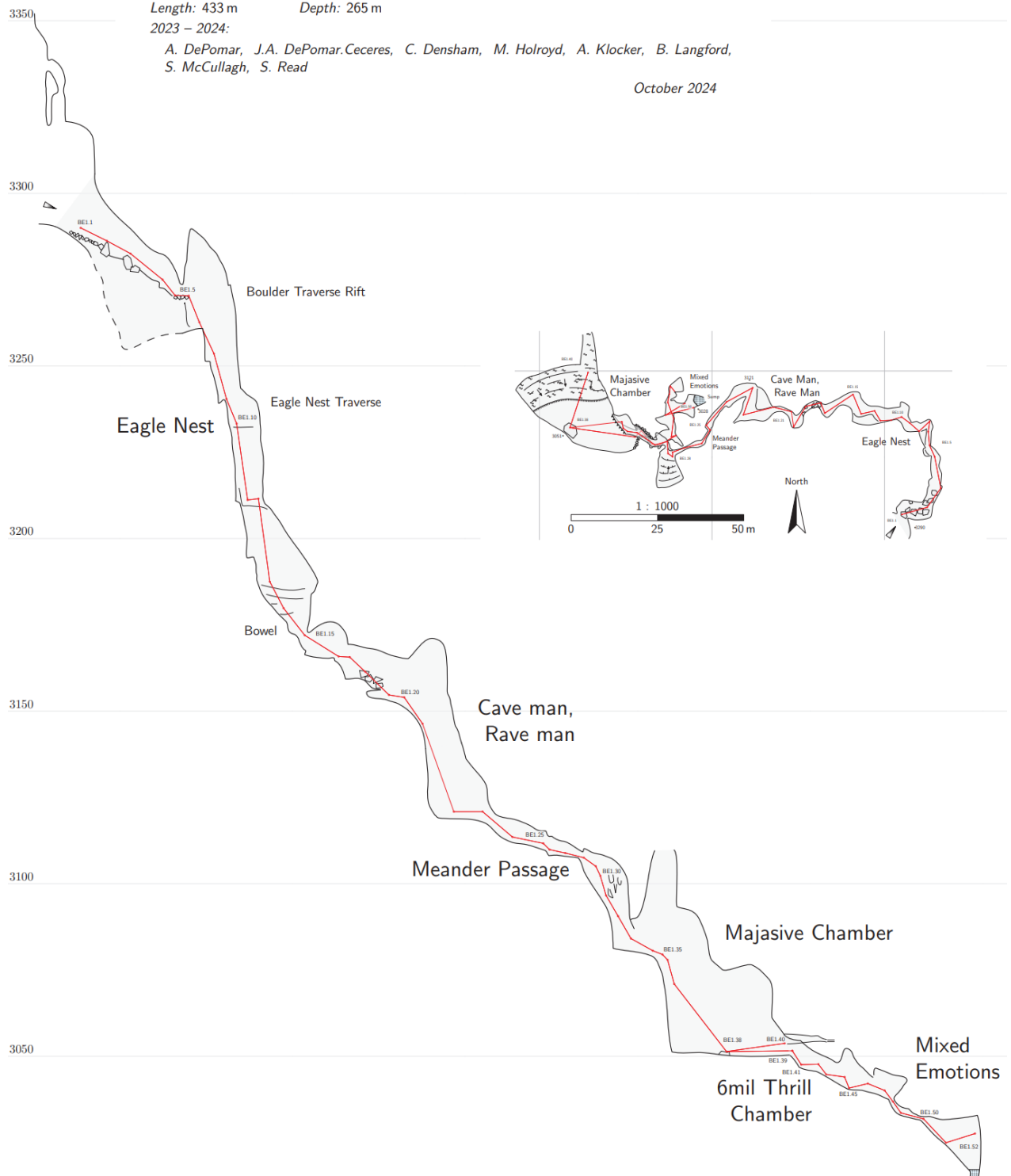


Figure 14. Extended elevation survey of Tragadero del Ojo Derecho de Lorenzo (Lorenzo's Right Eye). Drawn by Axel Hack.



Figure 15. Steve and Jock waiting out a major flood pulse in Right Eye in a small passage off the main chamber, where they were trapped overnight.

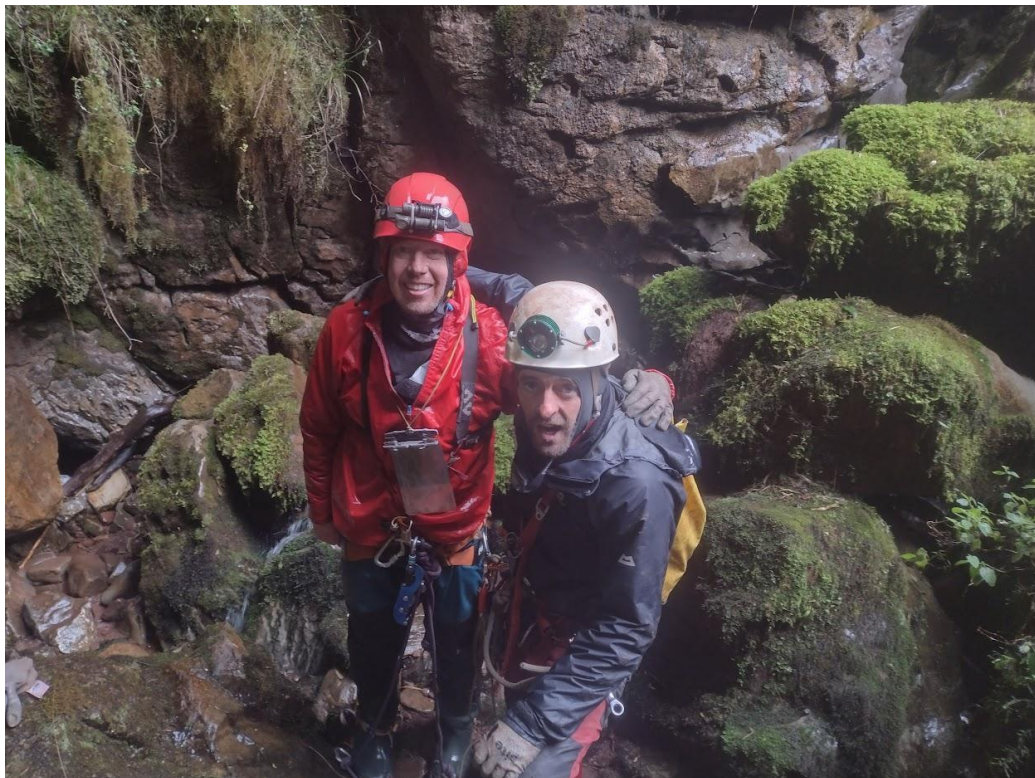


Figure 16.and arriving back the next morning on the surface after the flood pulse in Right Eye.

**Tragadero de Ojo Izquierdo de Lorenzo (Lorenzo's Left Eye): Coordinates -6.0251°S -77.4769° W
3290m length = 645 m depth = 275.**

Whilst being the smaller of the two sinks, this cave this still provided plenty of vertical challenges and stunning pitches. In 2023, it was pushed to the head of a pitch just beyond a narrow constriction and water shoot which took all of the main stream's water, judging by the smoothness of the rock and jammed flood debris.

In 2024, the cave was again rigged on the first day to the previous limit with some extra bolts and general improvements to the rigging, hopefully to clear any flood water. At the previous limit the team noticed a high level canyon passage, 'Cuddle Corner' as it soon became known, which provided a bypass to the constricted water shoot passage below. After a small pitch into a chamber a constricted pitch head opened into the 'FGM' series of pitches that quickly follow in succession and culminated in the magnificent 45m pitch 'Cathedral of Echoes'.

Below the cave changes character with a dry abandoned river passage above and an active series that descended a small narrow pitch 'Toilet Flush.' The dry passage was pushed in a few directions which all disappointingly choked or closed. The Toilet Flush was to be left for another trip, before this was pushed a much needed survey trip took place on the same day as the 'Big Eye' sink survey trip.

The banter on the surface as to which was the better of the two caves had seen a switch in the groups for the survey trips - to see first-hand and compare the 'rivals' claims.

On completing the survey of Little Eye, the trip out began uneventfully. However on reaching the canyon bypass things were to change. The unmistakable roaring sound was quickly followed by a strong draught and a wall of water came thundering down the passage ahead. The team were going nowhere soon. Forced to sit it out on the narrow ledge above the canyon they spent an uncomfortable ten hours cuddled together under a bivvy tent. Concerned that another flood pulse would be difficult to sit through they made a dash for the entrance as the water levels dropped. Entertaining tactics on the entrance pitch to avoid the worst of the water they too safely made it to the surface.

The flood pulses had been the result of a localised thunderstorm that had literally been confined to the watershed for the two sinks dropping hailstones as well as the rain. Those on the surface had been alarmed at the speed in which the water rose and the sheer volume of water. The following morning, they were starting to put in place a plan to try and reach the trapped cavers and were thankful to meet the two teams at the surface or in the entrance pitches. Both groups had been fortunate to be in the locations when the flood pulses had hit. On a lighter note, further flood pulses were ranked based on the colour of the water hence, Milo flush (severe) and Pisco flush (minor).

A pushing trip was organised to descend the active passage below the toilet flush once the water levels had dropped and the weather had stabilised. Again, another early start just in case. Three short pitches were descended which then dropped into a small chamber and the way forward was along an awkward sideways hading rift. Fresh flood debris was stuck to the walls above head height as a reminder that Little Eye took a big flood.

Beyond an active river passage was intersected. Upstream led to a choke believed to be below an area of the dry passage explored previously. Downstream dropped into a flat out crawl and an inevitable sump.

With no other leads to follow the cave was fully derigged with the kit left at the entrance to collect the next day. The

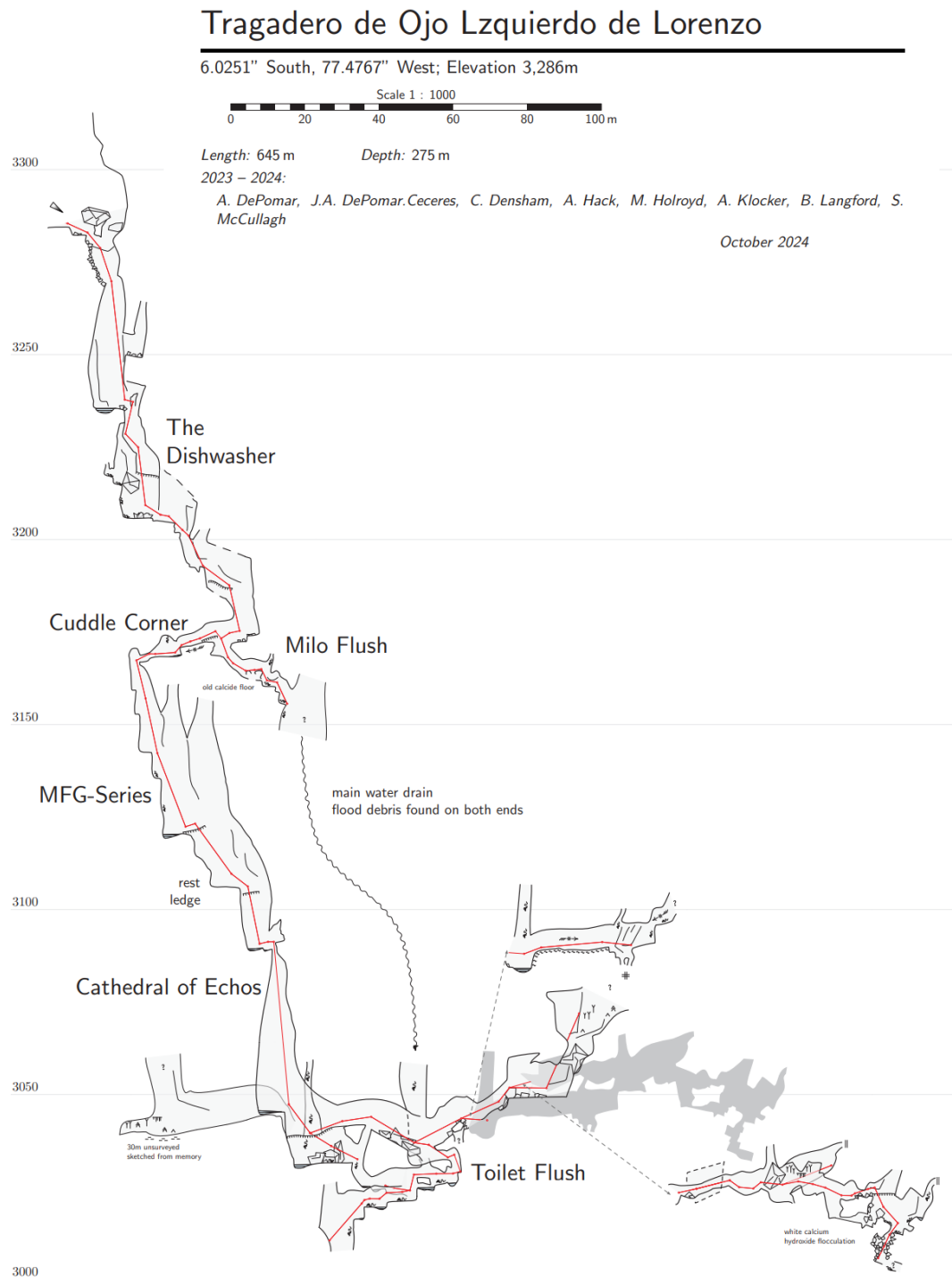


Figure 17. Extended elevation survey of Tragadero de Ojo Izquierdo de Lorenzo (Lorenzo's Left Eye). Drawn by Axel Hack.

Tragadero de Ojo Izquierdo de Lorenzo

6.0251" South, 77.4767" West; Elevation 3,286m
Planview



Maßstab 1 : 500
0 10 20 30 40 50 m

Länge: 645 m

Niveaudifferenz: 275 m

2023 – 2024:

A. DePomar, J.A. DePomar.Ceceres, C. Densham, A. Hack, M. Holroyd, A. Klocker, B. Langford, S. McCullagh

Oktober 2024

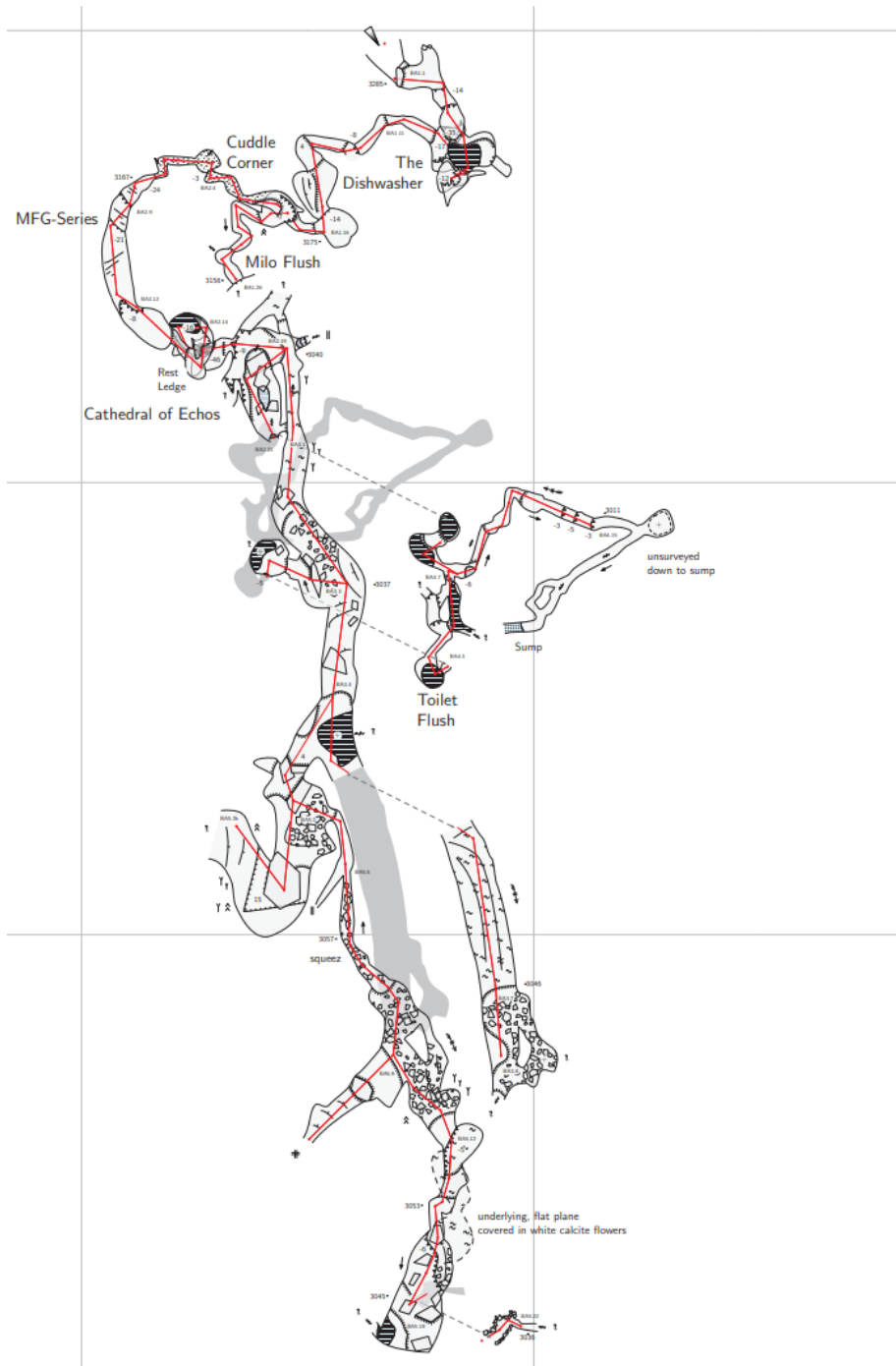


Figure 18. Plan survey of Tragadero de Ojo Izquierdo de Lorenzo (Left Eye). Drawn by Axel Hack.

Caves of the Suspended Valley

Jean-Yves Bigot

One of Group 1's first's objectives was to recognize a suspended valley seen on satellite views. This valley (**fig. 19**), roughly oriented N-S, is very close to the first camp (Lorenzo Camp) and I knew that the large karst phenomena could be reached, notably P3 indicated by satellite images.



Figure 19. The Suspended Valley.

Cut Cave (*Cueva Cortada*) Coordinates - 6.02591°S 77.47051° W 3195 m

Small cave that is unroofed on one side on the way from Scottish Loch to P3 megadoline. It is located on the left side, and various holes are visible on the opposite limestone cliff (**figs 20, 21**)



Figure 20. The bedding plane control the formation of Cut Cave.

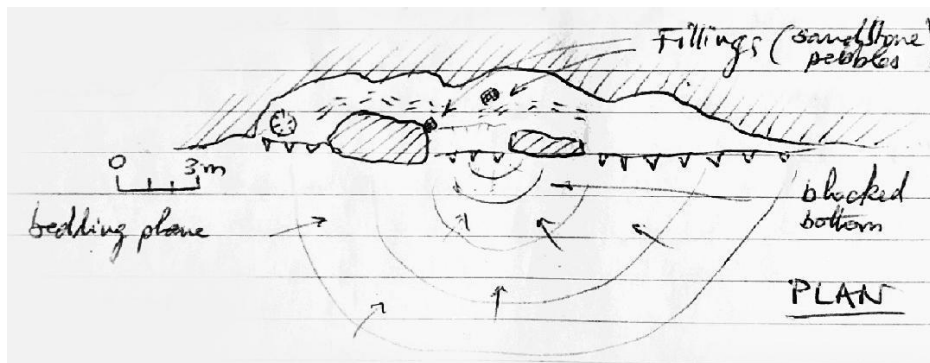


Figure 21. (top) Morphologic forms of the wall of cave, and (bottom) planform map of the cave entrance area.

Cave of the Block (Tragadero del Bloque): Coordinates - 6.02636°S 77.46995° W

A little further in the Suspended Valley, there are two sinkholes (**fig. 22,23**) separated by a threshold where a large block is installed. It is a big sinkhole with a block in the middle of the depression.



Figure 22. The Suspended Valley pierced by two sinkholes. Behind, in the upper sinkhole open the Cave of the Block



Figure 23. A black hole indicating the Cave of the Block

The upper sinkhole is interesting because black holes indicated continuations (**fig. 23**). A first reconnaissance allows you to explore a descending gallery with large pillars of white calcite. But another passage opens onto a large gallery with blocks. After 100 m, the gallery is blocked by the fillings at about 25 m deep. This cave could be revisited to survey and to see if a continuation is possible.



Figure 24. Sketches of the Cave of the Block.

P3: Coordinates - 6.03396°S 77.46636° W

After crossing an old circular chachapoyan house, a path opened by spectacled bears allows you to follow the bottom of the valley. Small rivers come from the left side, cross the valley and disappear on the right side at the foot of the cliff. This is the case for P3, the runoff is swallowed by a small hole completely blocked by fillings and stones. But there is a draft between the blocks, and we are very close of the cliff.



Figure 25. The sinkhole P3 is located on the foot of the cliff.

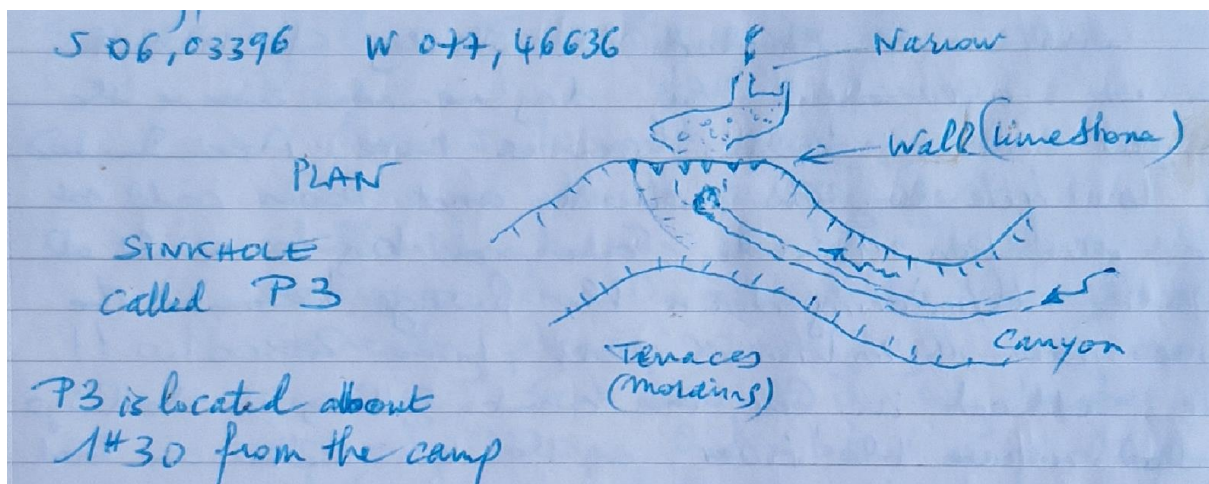


Figure 26. Logbook sketch of the terraced valley and area around P3.

Near-Camp Cave 1: Coordinates - 6.02630°S 77.47646° W [JYB, TdP]

Entrance is a small opening in the limestone with a pitch beyond of ~25m. Needs a rope.

Near-Camp Cave 2: Coordinates - 6.02630°S 77.47646° W [JYB, TdP]

Close to previous cave, a big pitch with a large entrance (20 x 20 m). Pitch is probably 20m deep, and needs a rope.

P4 (Hoyo Grande): Coordinates - 6.03844°S 77.46747° W [JYB]

Sinkhole P4 is difficult to reach, as you need to cross a pass, and valley floor occupied by jungle (need a machete).

The goal is to reach the sinkhole P4 close to P3, but located at the top of a hill. At the bottom of the Suspended Valley, it is easy to walk. The GPS tells me that the Sinkhole P4 is just above. Two circular houses show that this place was once occupied, but I can't find a path to P4. The right side of the valley is very steep and mainly covered by a rainforest. I decide to open a path with a machete. Impossible to know if P4 is close or not, and I have to continue without seeing the target. At one point, I think about giving up, but the outline of a threshold could indicate that the objective is close. After an hour or two, I arrive at a large depression surrounded by steep cliffs. It is very impressive, because there is a tropical forest at the bottom of the sinkhole. For this day, the objective is achieved, P4 is recognized, but remains unexplored (**fig. 27**).



Figure 27. The impressive cliffs surrounding P4 sinkhole.

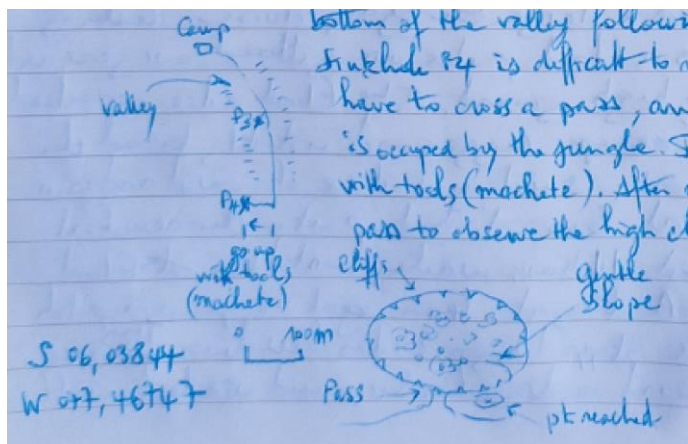


Figure 28. Logbook sketch of the area around megadoline P4.

A final reconnaissance takes place with Julian and Jock. Previous reconnaissance has shown that the objectives are not that far away, and if the path is well known, one can easily reach the points to be explored. The first objective is to descend to the bottom of the P4 sinkhole. I think it's possible, because I noticed, on the right hand, that one of the slopes seem less steep. But it was only an impression, and I have to give up after a few blows with the machete... We need ropes to go down. Julian pilots his drone over the P4 sinkhole (**fig. 29, 30**). P4 is thus not fully descended and explored.



Figure 29. Julian piloting his drone over megadoline P4.



Figure 30. In the distance, the cliffs of sinkhole P7 are visible in the bottom of the Suspended Valley.

P7: Coordinates - 6.03967°S 77.46470° W [JYB]

Large mega-doline full of jungle, descended by Jock via vertical grass climb. A couple of perched boulders, and one alcove on left-hand side was blind. No cave entrances found.

The cliffs of P7 have seen during a reconnaissance in 2022, it is a major depression which arouses interest. P7 corresponds is one part of the twin sinkholes P7-P8. P8 is located just above P7, but was not recognized in 2024. From the edge of the sinkhole P7, we notice that it is vertical. But Jock finds a way down without a rope. The bottom is occupied by a rainforest, and Jock indicates that the sinkhole is completely blocked (**fig. 31**). Julian flies his drone (**fig. 32**), brushing against tree branches and almost crashing. It takes 2 hours to go back to Scottish Loch camp.



Figure 31. Jock announces that the bottom of the sinkhole P7 is blocked.



Figure 32. On the edge of P7, Julian is flying his drone.

River sink – feature 1: Coordinates - 6.02950°S 77.48822° W 3345 m

Sink at base of cliff in depression with trees and vegetation. Water sinks in low crawls, no way on.

Feature 2: Coordinates - 6.03485°S 77.48406° W 3283 m

Heavily vegetated dry valley with small depressions. One slightly draughting rift, but no way on.

Pozo de las Orguideas (Cave of the Orchids): Coordinates - 6.03183°S 77.48355° W 3345 m

[102 m deep; 111m long]

Open shaft at the side of a large depression. Rocks fall for ~3 seconds, then roll for another 2 seconds. 80m Pitch has a lot of spray and it was rigged with 100m rope. Unfortunately, the end of the subsequent meandering cave is blocked, and there is no way on.

Descent into the Orchid Shaft (*Pozo de las Orquídeas*)

Jean-Yves Bigot

On August 26, 2024, Tonio, Andreas and Martin decided to prospect near a dry valley (**fig. 1**).

They discover a deep shaft where the stones take a few seconds to reach the bottom.

Figure 1.
The dry valley.



Yellow orchids dominate the shaft, this will be the *Pozo de las Orquídeas* (coord.: long. -77.48355; lat. -6.03183).

The next day a small team (Tonio, Julien and Jean-Yves) set off to explore the Orchid shaft.

The GPS coordinates recorded in the logbook are not the correct ones and the team must trust Tonio to find the entrance to the Orchid shaft.

Tonio remembers where the shaft opens, but the team has already lost a lot of time finding the route.

Julien begins to equip the shaft (**fig. 2**); Tonio follows closely, but good equipment takes time (**fig. 3**).

Figure 2. Julien at the
summit of the Orchid shaft.

In addition, some of the straps on Tonio's harness are worn and two of them are giving way.

This uncomfortable situation forces Tonio to go back up (fig. 4).

I no longer have a teammate to map the cave.

The shaft orifice is too well lit and makes it impossible to see the red dot of the Disto X and very small lines of sight are necessary at the start of the shaft.

It is impossible to make broad sight lines, because no one is there to indicate the points to aim for.

I have to survey for fixed points like anchorages to materialize the path.

Under such conditions, the accuracy of topographic surveys cannot be guaranteed.

Figure 3.
Rigging of the cave.



Towards the middle of the shaft, specific spray of the large verticals forces me to shorten the sight lines which do not exceed 25 m.

Further down, I end up joining Julien and I have to wait a bit for him to hit the bottom.

No luck, a knot located only 3 m from the bottom required us to do some maneuvering.

Unfortunately, the cave has no continuation.

The beginning of a meander is entirely filled with stones.

The bottom of the cave is made up of blocks which form a flat ground partly covered by settling clay.

Figure 4. Tonio in the
Pozo de las Orquídeas.

Water sometimes accumulates at the bottom of the cave. A flow of calcite is attached to the walls of this vertical shaft with a circular bottom. Towards the bottom, the shaft has the shape of a candle snuffer, a characteristic shape of meandering pitch in mountain areas. This cave resembles those we explored further down in the Alto Mayo massif. The observation is simple, the shafts intersected by the surface are not good access points to reach the active networks. Because they have accumulated a large number of stones coming from the dismantling of the karst surface. To access the active network, it is more reasonable to look for active sinkholes in which water disappears. We have to return to camp where Dario and his team are waiting for us. Tomorrow we will leave for the Calamina camp (Yanacocha tin hut).

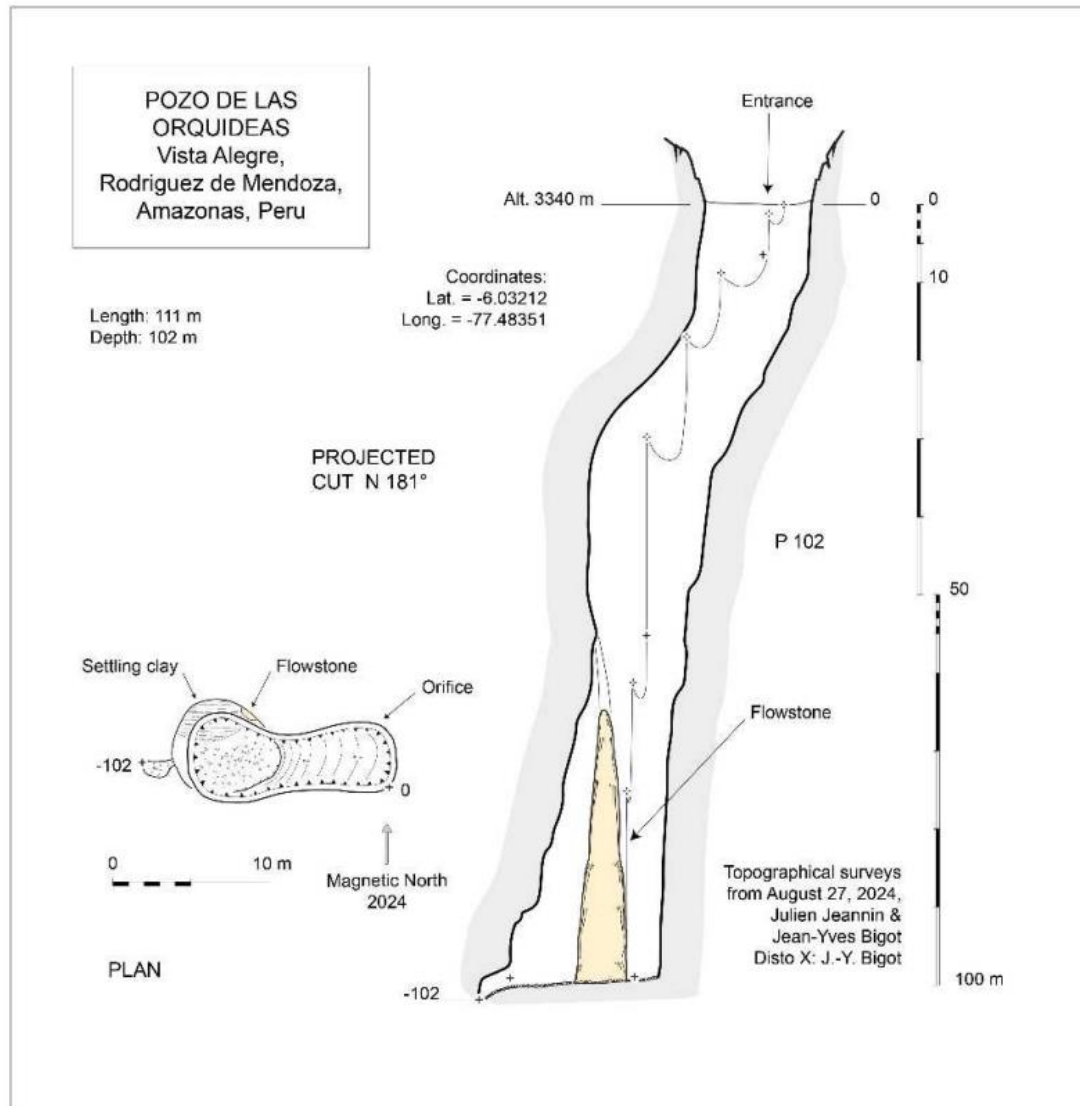


Figure 5. Orchid shaft survey.

Feature 4: Coordinates - 6.03103°S 77.48110° W 3339 m

Water sinks at a base of a cliff. No entrance.

Feature 5 (Handline Cave): Coordinates - 6.03070°S 77.48083° W 3339 m

Water sinks at the base of a large depression. Possible to enter a short meandering cave passage, that is clean washed with a cobble floor. Ropes needed for a handline, and worth a return.

Caves Explored by Group 2

Tragadero de la Soledad (Bigger Sink): Coordinates = 6.0648° S 77.5153° W. Elevation = 3409m
[length = 4,187 m depth = 323m]

This cave is sometimes referred to as 'Bigger Sink'. First found in 2022, it was explored in 2023 for 2.3 km to a sump in the lower Pisco and Codeine Streamway.

Entrance Series: The entrance is a few metres above the boulders into which the stream sinks, and a 1m tube quickly leads to a small chamber where equipment was stored. A series of short pitches (7m, 3m, 8m, etc) were rigged with 10, 15, 25, 15 m ropes (see below for full rigging topo).

At the base of the entrance series of two short down climbs and pitches lead to a horizontal passage that reaches a small sump. A short distance back there is a climb over the sump, into further chambers, from where a low cobble crawl leads to a junction with the first (Optimism is a Strategy) streamway.

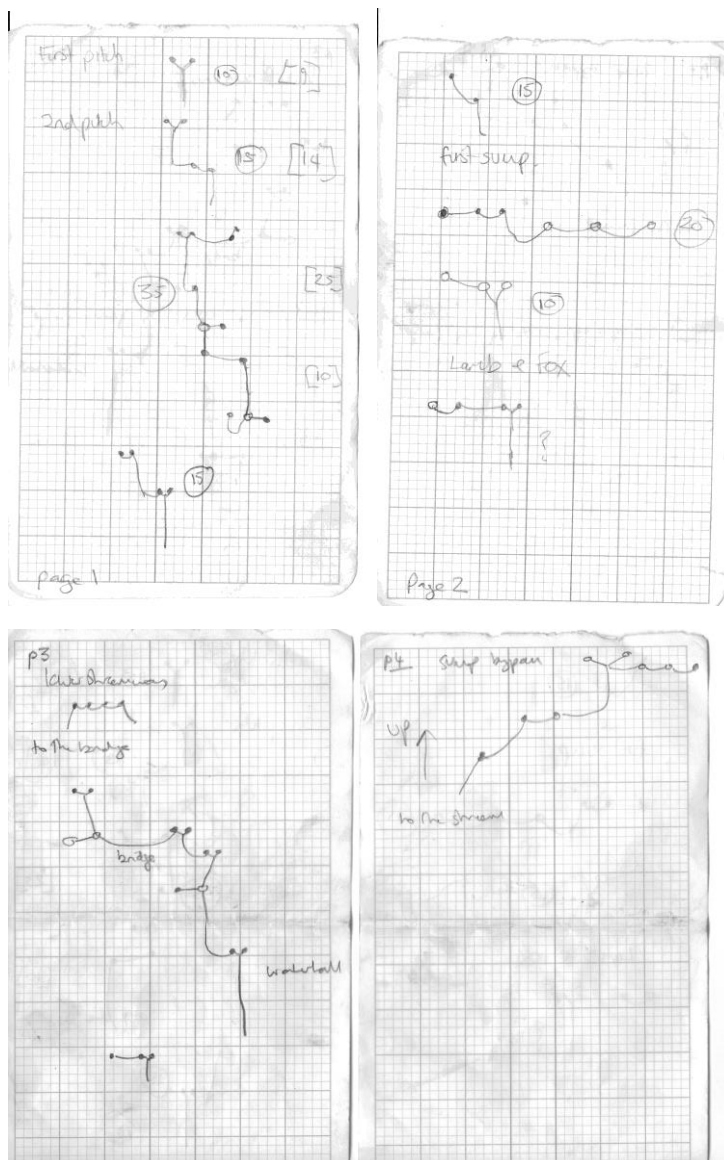


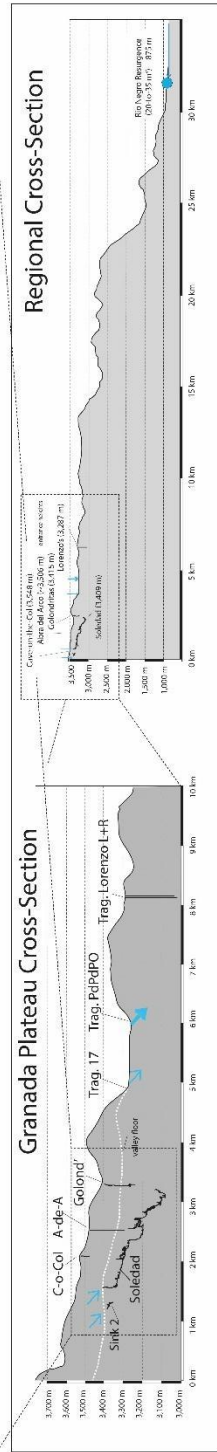
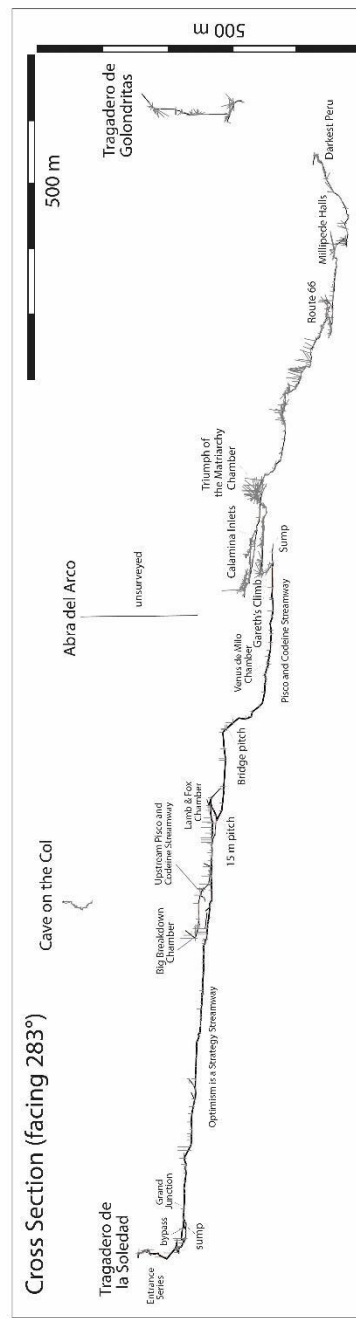
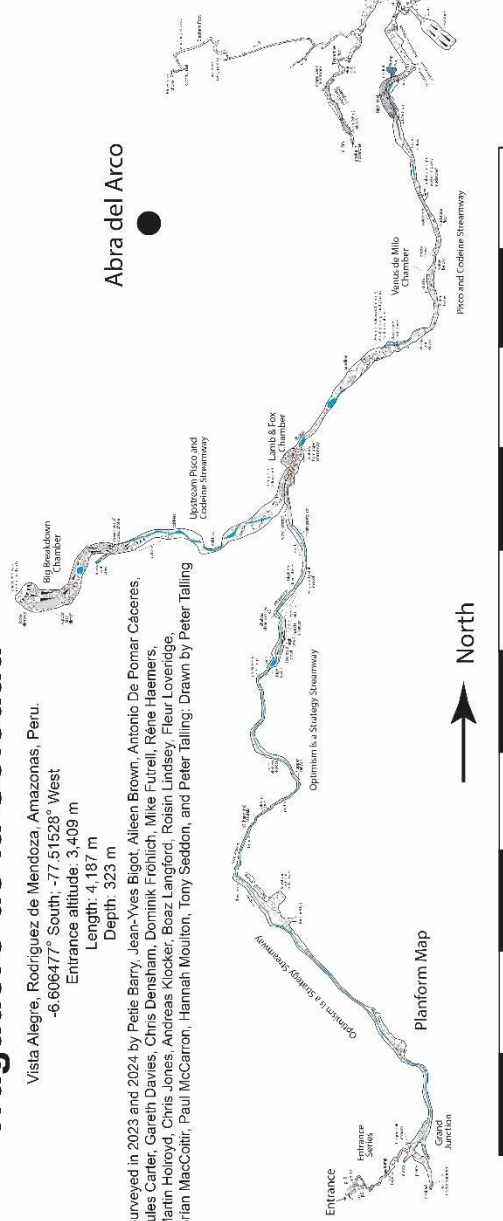
Figure 33: Rigging guide for ropes in entrance series and upper reaches of Tragadero de la Soledad.

Tragadero de la Soledad

Vista Alegre, Rodríguez de Mendoza, Amazonas, Peru.
-6.606477° South, -77.51528° West
Entrance altitude: 3,409 m

Length: 4,187 m
Depth: 323 m

Surveyed in 2023 and 2024 by Pete Barry, Jean-Yves Bigot, Aileen Brown, Antonio De Pomar Cáceres, Jules Carter, Gareth Davies, Chris Denham, Dominik Fröhlich, Mike Futrell, René Haemers, Martin Holroyd, Chris Jones, Andreas Klockner, Boaz Langford, Roisin Lindsey, Fleur Loveridge, Brian MacCotter, Paul McCarron, Hannah Moulton, Tony Seddon, and Peter Talling; Drawn by Peter Talling



Tragadero de Golondritas



Figure 34: Survey of Tragadero de la Soledad, also including Tragadero de la Golondrinitas, and entrance location of Abra del Arco. The lower panels show an extended elevation of these caves, and regional cross-sections that include the major Rio Negro resurgence at the base of the escarpment.



Figure 35. Optimism is a Strategy streamway within Tragadero de la Soledad, showing typical quality of formations, and depth of water. Photo by Boaz Langford in 2023.



Figure 36. Part of the well decorated Venus de Milo chamber within the lower Pisco and Codeine streamway in Tragadero de la Soledad. Photo by Mike Futrell in 2023.

Upstream end of Optimism is a Strategy streamway: At this junction, it is possible to turn right into a large dry passage that is initially well decorated. In 2024, several trips looked at the end of this passage. There is an upwards choke on the right, and a small tube was pushed past some loose rocks (dislodged with a stick) for a short distance, but it did not continue. There is also a 5m downward pitch on the left that is clean washed, and this was hammered. FL went part way down the vertical pitch lead (aided by ADS, BM) but it needs an even thinner caver to progress. These leads may eventually connect with Sink 2 perhaps.

Optimism is a Strategy Streamway: The downstream continuation of this major (~ 8-10m wide) streamway (called Optimism is a Strategy - El Optimismo es una Estrategia) is exceptionally well decorated, and pretty (Figs. 12-14) It is mainly easy walking-sized passage, with water up to one's boots, that slaloms between large stalactites hanging from the roof. In general, the passage follows the boundary between limestone and underlying mudstone, which dips at ~3 degrees to the north-north-west (Fig. 7). The passage also involves various small obstacles, including two 3m pitches (potentially free climbable, but rope may be essential if water level rises) that were rigged mainly off naturals, and a short canal that can be waded or easily traversed. After ~1.2 km, a short climb over blocks leads up to a very large chamber.

Lamb and Fox Chamber: At the end of this streamway, one reaches the large (20m x 20 m) Lamb and Fox Chamber, which is full of boulder breakdown. The main way on is either down a ~15m pitch into the lower and larger Pisco and Codeine streamway, or that streamway's upstream, continuation. *Please take care on this pitch, the floor is loose, the approach ideally requires a back up and the main hang is a Y-Hang in dubious rock.* In 2024, ADS and FL climbed ~ 7m into an obvious square hole in the side of Lamb and Fox chamber. A short stooping height passage lead quickly to wide but low well decorated chamber. To the right the floor rose to reach the roof, while to the left there were several windows back out to Lamb and Fox Chamber / Pisco and Codeine streamway.

Upstream Pisco and Codeine Streamway: The upstream branch of this larger stream way continues for ~400m as large passage to a very large (25 x 25m) chamber formed by an extensive collapse (Nervous Breakdown- Crisis Nerviosa). A very loose climb at the end of the main collapse leads via a short crawl to another low chamber, which is choked at its end. It may be worth digging with a crow-bar, but there is no strong draft in that final choked crawl. About 100m before the final climb up, there is a small passage on the left wall that descends a few metres. In 2024, this small side passage was found to be much drier, and it was pushed further into a choke of large boulders. But no way on was found, and there was not a draft. The main stream still enters boulders on the other side of the main passage, and there is no way on here. Thus, in general, there does not seem to be any continuation of this upstream passage at its far end. This is a pity because the origin of this major streamway is very enigmatic, as there is no local surface source for what is a notably large streamway, and the water could sink a very long distance away. Cave on the Col is located above the end of this streamway, and may be worth pushing to try to find its upstream continuation.

Lower Pisco and Codeine Streamway: This was explored in 2023 along an upper flowstone gallery. There are several routes through this impressive passage, but they all converge on a 3m flowstone climb (rigged with a long sling in 2024). Beyond the climb it is possible to take various routes to the top of the next pitch. This is the split Bridge Pitch involving an initial part down a slab, and traverse along a short muddy bridge that spans the passage, which is followed by a main hang to the floor. Almost immediately follows the Black Waterfall, which was rigged as a pitch in 2024. This is soon followed by a short 10m pitch, where cavers need to beware of a false floor at the pitch head. Below that is the beautiful Venus de Milo chamber to the ongoing stream passage. A further traverse line over a large pool was rigged in 2024, but may need further rerigging (there is a large block jammed

in the rift above the downstream end which would provide an excellent belay). Eventually this passage lowers and reaches a sump.

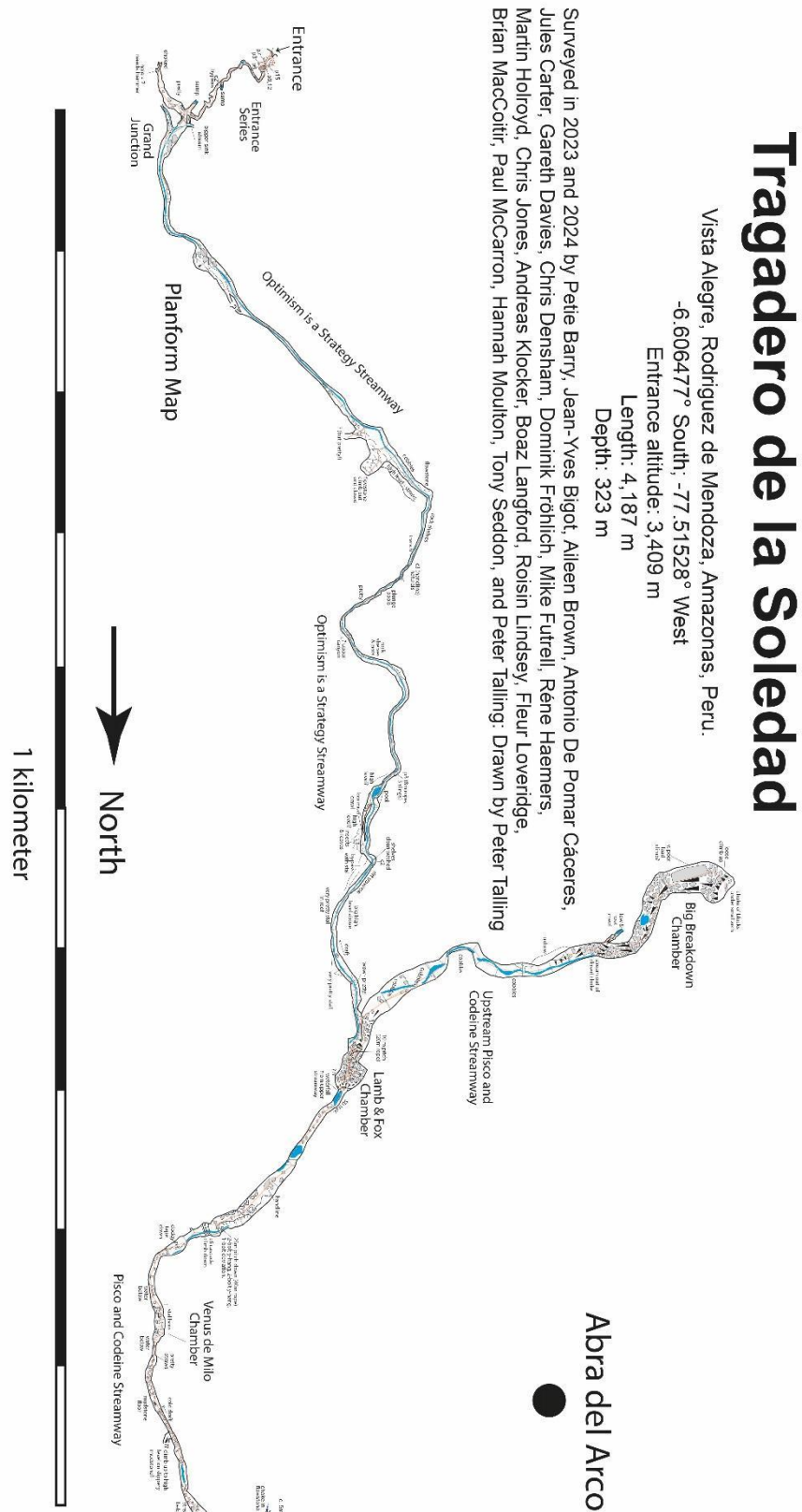


Figure 37. Detailed zoom in for the upper part of Tragadero de la Soledad (see full survey in Fig. 34).

Gareth's Climb: In 2024, a climb was completed about 150m back from the sump, on the left wall looking downstream. The climb initially goes up an inclined muddy ramp (Fig. 38), which was followed by a 5m flowstone wall, and a longer traverse above. This climb was rigged as a ~12m tri-hang from the upper chamber, and ropes on all parts of the climb have been left in place (Fig. 38).

At the top of the climb, a large sandy passage leads off, and a passage is soon encountered entering from the left hand side. This Cackle Climb was climbed by GD on his second attempt, but it led to a blind alcove. Almost directly above this passage is a dry aven, no attempt was made to enter this.

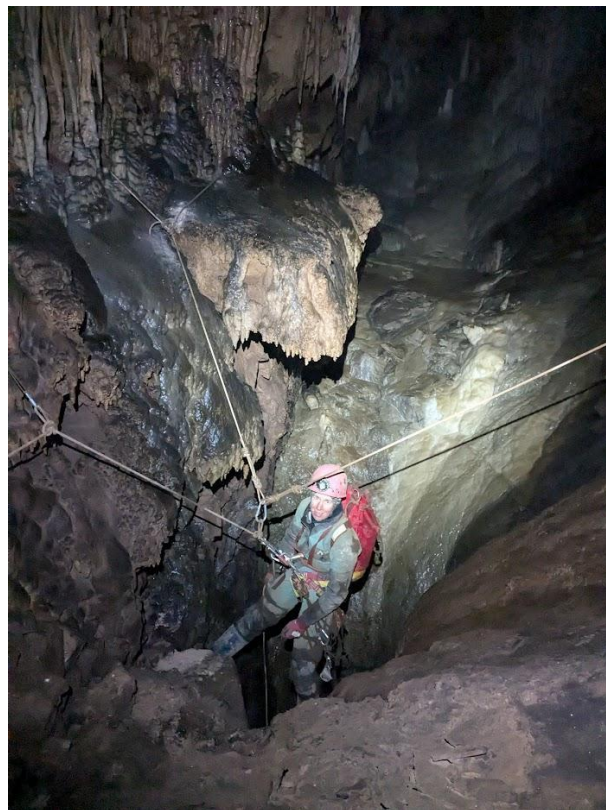


Figure 38. Photos of (top) the lower part of Gareth's Climb out of the main streamway, and (bottom) upper part after it was rigged. Climb goes up flowstone wall behind FL and traversed to her left.



Figure 39. Hannah Moulton in the large streamway below Victory for the Matriarchy. Jules Carter

Victory for the Matriarchy: The main sandy passage above Gareth's Climb soon reaches an area of chokes. The way on is a short climb on the right hand side (drafting) 5m before the end of the passage. The climb up is a narrow slot into a calcite grotto then a further short climb up through large boulders that enter the huge (90 m x 70m x 50 m) Victory for the Matriarchy Chamber (Fig. 40). There are several ways on from this chamber.



Figure 40. Photo of cavers illuminating the large expanse of Victory for the Matriarchy Chamber.

Inlets off Victory for the Matriarchy: Two stream inlets lead off the chamber. The smaller of the two was briefly entered but not explored, but just beyond is a much larger inlet, called Ebbs and Flows. This is initially up to 5m wide and 3m high and is well decorated. After a small cascade it splits into two. The left hand inlet is initially the larger but some bifurcates further with a pitch up in mudstone to the left and a low crawl in water to the right. (Roisin and Petie explored these further).



Figure 41. Fleur Loveridge in Calamina Inlet. Photo Jules Carter

The right branch takes more water but reduces in size after a short climb up, before becoming walking size again. Shortly after the passage reaches another junction. Left continued for a short distance whilst right continues for some metres.

'Downstream' Climb off Victory of the Matriarchy: A 12m climb was completed by HM. This leads to a short section of large passage ending in a calcite squeeze. Open lead, but no draft detected. Access is by an in situ rope from a Y-Hang.

'Upstream' Climb off Victory of the Matriarchy: Almost directly above the way into the VftM chamber a passage enters 10-15m above. This was accessed via a short climb (HM) from the top of the boulder pile to a ledge. A rope remains in situ rigged from stal and boulders. The passage is quite large (4m x 4m?) with a thick mud floor and contains some impressive formations, and after 15m an aven/passage in the ceiling is reached. Beyond the aven the passage gets wider and the draft can no longer be felt, at which point the floor turns to thin calcite and ramps up steeply. The passage continues for 20-30m, no way on was seen. The aven/passage in the ceiling may be worth further investigation.

Abra del Arco

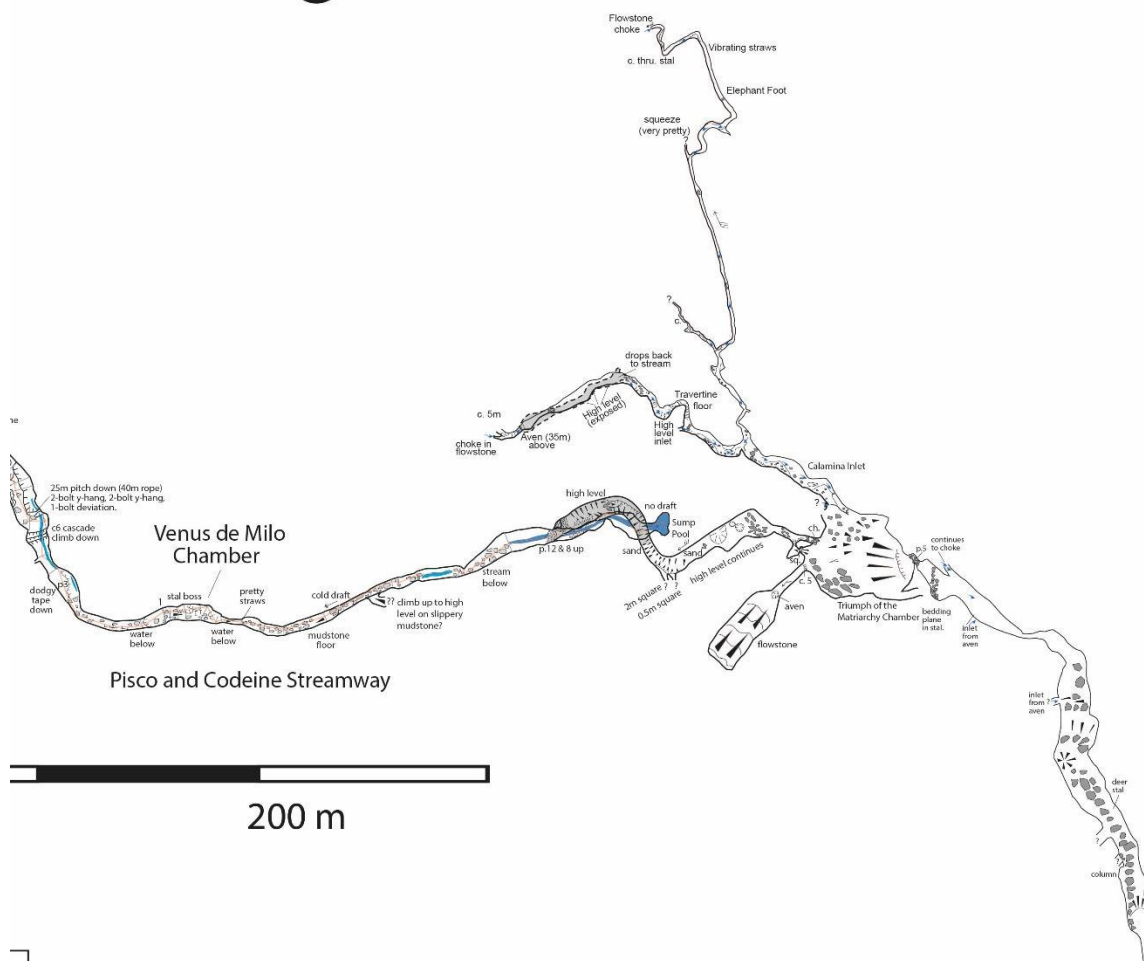


Figure 42. Plan survey of middle part of Tragadero de la Soledad, including Victory for the Matriarchy chamber and the inlets heading off that chamber towards the direction of Abra del Arco.

Canyonland: A (flagged) descent over big boulders in the chamber leads back to the main streamway. The upstream direction of the streamway soon chokes, but the downstream direction continues as a large passage that eventually narrows into a canyon cut into mudstone. This is not a good place to be caught in a flood pulse, and some short traverses were rigged out of the main water. There are also various very small spray waterfalls suggesting some inlets very high in the big passage, but the inlet entrances were not seen.



Figure 43. In the streamway.

Stal of Doom: The passage continues until a series of short climbs up and down are reached, with the water lost within a floor of boulders. There is a 2m climb down, and a 3m climb up and a 3 m climb down, which were originally rigged from two large stalactites and now simply bypassed by a scramble over the top of this section. This was de-rigged in 2024. From memory this requires a 25m rope, one hanger and 3 slings.

At the end of this traverse, a further 10m pitch leads back to the main streamway (**Brian's Pitch, rigged from a y-hang and back up to the previous rope**). At the base of this pitch it is possible to pass through the boulder choke with relative ease (CJ, JC and GD all visited). This led to 15m+ of awkward passage through large areas of collapse and with dense silt on the floor. There is no draft and it is assumed the passage sumps relatively soon, although a sump was not reached and it remains unsurveyed. A streamway emerges from a sump in the Millipede Halls and it is assumed to be the same water.

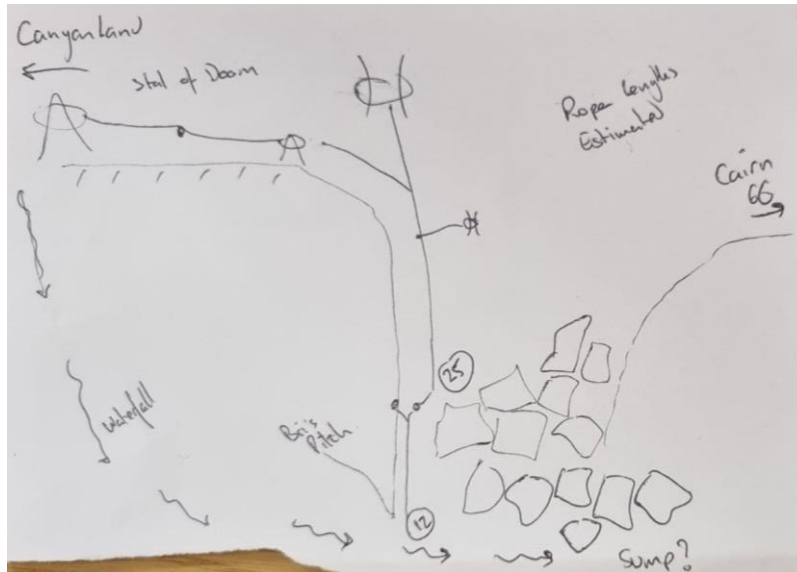


Figure 44. Rigging Topo for The Stal of Doom & Brian's Pitch

Route 66: After the Stal of Doom, descend partway down Brian's Pitch to the boulder floor, then re-ascend the into the obvious ascending passage. Once at the top of the rubble slope the passage begins to descend once more along lovely sandy floor. There are at least two obvious inlets along this sandy passage and a small 'lake'. The furthest towards the entrance chokes. But GD and RH explored the other inlet that is a tall meander which is gently ascending and explored without difficulty for ~80m. Despite getting smaller, this inlet had a draft and water flowed at the bottom. It is unsurveyed and open at its end. The main passage is easily followed through large galleries until the roof lowers at a well-marked cairn (Cairn 66).

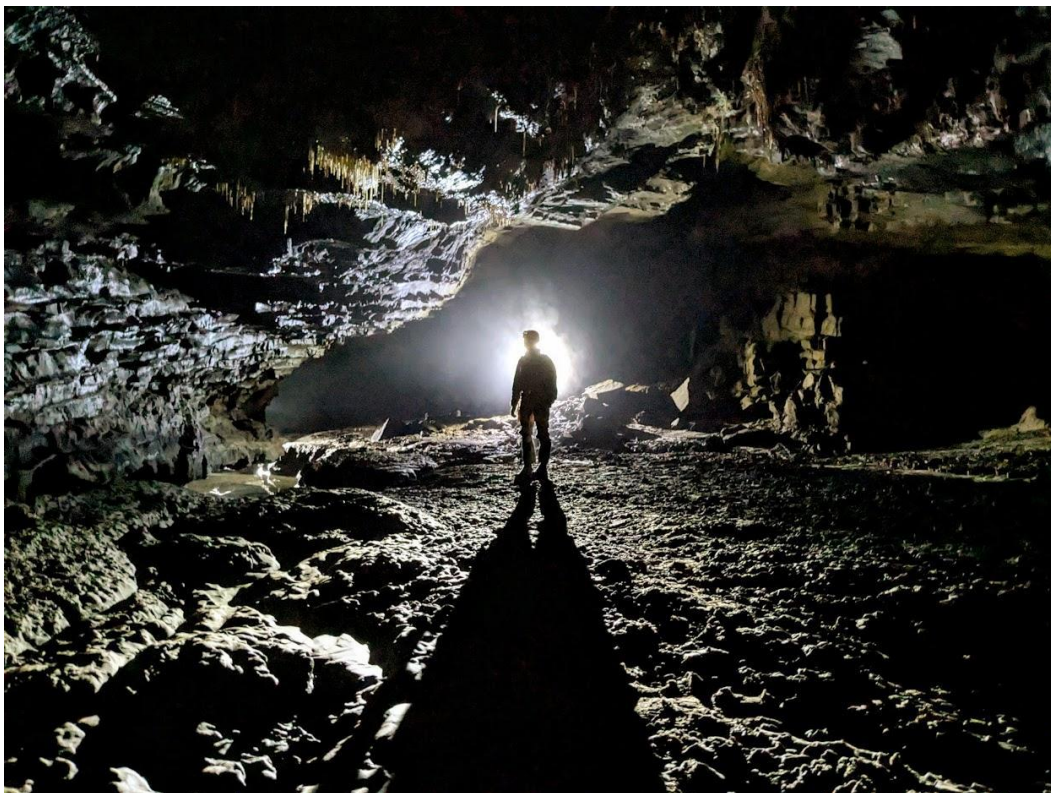


Figure 45. Large sandy floored passage approaching the small inlet and end of Route 66.



Figure 46. Planform survey of the further reaches of Tragadero de la Soledad, and also showing the position of Tragadero de Golondrinitas.

The Millipede Halls: At Cairn 66 an inlet enters (unexplored, small passage) on the left and sinks into the floor. A trickle enters from directly ahead (too small), again sinking in the floor. Both these streams contained small troglodytic animals including collembola and possible isopod crustacea. The way on is a descending sandy crawl on the right, with a strong inwards draft. Very soon this opens up into a large boulder filled chamber, progressing along this reaches a short pitch and the water can be heard. The pitch can be bypassed by climbing down through the boulders directly behind you when looking at the pitch. A boulder ramp leads down a sizeable streamway emerging from a clear sump. More animals spotted here including cave adapted carabid beetles, small diving beetles and cave amphipods. The streamway has changed character here, being present in the base of a very large

boulder filled rift. Heading downstream a series of lower sections in the stream are passed, which separate the large chambers. At least one of the lower sections appears to sump in wet weather, and several of the chambers appear to connect via a higher level. There are large amounts of millipedes in all the chambers and an unusual mud deposit on the walls, this is presumed to be millipede poo! Several sizable inlets enter from quite high and all remain unexplored (2024). The stream sinks into boulders in the 3rd chamber and it is no longer possible to follow the stream.

A large boulder ramp (40m) leads from the streamway to an even larger chamber high above (handline, in situ 2024, take care on ascent, loose). A strong draft is present upon entering this chamber, but is immediately lost and hasn't been relocated. Directly above the way into the chamber is an enclosed grotto and to the far left is a very unusual mud sink, neither has any way on. Continuing upslope appears to be the main way on and from here two obvious passages continue, one high and one low.

The lower passage descends to rubble and was explored briefly by AB. It was possible the stream was heard rumbling through boulders below but no way on was found.



Figure 47. The upward inclined slope beyond Millipede Halls and heading towards Darkest Peru.

Darkest Peru: The high passage is an overhanging inlet that is approximately 3m off the ground. No easy route to gain access to the inlet was available, due in part to a water washed pot below.

GD supported by PB climbed to the roof from the adjacent old floor, only to find the roof had a shale-like consistency that fell away when drilled. The inlet was thus reached by traversing an exposed mud slope with occasional protection until the safety of limestone was reached, and an abseil was constructed for PB to join GD.

The passage ascended steeply becoming low and broad, the floor made up of thin slabs fallen from the ceiling. The passage turned sharply to the right, and a 20m crawl over more unstable thin slabs reached a 3m climb upwards. This climb looked unstable and unpleasant and had only a faint draft, making it unlikely to be the main way on.

There was a blind passage below the climb that Tonio descended. PB also briefly went down there after coming down from the climb, and he felt there was potential there - but he didn't go to the end. There were some prospective dig sites, however no draught was noticed.

On our return several tubes were pushed and nothing was found that warranted a return.



Figure 48. Gareth climbing along the mud bank and into Darkest Peru.

Area A – Near the Col on Path from Calamina Camp to Sink 2 Camp

Cave-on-the-Col: Cueva en el Collado: Coordinates - 6.0587° S -77.5211° W 3542 m [length = 73 m; depth = 46 m]

Also called '16-1' in 2022 & 2023 expeditions. Located at edge of limestone, at closest point to Calamina Camp on walk over to Soledad. Cave entrance found by 2022 expedition, and pushed for just a few meters in 2023. This is a narrow cave for thin cavers, but it drafts and was left ongoing.

2m climb down at entrance, and 2 further 2m climb downs, lead to a 5m pitch/climb down. [first pitch was later rerigged to go over boulder and avoid tight squeeze]. This is tight at the top and needs rope [RH who is thin needed to take his SRT kit off on return]. This leads to chamber and vice squeeze to another short pitch. Left cave at 5m climb/pitch into a shallow pool of water. Very tight vertical rift around righthand corner, constricted by calcite column. Then a downward constricted traverse (bolted) leads to a 10m pitch down, and another larger rift, which is followed by a 12m pitch. Then a very tight 1.5 m long horizontal rift, which widens out to a ~10m pitch that is undescended. Last survey station is a cairn on the right of the final right as you look into it, but the last marked survey station (no. 22) is 3 stations further back. Cave is draughting.



Figure 49. AB revelling in the tight passages of Cave on the Col.

Hummingbird Cave: Cueva del Colibrí: Coordinates – 06.05798°S 077.51836° W 3512 m

This cave is located near Cave-on the Col, but a few hundred metres towards Bigger Sink. Cave terminated only 5m beyond the limit of exploration in 2023, a short distance into cave. Also called '16-4' by 2022 and 2023 expeditions. Entrance is hole in rockface at base of shakehole. Scramble into 1-2m wide rift, continue 10m to constriction, chimney down 2.5m to a 3 x 5 m chamber with pebble floor. No way on. 20cm wide hole takes water.

Area B – Vicinity of Sink 2 and Camp

Torridon View Cave: Cueva del Musgo: Coordinates - 6.07039° S 77.51538° W 3530 m [length = 137 m; depth = 72m]

Entrance relatively close to Sink 2 Camp, above a gully in the cliffs above camp. It was explored to a depth of 72m and is ongoing. A larger hammer is needed to remove an obstruction at the current end, but is it worth a further look, as it is now close to the height of development in Sink 2 and Bigger Sink. It also has a good draft and a takes a small stream in the dry season.

There is an adjacent hole to Torridon View that was rigged off several tussocks. Around 8m deep, choked with mud and suspected to link into the horizontal section of Torridon View.

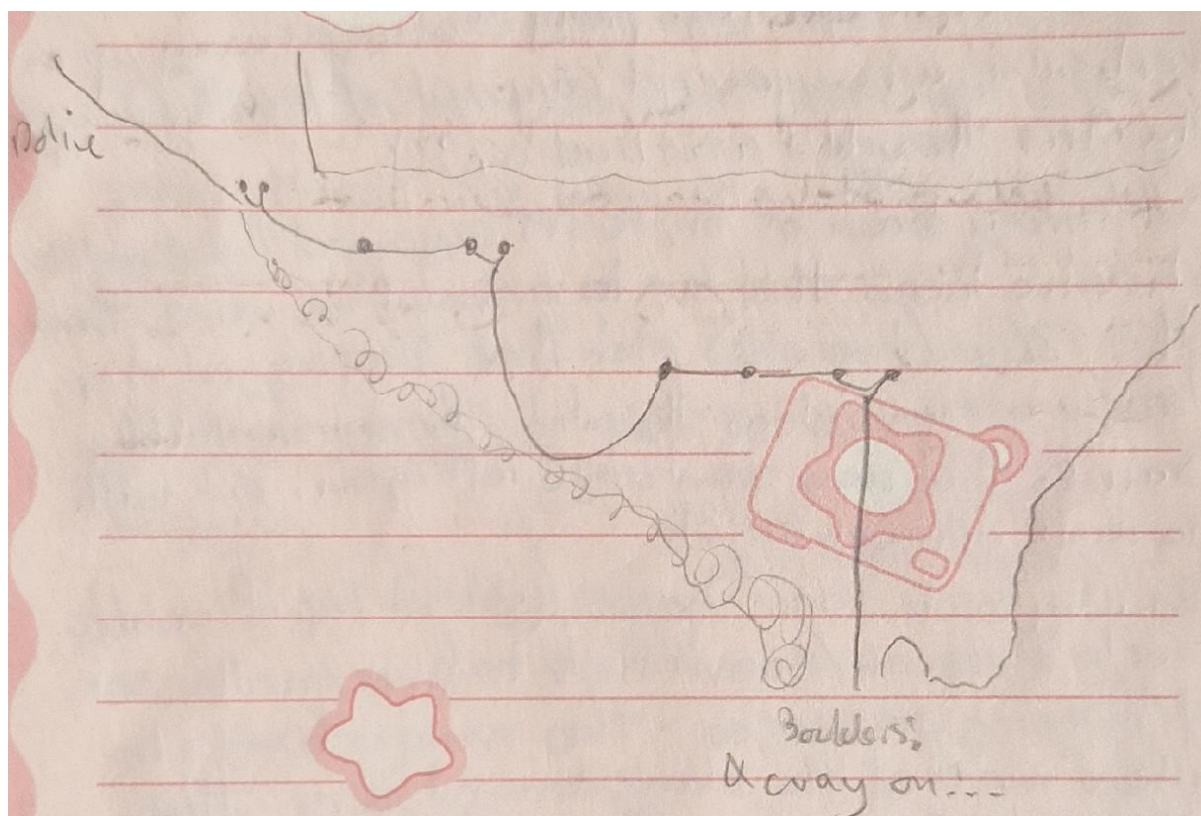
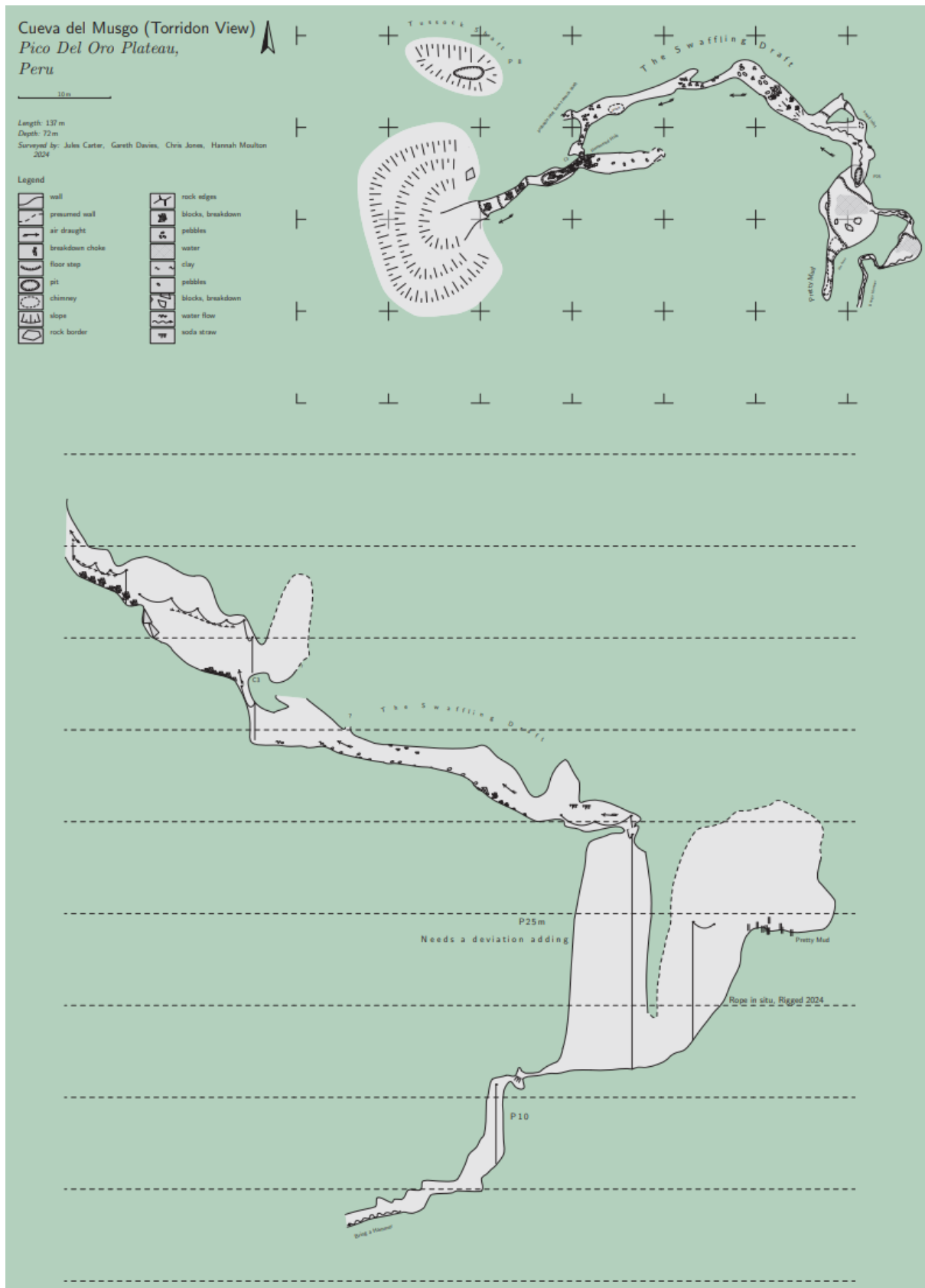


Figure 50. Rigging diagram for the entrance pitch into Torridon View cave.



Figures 51 and 52. Plan survey and extended elevation of Torridon View cave, which is well placed and ongoing (with a bigger hammer.).

1st pitch is rigged from the bottom of the doline with a 40m rope and 9 hangers/maillons. The rope ends in a sizable rift filled with large sandstone boulders. It is possible to descend through the boulders, however this is not advised as any movement of the boulder is likely to be detrimental to life. A bypass to the boulder choke was hammered out which leads to an easy 3m climb, with an awkward take off. This was rigged using a 5m handline on 2 'ok' natural threads directly above.

The handline climb leads to 50m of descending fossil passage, with a strong draft and small stream. Too soon, this passage arrives at a fine 25m pitch. Two naturals provide a safe approach and three bolts provide a tri-hang (these bolts were placed without a hammer), free hanging down the fine Yorkshire-esque pitch. This pitch would be improved with a re-belay to keep any cavers out of the water.

At the base of pitch are 2 ways on. A large flowstone climb (~15m) in old rift passage leads to some excellent mud formations in a small grotto. No draught was noted in the grotto, however the roof rises quite spectacularly above this. Back at the base of the pitch, the small stream flows down a short awkward meander to a further 15m pitch. Tight passage below goes to small chamber, and then there is another tight rift. A 'triceratops shaped' protrusion marks the limit of exploration, however beyond this, appears to be a bigger (walking? 'JC') passage, a draught is present here.

This cave is in the 'good limestone', emits a strong draft, and the depth of ~72m is promising. However, given the proximity to the cliff face it is possible that another nearby entrance is providing the source of the draft.



Figure 53. Chris Jones descending 'Tussock shaft' with the Torridon View doline behind.

Sink 2: Cueva de los sueños de los ancianos: Coordinates - 6.0687° S 77.5128° W 3408 m [length 390m; depth = 36 m]

Found in 2023, and next to camp. Also sometimes called 'Another - Old Men's Dream Cave'.

In 2023 it was suggested that the cave had bad air beyond the cobble ramp of doom. But in 2024, perhaps due to changes in sumps or other factors, there was a howling gale of air at the cobble choke, and no issues with bad air were noted. In general, this cave seems to be heading back towards Tragadero de la Soledad, and maybe the small lead at the upstream start of Optimism is a Strategy, but other options are also possible, and it is deserving of further exploration in the left branch.

Large river sink entrance with cobbles leads to a steeply inclined tube lined by cobbles at the angle of repose (cobble slope of doom), and this had to be dug on the initial trip. At the top of the cobble slope the cave bifurcates into a left and right branch.

The left branch is initially through a small tube at floor level on the right, about 5-10m beyond the top of the cobble slope. This leads via dry passages and a 5m handline climb (dyneema drilled thread) down to a chamber, and below that is a two-part 10m pitch rigged with a 20m rope. Below this there is a chamber with two low cobble crawls leading off, with the left one being much bigger and continues for several tens of metres at least, and was left ongoing. There is little draft but good air.

Going back to the top of the cobble slope, the right hand branch of the cave is entered, past a pool, where a short rope (~20m) was rigged., past pool and down next immediate short pitch down, and then a large water worn passage is followed. Unfortunately, this passage is smaller, and it seems that the very good draft is maybe lost. The passage ends at a squeeze, through which is a full blockage, but through which water drains in flood. It is probably not worth returning to this right hand branch.



Figure 54. BM about to commit to go down into the cobble slope that had to be excavated, but has a howling draft.



Figure 55. Bolting down a small pitch in the right hand branch of Sink 2, and in the water washed passaged beyond.

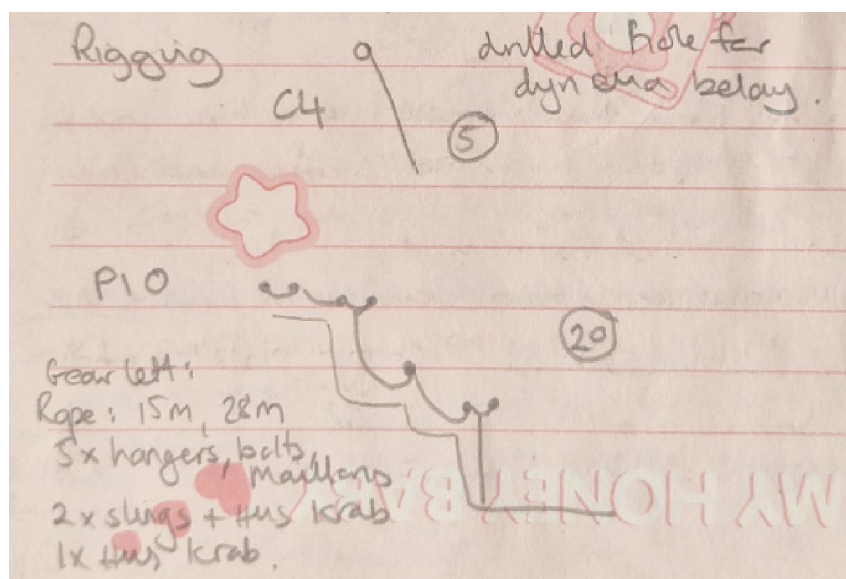


Figure 56. Rigging guide for the pitches in the (ongoing) left branch of Sink 2.

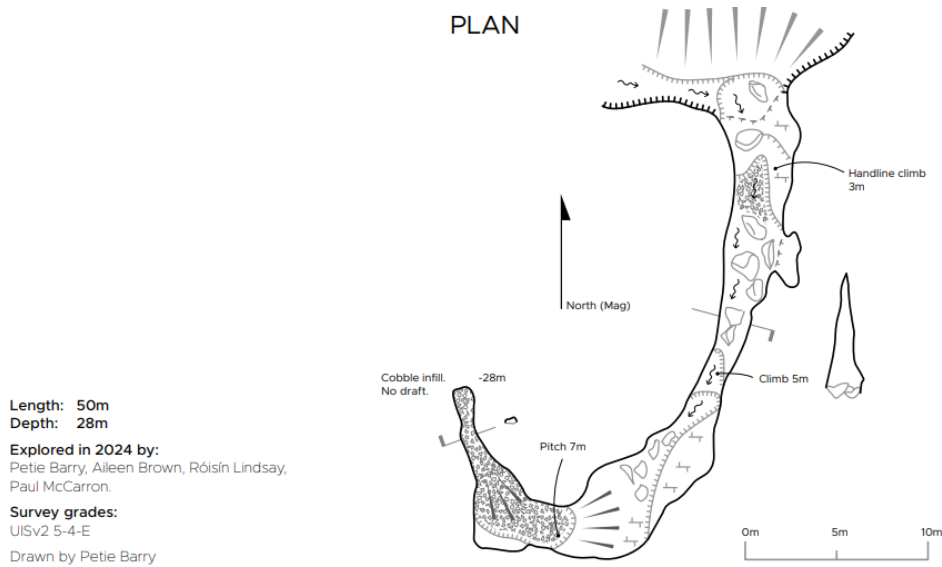
Area C – the line of sinks extending from Camp to the Southeast

Sink 3 [Discovered in 2023, and is choked due to a landslide]

Sink 4 [Discovered in 2023, and this large depression is choked]

Sink 5: Torca de las Avispas: Coordinates - 6.0769° S 77.5076° W 3483m [length = 50m; depth = 28m]

Good looking stream sink, with two short (< 5m) pitches at start, but chokes after 29m.



Cueva de las Avispas

Vista Alegre, Rodriguez de Mendoza, Amazonas,

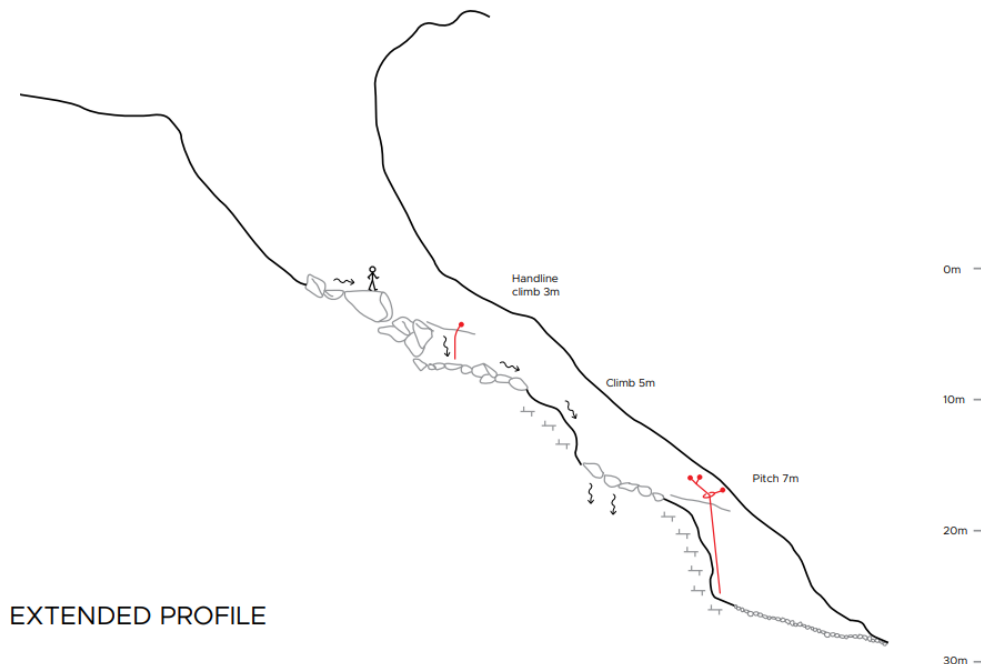


Figure 57. Survey of Sink 5 (Cueva de las Avispas) drawn by Petie Barry.



Figure 58. The entrance to Sink 5 (Cueva de las Avispas).

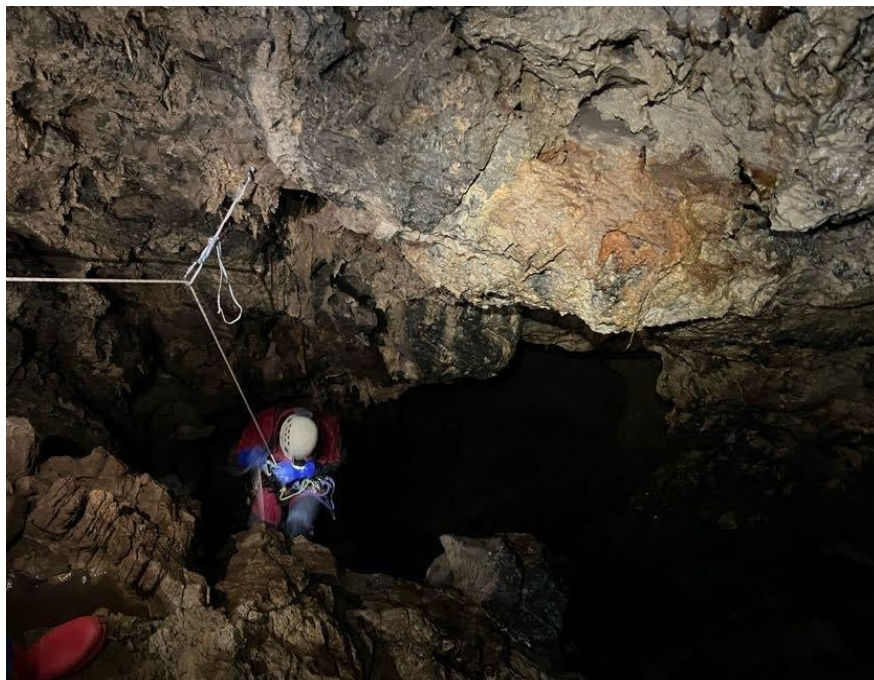


Figure 59. The entrance pitch inside Cueva de las Avispas

Sinks and cave features in the valley beyond the Watershed Col

Heading up valley from Sink 5 an obvious col is reached (GR 6.08252 S, 77.50577 W). A large valley runs South East from this col with a sandstone escarpment and associated streams on the South of the valley and an large limestone massif on the Northern side. The streams running off the sandstone create sizable v shaped valleys, which inevitably sink when they reach the limestone. The majority of the sinks are at an altitude of 3400-3420m. There is an obvious, fairly large resurgence 2 km further down the valley at an altitude of 3330m. The depth potential is poor, but there is evidence of large phreatic fossil passages and when combined with the sizable resurgence (in the dry season) it is possible for a tidy stream cave of decent length to be discovered. It is also possible that most of the sinking in the limestone massif to the North drains into this valley (theoretical depth potential of ~400m). Many of the sites visited were choked with sandy debris and given the remote location are not a priority.

During the 2024 expedition a team of 3 (CJ, HM and JC) spent 3 days logging and exploring the more promising of the caves in this valley.

Below is a list of the caves descended and sites visited. More sites were visited than were on the original list so names may not cross reference very well.



Figure 60. View from Watershed Col looking down the valley. The vegetated valley of Sink 7 can be seen in the mid distance. The stream forming sink 6 is just to the right of Hannah and Jules. The large limestone massif can be seen rising to the left of the image.

Sink 6: Coordinates - 6.08458° S 77.50250° W

This is the original position of 'Sink 6' visited by 2023 expedition. There is a 3m climb to a sandstone river bed. Not worth a visit and undescended.

Sink 6-Rift: Coordinates - 6.08458° S 77.50250° W [length 15m; depth 12 m]

Large rift, found at the base of a gully. Part way down the open rift a daylight connection was seen and a small stream sank in boulders. Explored to completion. Pitch ended after 12m.



Figure 61. Jules Carter in Sink 6-Rift.

Sink 7: - 6.09083° S 77.499948° W 3418 m [length 80m; depth 28 m]

An impressive entrance with swifts flying around, and an obvious river sink. The large entrance continues in sizable proportions for 50m, with several avens entering. Flood debris can be seen high on the walls. At the end of the large passage a short climb leads into a pleasant section of crab walk. The cave continues to a short downclimb into a chamber, the way on is a muddy and squalid duck, not entered. Shortly before the downclimb a fossil tube passage is encountered on the right (heading into the cave), this leads to a short series of damp interconnecting phreatic passages, exploration ended at a body sized tube partially filled with clear water. It is not thought to bypass the muddy duck. Both the muddy duck and the water tube are 'interesting-ish' leads, but having no draft are low priority. Small mammal poo was noted throughout the cave. No tackle required to reach the current limit of exploration.

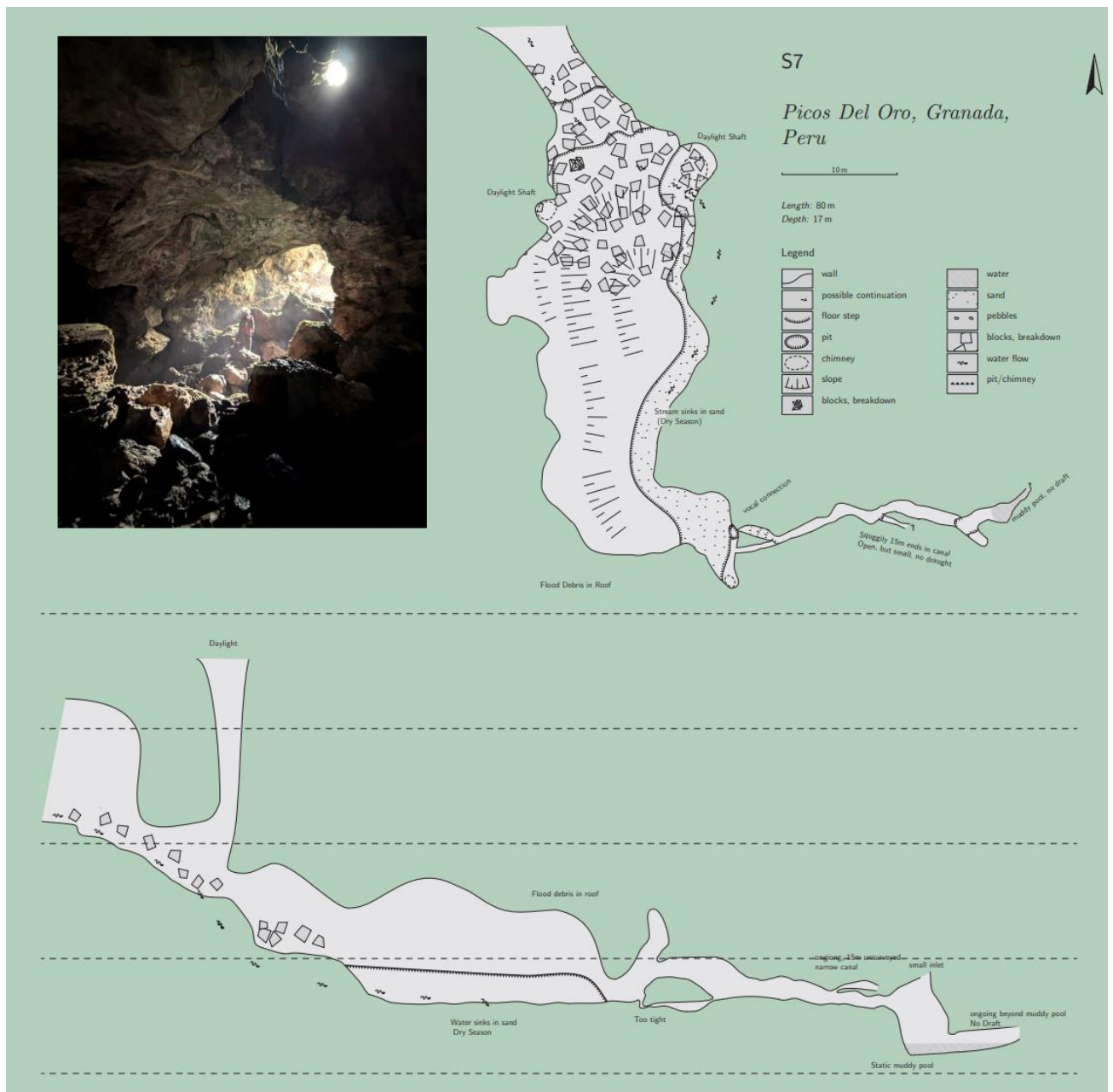


Figure 62. Plan and extended elevation survey of Sink 7, which ends in small non-drafting tubes.



Figure 63. Hannah Moulton at the impressive entrance to Sink 7

Sink 8: - Coordinates - 6.09154° S 77.49912° W 3430 m [length = 50 m; depth = 32m]

A fine pitch series using 18m, 23m and 23m ropes reaches a sizeable chamber with two ways on. The most obvious (right) descends a rift to regain the small stream lost after P1. Current limit ends with a small wet tube. No draft. Back at the bases of the pitches heading left leads down 2 short free climbs, passes under a dry aven and ends with sandstone cobble choke.

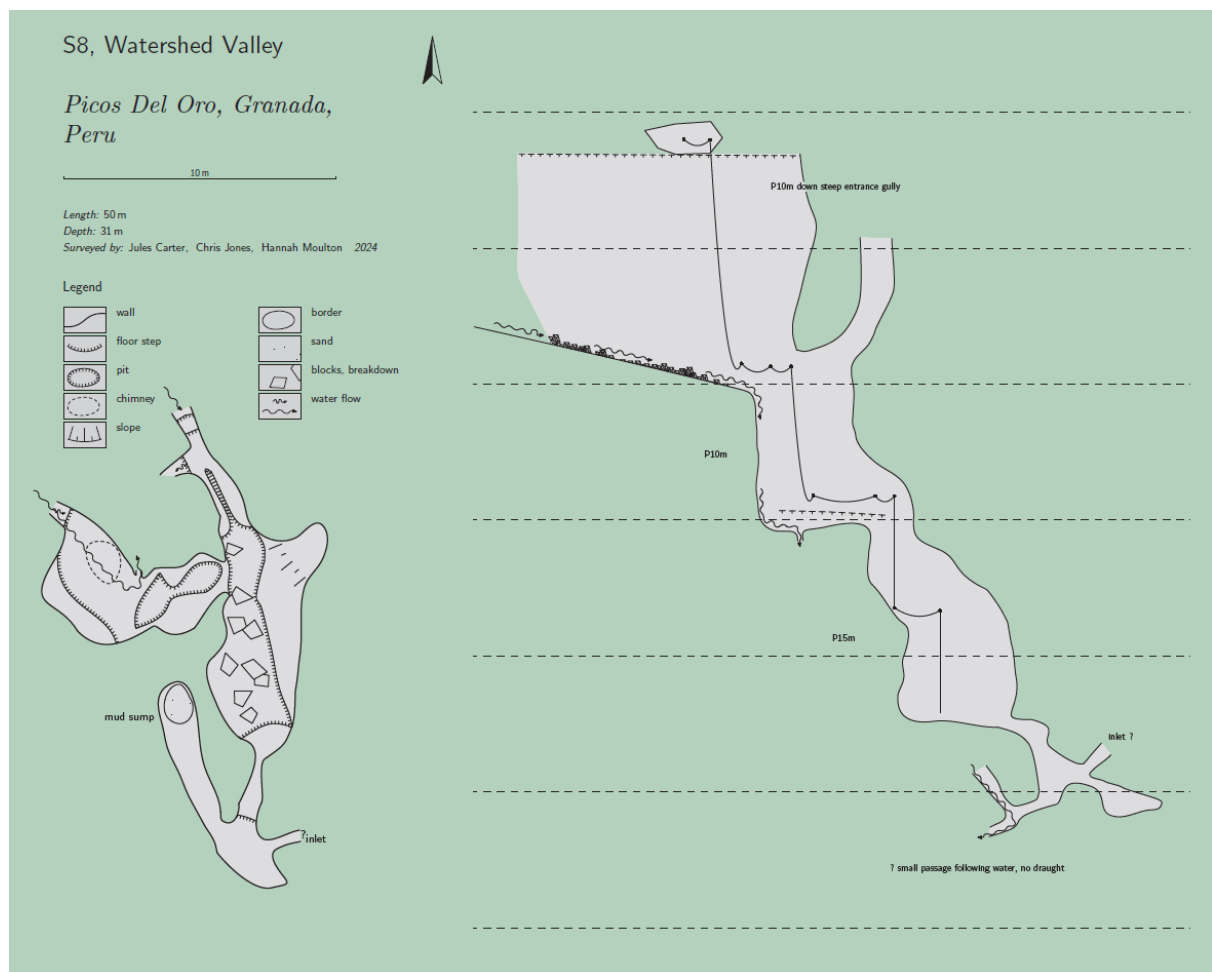
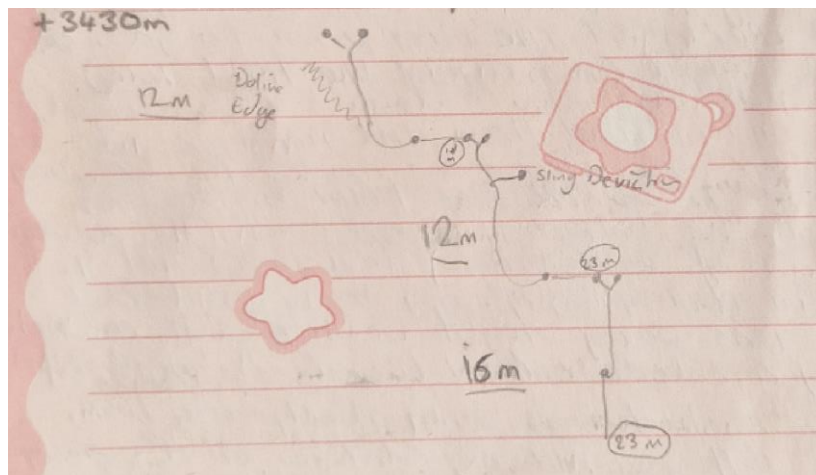


Figure 64. Rigging topo and survey for Sink 8. 1st Y hang from bolts in bed rock above streambed.

Sink 9: - 6.09168 S, 77.49887 W

Not entered - requires ground anchors or a tussock abseil. Small, heavily vegetated streamway.



Figure 65. Hannah Moulton at the Sink 9 doline

Sink 10: - 6.09175 S, 77.49831 W

Small stream sinks in a choke at the foot of a small limestone cliff. This would be dug in the UK. There is a small pitch in the floor (just to the left of HM in the below photo), this was assumed to choke but not entered. Minimal interest given the location and proximity to other 'open' caves.



Figure 66. Hannah Moulton in the small stream forming Sink 10.

Silt Sink 1: - 6.09188 S, 77.49820 W

Small stream sinks into the moor, short pitch, assumed to be choked with mud/sand.

Pitch in floor: - 6.09219 S, 77.49812 W

Not descended.

Silt Sink 2: - 6.09238 S, 77.49779 W

Pitch on open moor - assumed to be choked with mud/sand.

Sink 11: Coordinates - 6.09298°S 77.49771° W [visited by CJ, HM, JC]

Descend into doline upstream of the vegetation. Stream enters a low opening, this continues on a rubble floor to end in a sand and cobble choke after 20m. No way on. No draft. (Is this PT sink 9?).



Figure 67. The large doline of S11. Entry is possible via the streambed.

Sink next to S11: - 6.09298°S 77.49771° W

Small sink near S11, undescended. Likely choked.

Sink 18: - 6.09294 S, 77.49705 W

Undescended. Likely choked.

Sink 12: - 6.09401°S 77.49674° W [visited by CJ, HM, JC]

Descended into doline, water sinks into a calcited boulder choke. No way on.

Sink 13: - 6.09413 S, 77.49656 W

Undescended - no notes, assume difficult access. Assume needs ground anchors.

Silt Sink 3: - 6.09426 S, 77.49652 W

Undescended - no notes, assume difficult access. Assume needs ground anchors.

Rift Cave / Cueva de Grieta: Coordinates: 6.09429°S, 77.49654° W 3400m [length ~30 m; depth > 11m]

An interesting and ongoing fossil cave, with a draft and echo. Ongoing and unsurveyed, with hangers in place.

Not in a riverbed, so perhaps not that easy to re-find, but maybe less likely to be choked. This cave is at an interesting location as it is at the confluence of two large, dry surface valleys.

A 23m rope descends a steep slope to a pitch head, here a draft can be felt. An 18m rope will reach the bottom of the pitch, however the way on is reached via a ledge partway down. The same 18m rope can be used to descend the next drop into fossil horizontal passage. This smallish passage was explored (unsurveyed) for ~50m via a few 'larger' chambers and shorter more awkward sections to the head of the next pitch (4-5m?). A draft was noted throughout this passage, the pitch gave a good echo and a way on was visible at the base of the pitch.

There is a 60m height difference and a few km in distance to the resurgence. This cave is worth another trip if in the vicinity for the (small) chance of development uphill into the mountain, as well as downhill development to the resurgence.

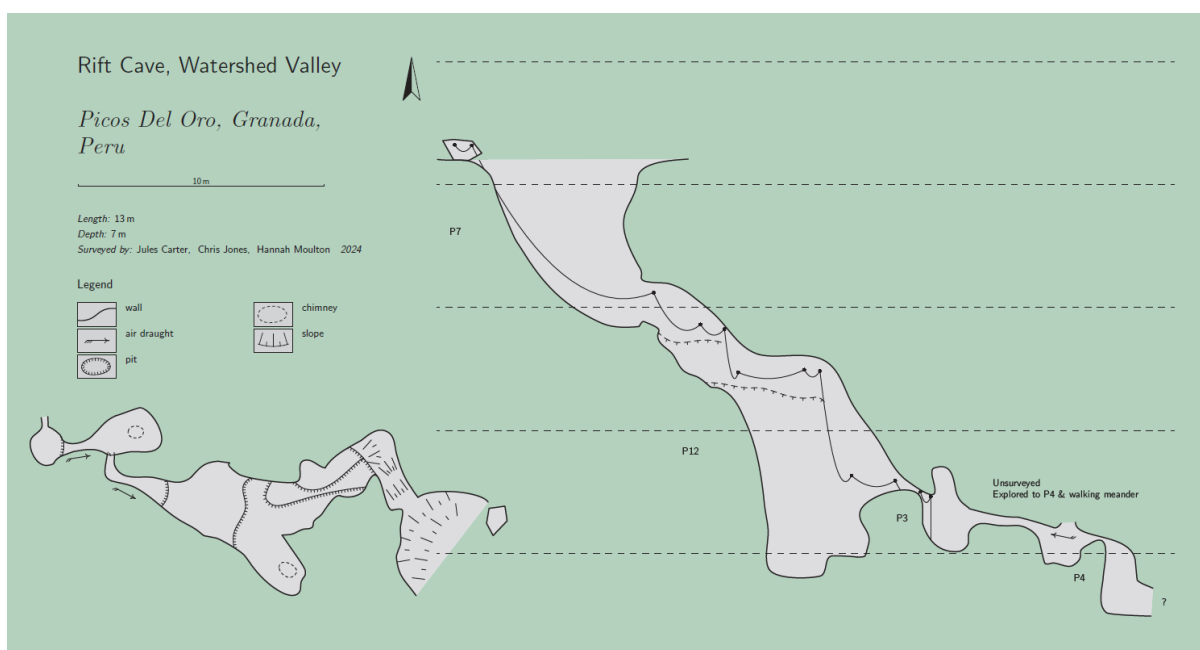
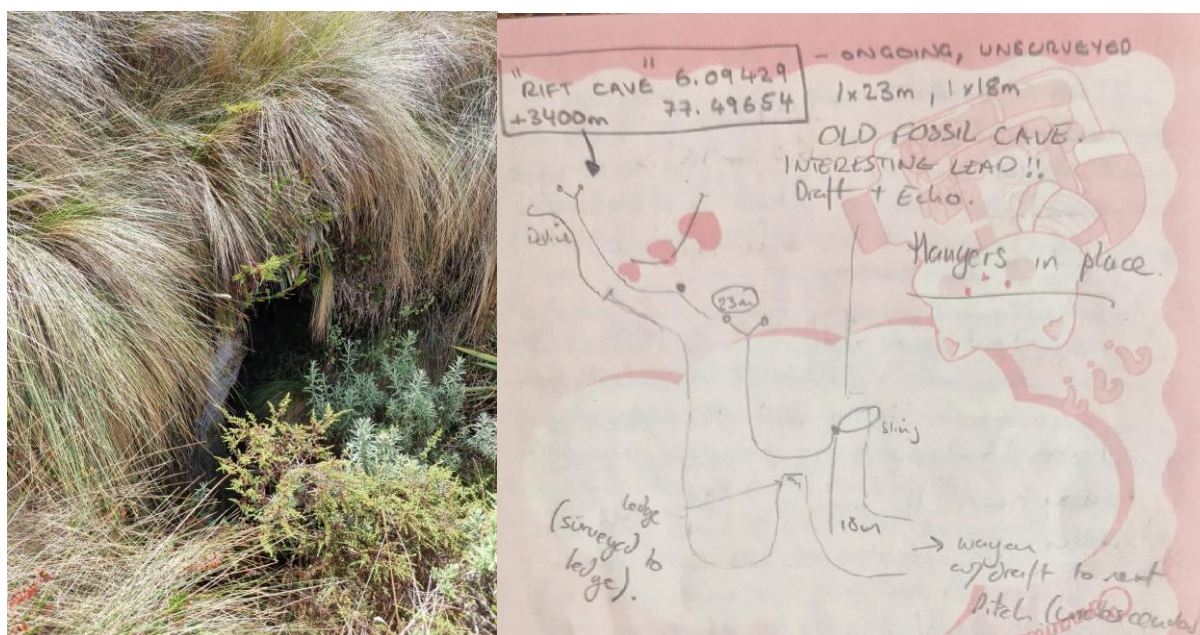


Figure 68. Rift Cave entrance, rigging topo and survey. Y-hang from a boulder above the small doline. The entrance is bigger than it looks...

Silt Sink 4: - 6.09430 S, 77.49651 W

Undescended - ran out of time. Assume needs ground anchors.

Sink 23: - 6.09431 S, 77.49650 W

Undescended - ran out of time. Assume needs ground anchors.

Sink 14: - 6.09927 S, 77.49167 W

Undescended - did not think it had great prospects due to the proximity of the resurgence.

Sink 15: - 6.09975 S, 77.49198 W

Undescended - did not think it had great prospects due to the proximity of the resurgence.



Figure 69. Sink 15 entrance - note terraformed land above, there were a lot of ruined round houses in the vicinity. Archeological interest.



Figure 70. Several ruined round houses in the vicinity of Sinks 14 and 15.

Sink 17: - 6.10635 S, 77.48978 W

Large sinkhole above resurgence. Not re-visited. I think it was choked otherwise we would have got excited. Can't be 100% as we didn't have our caving kit with us when we were in this area.

Abandoned resurgence: - 6.10620 S, 77.48954 W

Several meters higher than current resurgence, either abandoned or flood overflow. No obvious signs of active streamway. Entry not possible. Large boulder choke. Not as large as the active resurgence below.

Far-East Resurgence: Coordinates - 6.10695°S 77.48958° W 3320m [visited by CJ, HM, JC]

Resurgence visible on satellite images, located ~5 km east of Camp at Sink 2 (3 hrs walk). A large landslip of open boulders, 5xm wide by 8m high. A sizable stream in the dry season, given the lack of sand and mud debris throughout the boulder choke, I expect a lot of water in the wet season!

No way into the passage was found. A draft could be detected throughout the choke.

The terrain above the resurgence was a mix of glacial debris & limestone, there did not appear to be a lot of great limestone.



Figure 71. The far eastern resurgence.

One site was spotted but not visited, this appeared to be a large horizontal passage. It is visible from watershed col and around 100-150m higher above sink 7. Approx GR 6.08848 S, 77.49695 W. Approx Altitude 3520m. [Is this the cave entrance reported by Rob Dover to PT?]

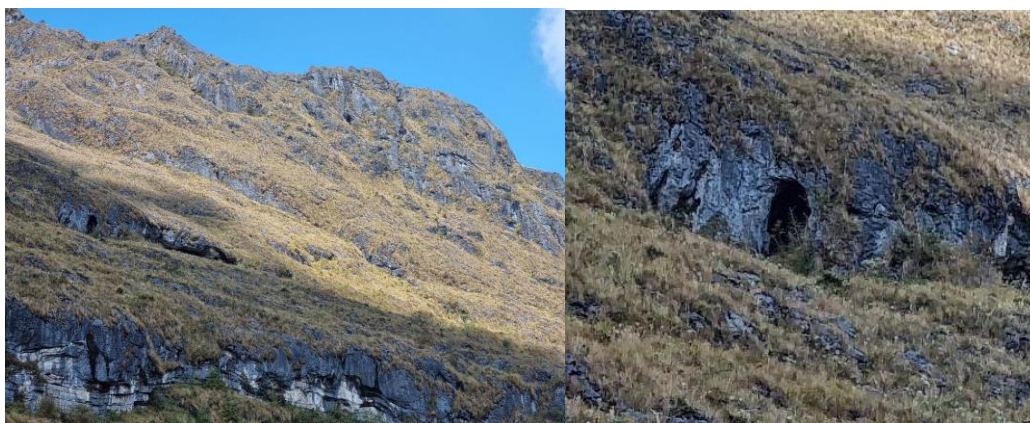


Figure 72. View of the un-explored cave entrance above Sink 7.

Area D – On broad mountain ridge above current end of Tragadero de la Soledad

Tragadero de Golondrinitas – Coordinates - 6.04958°S 77.51075° W 3415 m (3888m at entrance pitch) [220m long and 158 m deep]

Major feature in the same large-scale depression that contains PT5 and PT6, it was initially called PT7 (and corresponds to Sink 15 in satellite images). Big doline with three small active streams draining into it, and swifts nesting. There is a large entrance pit (~120m deep) at the base of the doline, which is best reached from the surface pools of water on the eastern side of the doline rim, by scrambling down steep grass and one of the stream beds. The entrance is well placed because it is about 300m higher, and 170m horizontally from the current known end of Tragadero de la Soledad, and may provide a back door into a continuation of that cave.

The entrance pitch is a ~120m deep shaft, which is serious to rig as it contains loose rock. Parts of the pitch also have water drips even in dry weather, and some thought may be needed to avoid water produced by heavier rainfall.

At the base of the entrance pitch there is a large (30m x 20m) chamber. A narrow rift takes the water at the base of this chamber, and cobbles and sediment could be scooped by hand to enlarge that rift to allow progress. A clean washed and larger passage could be seen ahead, and it carries a draft.. A very loose climb up to the boulder slope at the top end of the chamber found, with no way on.



Figure 73. Entrance of Tragadero de las Golondrinitas within large doline.

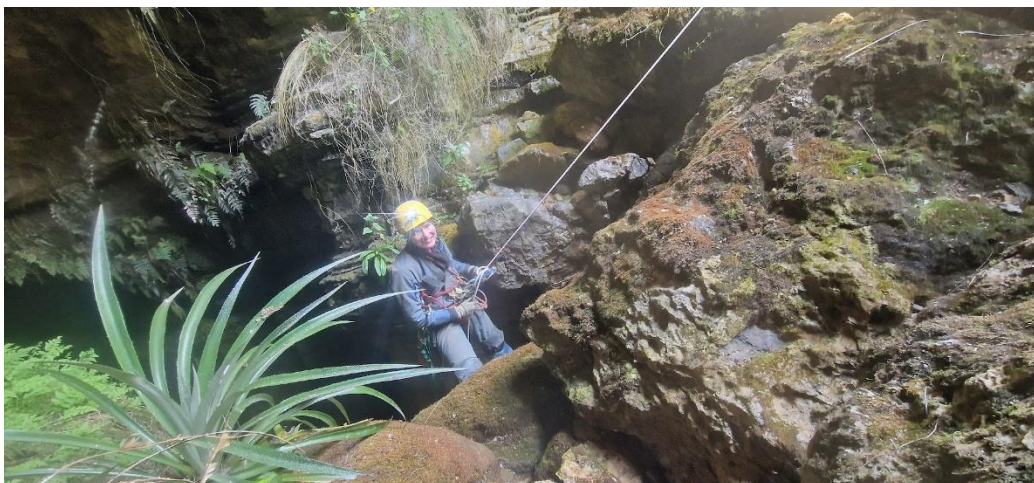


Figure 74. AB descending into entrance of Cueva de las Golondrinitas, shortly before a large rock fall.

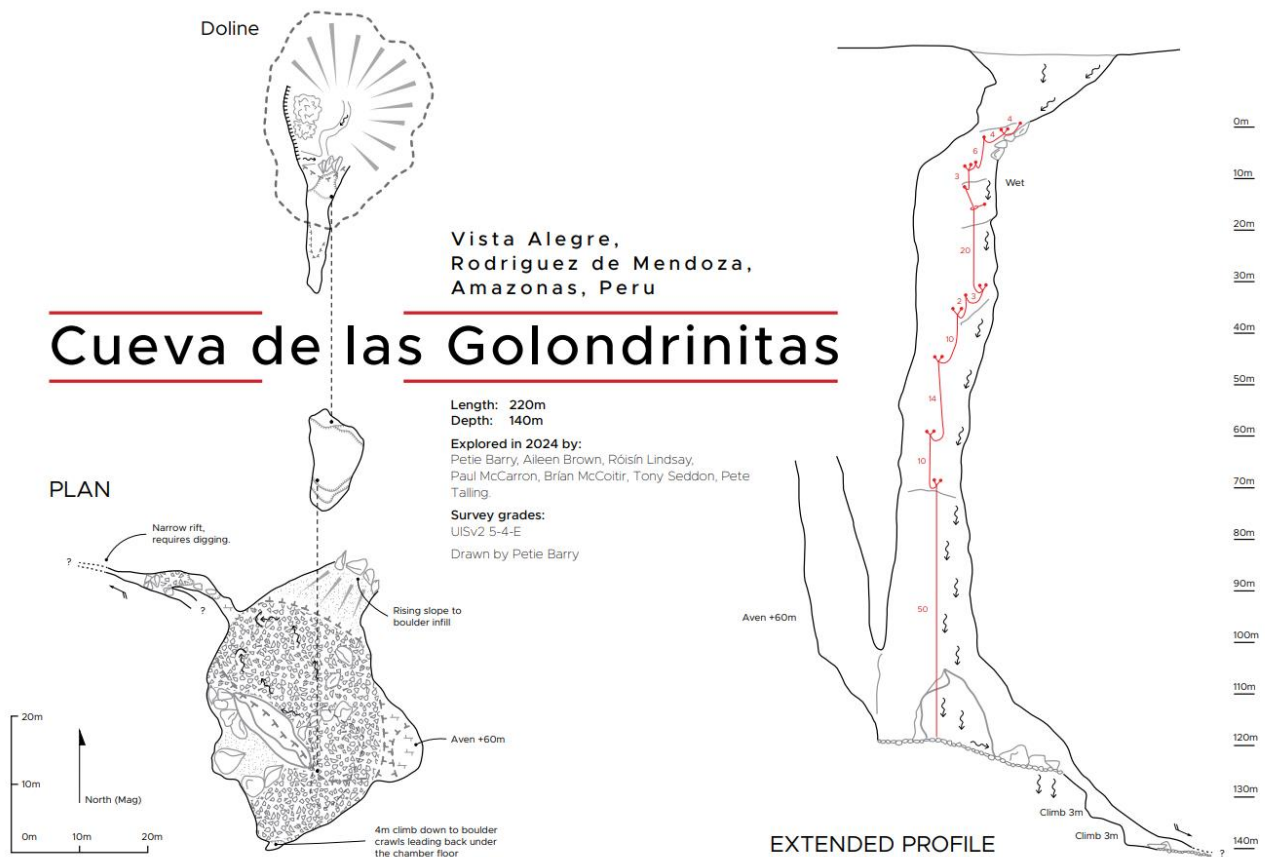


Figure 75. Survey of Cueva de las Golondrinitas, with pitch lengths in red. Drawn by Pete Barry.

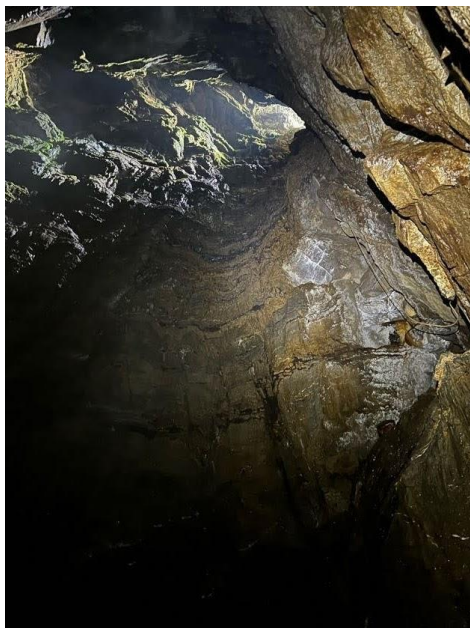


Figure 76. Upper part of the entrance pitch series of Cueva de las Golondrinitas.



Figure 77. View up towards the entrance within of Cueva de las Golondrinitas.

PT1 – Coordinates - 6.05653°S 77.50976° W 3474 m [PT]

Choked. [Previously logged by JYB – see below?]

PT2 – Coordinates - 6.05494°S 77.51029° W 3464 m [PT]

Hole under small cliff at base of depression, which needs a rope. But no obvious draft.



Figure 78. PT2 entrance.

PT3 – Coordinates - 6.05311°S 77.50959° W 3446 m [PT]

Initially a promising hole at end of small valley, with a tree. But totally choked. Possibly faint draft but not sure.



Figure 79. PT3 entrance.

PT4 – Coordinates - 6.05248°S 77.50952° W 3444 m [PT]

Promising. Small pitch down that needs rope at base of cliff in depression, but can't get to pitch head safely without rope. Some draft.



Figure 80. PT4 entrance.

PT5 – Coordinates - 6.05046°S 77.50938° W 3415 m [PT]

Depression below obvious landslide on slope above, and it is indeed choked. In same overall depression as Wagtail Sink.

PT6 – Coordinates - 6.04932°S 77.50943° W 3415 m [PT]

Largest cliff in major depression (with Wagtail Sink) and major feature. Originally called sink 14 on satellite images. Base of cliff has hole below very unstable boulders that needs a short rope for return. There may be a faint draft.



Figure 81. PT6 entrance.

PT8 – Coordinates - 6.05418°S 77.51159° W 3464 m [PT]

Biggish hole at bottom of grassy sinkhole, which will need a rope to approach a drop of 15-20m?

PT9 – Coordinates - 6.05485°S 77.51306° W [PT, then JC, HM, CJ]

This depression is complex, and a sandstone stream leads to an impressive limestone rift. Originally called Sink 26 on satellite image. This rift was descended in two places, but could not enter the sink safely. Ground anchors (large metal stakes) are probably needed. The obvious shaft at the base of the streams could be rigged off a limestone boulder perhaps. Quality of rock at the top of the shaft looks poor so ground anchor back-ups advised.

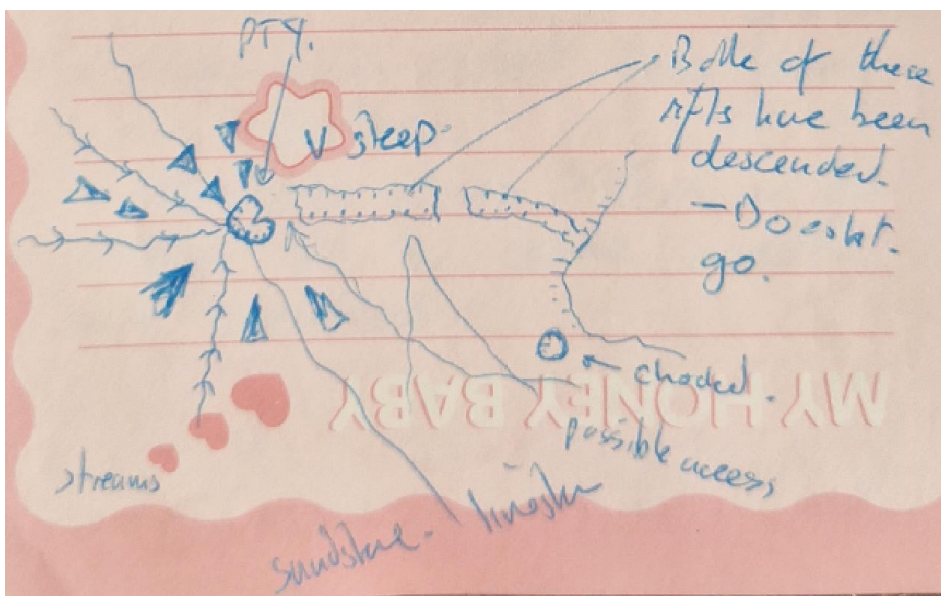


Figure 82. Sketch of the entrance to PT9 by CJ.

PT 10 - Coordinates - 6.05864°S 77.51351° W 3463m

Small depression that is blocked.

PT 11 - Coordinates - 6.04814°S 77.50942° W 3422m

Small depression with hole, but needs some ground anchors to approach?

PT 13 - Coordinates - 6.04757°S 77.51172° W 3444m

Lowest depression in tree filled gulley, and totally choked. No way on.

PT 14 - Coordinates - 6.04743°S 77.51199° W 3450m

Tree filled gulley, and totally choked. No way on.

[Note that there is a very big and broad depression in the limestone to the east of the Wagtail Suinbk depression. PT and JYB walked along it rim, but could not see any entrances at its base, so did not descend the long way down to that base. Could be worth checking in future].

CJ's Large Doline - Coordinates - 6.05864°S 77.51351° W

Choked with sand.

CJ's Doline 2 - Coordinates - 6.05665°S 77.51252° W

Not entered. It has two obvious ways in an open shaft that are descending into boulders, and some openings at the base of the doline.

Nettle Pot - Coordinates - 6.05511°S 77.51175° W

This is an interesting prospect, and has a very good draft, as well as a large limestone cliff above. Jules sat on a nettle (hence name) and went down the boulder slope for 20m. There is a way through a drafting boulder choke, into a daylight shaft and into a mud floored chamber.

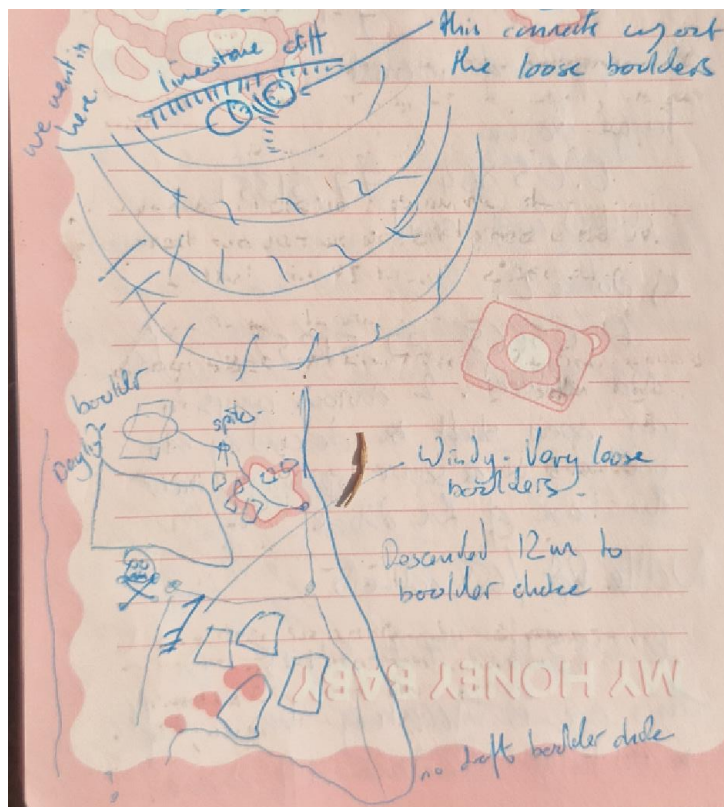


Figure 83. Logbook sketch of area around Nettle Pot.

The following series of small holes were also logged by JYB, but none is promising.

Hole 84: Coordinates - 6.05392°S 77.50349° W [blocked]
Hole 85: Coordinates - 6.05413°S 77.50478° W [blocked]
Hole 86: Coordinates - 6.05439°S 77.50544° W [blocked]
Hole 87: Coordinates - 6.05590°S 77.50687° W [blocked]
Hole 88: Coordinates - 6.05598°S 77.50821° W - open?
Hole 89: Coordinates - 6.05608°S 77.50837° W - pitch – needs rope
Hole 90: Coordinates - 6.05673°S 77.5097° W - blocked
Hole 91: Coordinates - 6.05802°S 77.5114° W - blocked
Hole 92: Coordinates - 6.05793°S 77.51259° W - blocked

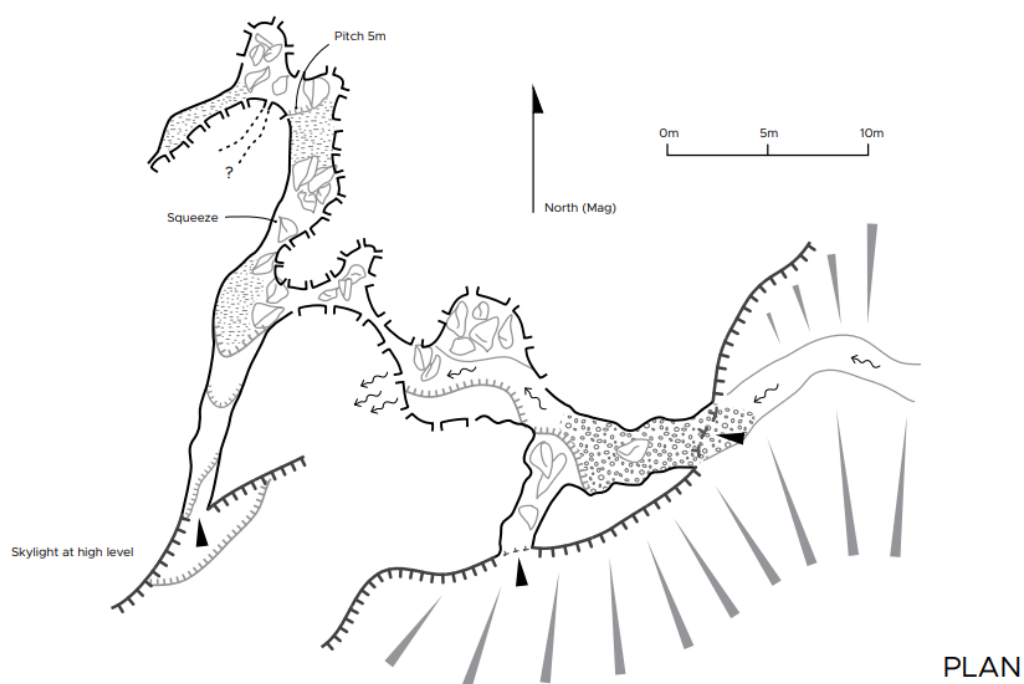


Figure 84. One of the small surface holes descended by BM, GJ, JYB and TdP.

Area E – Pianura del Pico de Oro depression

Sink 17 – Coordinates - 6.0450°S 77.4974° W 3296 m length = 45m depth = 9 m

This is 'Tragadero 6 de la Planura del Pico de Oro' of the NorPerú2019 expedition, and was referred to by some UK cavers as 'Mosssdale Sink', and it lies at the southwestern margin of the large and flat Pianura del Pico de Oro depression that also contains the largest river sink. It was also explored in 2023, but a tight z-shaped bend was noted, which needed thinner cavers. This bend was passed in 2024 by a team that dug through a further boulder choke, but no way on or draft was found.



Cueva de las Huellas

Vista Alegre, Rodriguez de Mendoza, Amazonas, Peru

Length: 45m

Depth: 9m

Explored in 2024 by:

Petie Barry, René Haemers, Róisín Lindsay,
Paul McCarron.

Survey grades:

UISv2 5-4-E

Drawn by Petie Barry

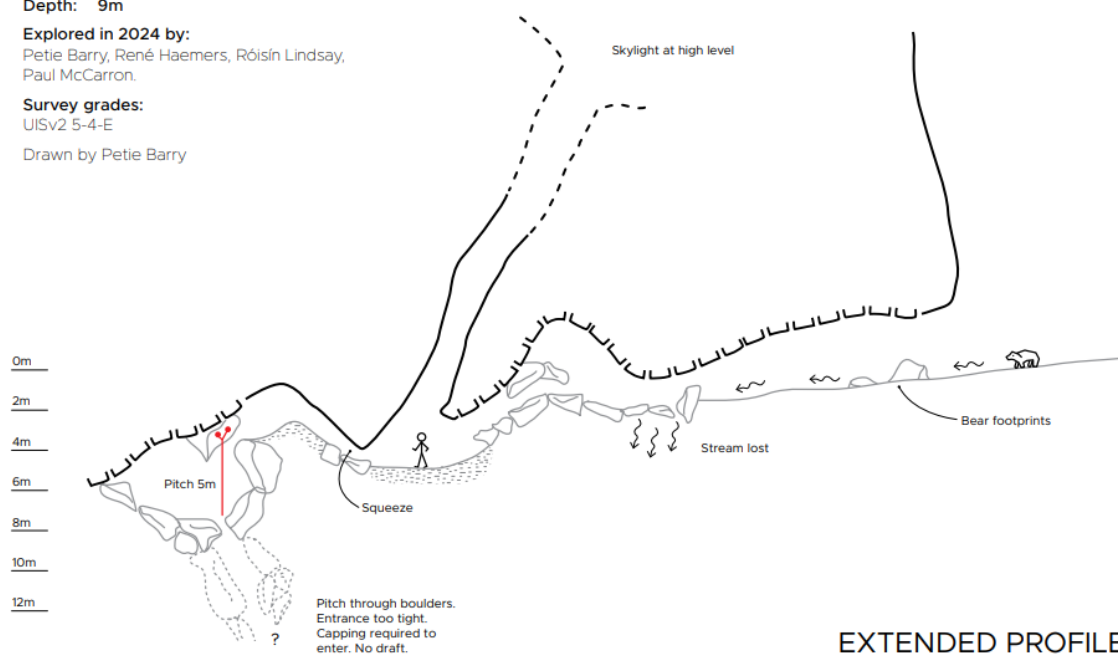


Figure 85. Survey of Tragadero 6 de la Planura del Pico de Oro, first entered in the NorPerú 2019 expedition, which was sometimes called Cueva dre las Huellas or Mossdale Sink on this expedition.

Group 3

Pozu del Arco – Coordinates - 6.05664°S 77.51738° W 3296 m

10m pitch in large circular shaft, but the base is blocked.

Abra del Arco – Coordinates - 6.05664°S 77.51738° W 3505 m

Three short entrance pitches (4m, 5m and 6 m) lead to a small horizontal passage that continues for 15-10m. After a block is squeezed over, there is an initially human sized fissure. This continues and expands downwards to become a beautiful 160-170m deep shaft. A meander continues from the base of the shaft, with further exploration only stopped by a lack of rope at another 10m pitch.

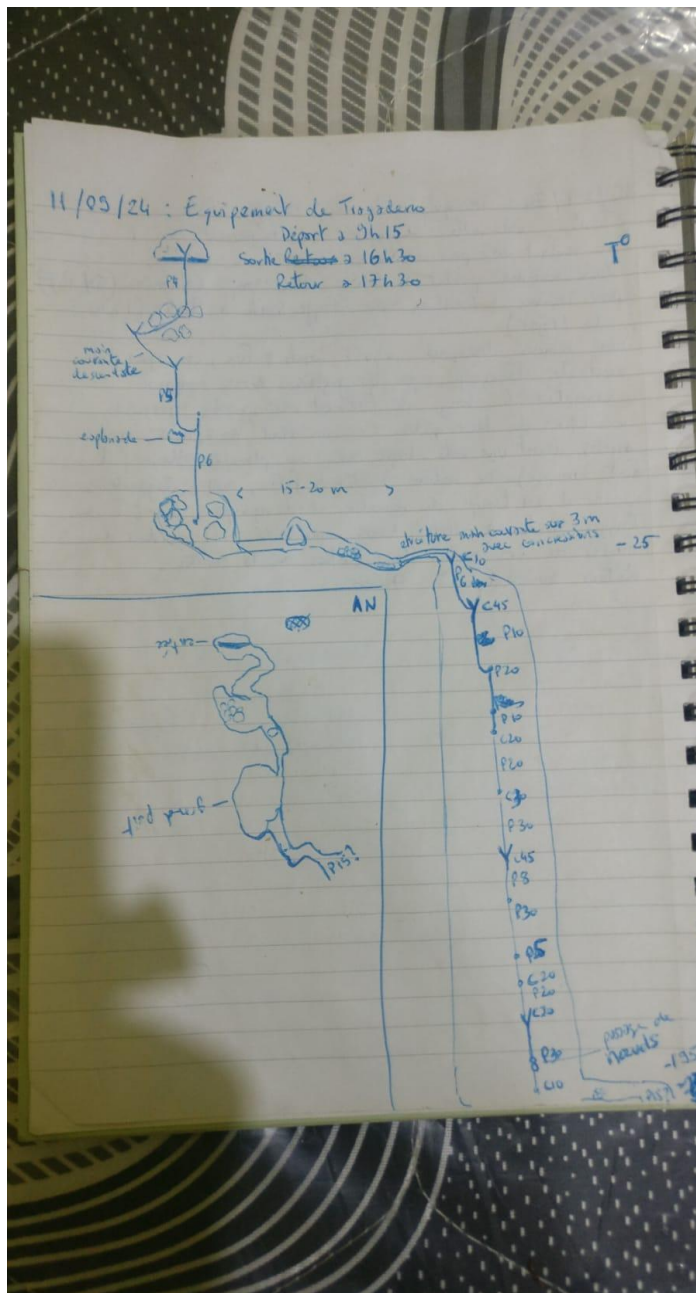


Figure 86. Photo of a logbook sketch of the ~190m deep Abra del Arco, which is still to be surveyed.

Four days to do everything

Jean-Yves Bigot

On September 8, 2024, group 2 installed at “Inca Camp” is preparing to leave for the Calamina site (Yanacocha hut). Tonio and I are the only ones to continue the adventure with a third group mainly made up of French people. Certainly, we know that this group 3 will have a smaller workforce than that of group 2 (14 people). But not to the point of being reduced to four people! Indeed, Jean-Denis suffering from his knee had to leave the Calamina cabin accompanied by Liz.

When we hear the news, we know that it will not be possible to “hold out” for long on the “Inca Camp”; That’s when we decide to leave with group 2 to enjoy Dario’s horses. Indeed, logistics are not easy to organize on the Granada plateau and we must take advantage of the availability of the “arrieros” (the men behind the horses).

Because the Calamina cabin is both close to the areas to explore and to the path connecting to the village of Granada. This way, we will be able to save a day and especially an Inca Camp - Calamina rotation.

Tonio and I then begin to quickly fold our tents; the dismantling of the rest of the equipment (generator, etc.) is taken care of by our friends upon departure.

In the meantime, Florian and Raphaël have already left the Calamina cabin and soon arrive at the Inca Camp. There, to their great surprise, they learn that everyone is moving to Calamina... Indeed, the Tragadero de la Soledad remained rigged up to Lamb and Fox Chamber (-110 m), so that the participants of group 3 can visit this beautiful cavity located just 1 or 2 hours from Calamina.

A misunderstanding, followed by an argument, arises between the participants of the newly formed group 3.

Certainly, it had been agreed before that group 3 would come without rope and without food. But the fact that group 3 came without a stove poses a problem...

Because when it comes to cooking, the logics of the two groups are radically opposed. Group 2 uses multi-fuel stoves (oil or gasoline) intended to heat only water and then mix it with cooked and dehydrated meals in individual sachets. Group 3 uses a large gas bottle and collective bowls intended for cooking or reheating prepared meals. However, the gas bottle and the dishes remained with Dario in Granada...

As for the food: no problems; but working multi-fuel stoves are rare and remain individual equipment requiring a lot of maintenance... Peter lends us his, as well as a Garmin inreach explorer GPS which allows us to send SMS via satellites. Furthermore, group 2 entrusts us with 185 m of ropes of various lengths as agreed.

The next day, September 9, 2024, once group 2 had left, we found ourselves alone in the large common tent set up near the Yanacocha stream. We have 4 full days ahead of us before Dario returns with his horses.

We are all in this together and absolutely must get along (fig. 1).

**Figure 1. All together at camp Calamina (Yanacocha).
From left to right:
Jean-Yves Bigot,
Antonio de Pomar,
Raphaël Gueit and
Florian Richard.**



A point is made and we adopt a strategy: it is a question of favoring prospecting. It starts with sinkholes that Chris and Hannah didn't have time to fully explore: sinkholes 2 (lat.: -6.05665° S; long.: -77.51252° W) and 3 (lat.: -6.05511° S; long.: -77.51175° W).

Loaded with the necessary equipment, we leave the Calamina camp, taking a shortcut across the mountain.

But it's wasted effort because even with a GPS in hand, deep ravines force us to take a route quite close to the one that leads to the Inca camp.

However, we turn left as we approach a pass. My colleagues do not follow me and continued to climb a long crest made up of moraines. But no holes open in the moraine sediments ! I have to put them back on the right path. Indeed, it is me who holds the GPS and has the data concerning the sinkholes to be reviewed.

I am on a col ("abra" in Peruvian language) and I am patiently waiting for my colleagues to join me.

The col where I am is dominated, on the right, by a limestone peak ("Cumbre del Arco", alt.: 3540 m).

This is located exactly at the limit of moraine deposits and limestones. The water flowing over the moraines tends to disappear into sinkholes at the bottom of which limestone emerges.

I explain to Florian why such a configuration is interesting. In particular, the fact that the waters concentrate on impermeable areas (moraines), then disappear into the underlying limestones when the covering formations thin.

It is at the limit of the moraines and the limestone that we must look for, because in this way the sinkholes are supplied with water which allows the fillings to be evacuated. In fact, in the middle of the limestone plateau, there is little permanent circulation and therefore fewer possibilities to empty the sediments blocking the entrances.

We learn all these details while exploring the Granada plateau. Peter has already observed and understood the phenomenon of emptying of the sedimentological filling, because he found a few days earlier the Tragadero de las Golondritas.

Near the col ("abra"), a summit ("Cumbre del Arco") has some interesting parts that Raphael has already started to explore. As he progresses along the steep slope of the Cumbre, he arrives at the top of a shaft topped by a stone arch.

There is no question of going down here, and Raphaël decides to approach the shaft from below (lat.: -6.056640° S; long.: -77.517380° W).

Apparently, the bottom of this void, called "Pozo del Arco", is overgrown with vegetation, but there may be a continuation (fig. 2).

Raphaël installs a rope and descends approximately 10 m to find a foothold at the bottom of a vast circular shaft.

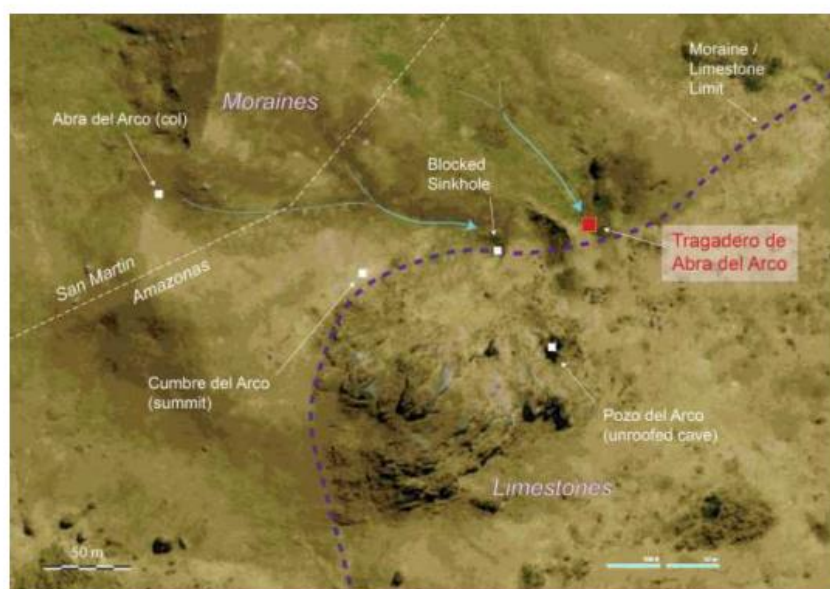


Figure 2. Location map.

Then, he carefully walks around it and notes that a passage deserves to be unblocked. But we must face the facts, the "Pozo del Arco" is an old unroofed cave whose bottom is largely blocked.

On the surface, I notice a few animal bones lying around at the top of the shaft. Following a path on the slopes bordering the "Pozo del Arco", I arrive at a den overlooking the shaft. This den is surrounded by trees whose bark has numerous claw marks. On the ground, a white-tailed deer skull and various bones constitute the last reliefs of the meal of a probable spectacled bear. Obviously, the bear is not only vegetarian and also feeds on carrion.

We are surprised that a cavity, like the "Pozo del Arco", has remained unknown. It seems that this part of the plateau was not the subject of any investigation by previous groups; all team members are very enthusiastic.

Looking a little further, other holes are discovered, but they are not fed by a stream and resemble the many holes without continuation previously explored by Gareth and Brian of group 2.

Raphaël goes down into a small hole and comes out dirty like a wild boar. From experience, we know that this type of hole does not lead to large networks. It is time to eat and take stock, we decide to definitively abandon sinkholes 2 and 3 to concentrate our research in this area close to our camp.

Florian, who precisely keeps accounts of the holes discovered (management of GPS coordinates), reminds us that there is a sinkhole with a grassy bottom that we have not yet inspected. I hardly believe it, because we have already explored the bottom of a large sinkhole located just above and it is completely blocked (lat.: -6.056150° S; long.: -77.51768°W)...

It is precisely this large sinkhole that served as an example for me to show Florian the interest of holes located near impermeable areas. But Florian does not give in to discouragement and remains very enthusiastic. Imperturbable, it leads us directly to its sinkhole (lat.: -6.05601° S; long.: -77.51720° W; alt.: 3505 m). Raphaël follows him, while Tonio and I decide to wait quietly on the surface; perhaps a little tired from fruitless explorations.

But while the two friends have disappeared into a mouse hole that opens at the bottom of the sinkhole, the minutes pass without them reappearing on the surface. Maybe something happened...

After 30 to 40 minutes, Florian finally comes out to announce to us, with a smile on his face, that the hole goes on.

There would be a shaft at least 100 m deep! And the stones would take 9 seconds to reach the bottom....

It is difficult to hear this speech as the news is so unexpected, but it is not a joke: Raphaël and Florian have indeed discovered an exceptional cavity (fig. 3).

**Figure 3. Raphaël and Florian
at the exit of Tragadero
by Abra del Arco.**



On September 10, 2024, we have the task of derigging the Tragadero de la Soledad. There are only three of us, because Tonio is a little ill. We leave the Calamina camp to arrive after an hour and 10 minutes of walking in front of the entrance to Tragadero. We go to Lamb and Fox Chamber, from there we go up a tributary which flows into a fairly enormous section of gallery (more than 10 m in diameter). Such dimensions of galleries expose the vaults to phenomenal mechanical stresses and, as always, the tributary named "Upstream Pisco and Codeine Streamway" ends in a chaos of blocks...

Going back up during derigging, Raphaël falls 3 m to the bottom of a pitch in which there is a deviation only a few meters from the bottom. Fortunately, no harm was done; but during a previous visit I had the same fall, only 1 m, in the same place under the same deviation.

Arriving at the "rope store" located at the entrance to the cave, we leave four ropes of less than 20 m and take the rest for the exploration of Abra del Arco. These are actually large diameter ropes that no one will miss.

On September 11, 2024, the exploration of the big shaft is scheduled. All the equipment is transported in front of the entrance to the Tragadero de Abra del Arco. There we will put everything we have; hear all the available strings. But things are not so easy, because the entrance pitches lead to the bottom of a meander or rather a fracture blocked by a stalagmitic massif. Indeed, around -25 m you have to slip between this massif and the left wall to reach the top of a big shaft. This deep shaft begins modestly with a human-sized fissure. Further down, the void expands and takes on unsuspected proportions. Raphaël joins, followed by Tonio, then Florian.

But communication is not easy to establish in this vast volume. The echo and the water flowing throughout the shaft don't help anything. Impossible to communicate with Raphaël who must manage the descent and the equipment alone.

The shaft does not seem to have an end and Raphaël tends to save the ropes: this is why he descends in the most direct way and ends up hitting the bottom after a final passage of the knot.

Then, he takes a look at what follows, which appears like a big meander. But a pitch of around ten meters soon stops him.

Further on, it goes on, but he no longer has a rope in his bag. The bottom of the big shaft is wide and swept by spray, it is not good to linger here (fig. 4).

He decides to go back up to report his adventure to his teammates who remained in the big shaft. From the lengths of ropes installed, he estimates the depth of the big shaft at 160 or 170 m.

If we add the lengths of the entrance pitches, the terminus should be located around level -200 m (fig. 5).

I did not go down into the big shaft, because even small stones tend to come loose, especially in the presence of several people: which increases the risk of falling stones.



Figure 4. The bottom of the big shaft has a fairly broad base.

After several hours underground, Tonio finally comes to the surface: he is soaked and tired. I tell him not to wait for the others and to go straight back to camp.

The other two also come out soaked and cold, because the sun has disappeared. At an altitude of 3500 m, as soon as the sun's rays are obscured by clouds, temperatures drop drastically.

September 12, 2024 is the last day we have to return to the Tragadero de Abra del Arco. Normally, we should have surveyed the cave yesterday, but the difficulties encountered in the rigging of the big shaft made it impossible to do so.

Today, the goal is to derig the cave. There are only three of us for this task, because Tonio is still ill.

It was decided to leave the ropes of the big shaft at its top, respecting the order in which they were installed. A string stretched for about 10 m is used to suspend the ropes inside a new “store”.

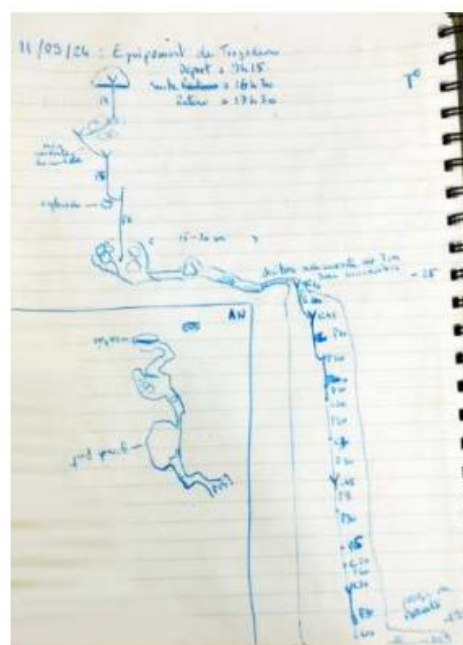


Figure 5. Sketch of Tragadero de Abra del Arco after the descent of September 11, 2024.

The place is not the most comfortable, because there is a certain humidity in the “store”. Raphaël and Florian are responsible for dismantling the big shaft. In the meantime, I'm busy widening the narrowest places, particularly towards the entrance where an imposing block forces us to twist sideways.

Further on, a hole is backfilled to make a higher passage easier. Arriving in front of the stalagmitic massif, I strike numerous blows with a sledgehammer on the calcite formation, sometimes without removing a shard, but just a little powder. Everything is good for widening the passage between rock and calcite, even by a few millimeters.

However, care must be taken to ensure that no calcite flakes fall into the big shaft, because Raphael has already received a small stone on his hand. Even with protective gloves, he still has after-effects.

Everything is in place for a future exploration. Although most of the ropes have been left at the top of the big shaft (C10 + C45 + C20 + C30 + C45 + C20 + C20 + C10), we return quite loaded to the Calamina camp where Dario and his “arrieros” are already installed near the Yanacocha cabin.

The 4-day mission of group 3 is over, we will return to Granada tomorrow, for some of us, after a month spent on the plateau.

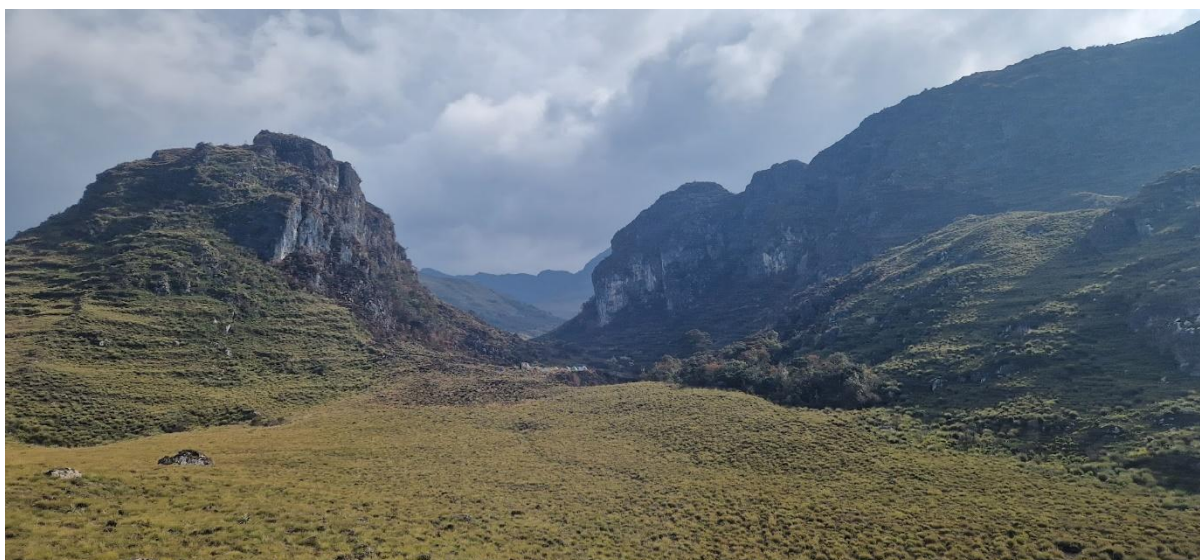


Figure 87. Group 2's Camp 2 in a relatively flat and idyllic location next to Sink 2.

Notes on Logistics

Travel: Jaen airport is now permanently closed, so that 2024 expedition members flew from Lima into Chiclayo, Cajamarca or Tarapoto. Small planes can land at Chachapoyas airport, but baggage weight is restricted. However, it is possible that Chachapoyas airport may soon be lengthened so that it can take larger aircraft, which may allow larger baggage weights. It is also possible that some members of the team could take main baggage to/from Lima by bus, to allow others to fly into Chachapoyas and avoid lengthy bus journeys (10-13 hours) to Chiclayo, Cajamarca and Tarapoto.

Group 2 also discovered at the last minute that there are no day buses from Chachapoyas to Chiclayo, only night buses. This meant that they hired a minivan (from Turismo Explorer in the main square in Chacha) at a cost of about £40 per head for 20 people, which was pretty efficient.

Horses: During this expedition, up to 13 horses were used to carry equipment up to Calamina Camp (day 1), and then on camps at Scottish Loch and Sink 2 (or Inca Camp) (day 2). Each horse carried about 3 large (23 kg) bags when fully laden, and were impressive. We are especially grateful to Dario and his team for pulling back all of the equipment from Scottish Loch to Calamina Camp with just 5 horses.

Satellite Camps: A key aspect of the 2023 and 2024 expeditions was use of entirely self-sufficient satellite camps on the plateau, allowing teams to be based closer to cave entrances, and thus avoid long daily commutes. A good satellite camp site was found near to Sink 2, and not far beyond Tragadero de la Soledad, with at least 15 flat tent pitches (maybe more), and is much flatter than Calamina Camp. A good satellite camp location ('Scottish Loch Camp') was also located next to a small lake, by Lorenzo's sinks.

Evening meals: The various groups of cavers transported almost 450 dehydrated meals (weighing ~100 kg) onto the plateau, and benefitted greatly from sponsorship by Adventure Nutrition. These meals were chosen to have high protein levels. Each dehydrated meal has 800 to 1,000 kCal of energy. However tastes varied, and it could be difficult to eat more than one of the dehydrated meals. In 2024, we thus also took a significant amount of dehydrated cheesy smash (potato) that proved popular and even easier to eat, as well as ramen noodle packets. The expedition functioned very happily (if a bit windily) on probably about 2,500-3,000 kCal/day. About 110 of the dehydrated meals are stored at Luya for 2025-26.

Breakfasts: 80kg of (artesenal) granola was procured by Tonio in Cajamarca and carried onto the plateau, together with chocolate Milo powder. A 200kg serving of granola would approach 1,000 kCals. But again tastes varied, and some people found the granola hard to eat. So in 2024, we also brought a significant amount of porridge, which together with cheesy smash and noodles provided more varied options for breakfasts.

Lunches: We bought lunch materials in Chachapoyas, including tortillas, peanut butter, dried meat, jam and honey, and mayonnaise. The resulting wraps were very tasty, but we only budgeted for 3 tortillas per person per day, and we might think about more wraps. We also had various 'trail food' including one granola bar per person per day. Individuals augmented their ration with things like condensed milk sachets, chocolate etc. A variety of lunch material is also good for different tastes.

Water: Water was typically filtered before use, or boiled. But we tended not to use chlorine tablets.

Health: There were no issues with people getting seriously ill, as occurred to two people in 2022.

Fuel: In 2024 a significant issue was that many MSR stoves eventually struggled with getting clogged after using unleaded fuel obtained from a petrol station. With help from Rob Dover in Chachapoyas, Group 2 were able to buy white fuel (called 'benzina') that was better for the stoves.

Solar charging: Paul McCarron successfully developed a large solar charging system that was often used to charge Makita drill batteries (an adaption would be needed to charge Bosch batteries, but is feasible).

Generator issues and full maintenance kit: This was a major asset in particular when we had issues with the generator when it was also affected by impurities in the fuel. In future expedition that use a generator, a full set of maintenance gear is essential, especially the spanner for the spark plugs, which had to be improvised with a hammer in 2024.

Caving Equipment: We carried 1,600m of rope onto the plateau, which included 1200m of excellent new Beal 8.5 mm rope, and 400m of rope from the ECA-GSBM tackle store located at Luya. About 900m of this rope was stored in the entrance of Tragadero de la Soledad for forthcoming expeditions, together with some (stainless steel) rigging gear. We eventually just used 8mm through-bolts for rigging, with both 65 and 80mm lengths. The presence of mudstone intervals means that those longer lengths are probably justified, although much of the rock is very good. Some of these Raumer throughbolts failed to engage and 'spun', and this is something to talk to suppliers about.

Capacity building: Martin Holroyd kindly brought a stretcher to donate to Peruvian cavers. We hope this area, and future expeditions in this area, will provide further inspiration and capacity building.



Figure 88. MH demonstrating the stretcher brought from UK and donated to Peruvian Cavers.



Figure 89. Some of the gear that was purchased and taken out to Peru.

Expedition Budget: Income and Expenditure

INCOME	
Ghar Parau Foundation sponsorship	£1,500
Mount Everest Foundation sponsorship	£5,500
Speleological Union of Ireland sponsorship	£3,360
UIS - International Union of Speleology sponsorship	£504
	Total = £10,864
EXPENDITURE	
Hire of Horses and Guides to Transport Equipment onto Plateau	£3,072
<i>Equipment</i>	
1500m of ropes (8.5 mm)	£1,832
Rigging equipment (bolts, hangers, maillons etc)	£2,660
Extra bags on flights to carry equipment and food to Peru	£1,323
<i>Food</i>	
Dehydrated meals (350)	£3,351
Food bought in Chachapoyas	£1,584
<i>Communications and Power</i>	
Communications (Garmin InReach Satellite Phones)	£505
Starlink communication device	£187
Solar power system to charge batteries	£124
<i>Travel and Accommodation</i>	
Buses to/from Granada/Chachapoyas and Lima/Chiclayo/Cajamarca	£1,206
International Flights (£850 x 20 international cavers)	£17,000
Accommodation in Chachapoyas (£18 x 21 cavers x 2 nights)	£756
<i>Miscellaneous</i>	
Peruvian cavers support	£527
	Total = £34,127

Note: Budget Summary is for Group 1 (8 cavers) and Group 2 (15 cavers) only.

<i>Original Estimates (based on 21 persons; 20 international and 1 Peruvian caver)</i>	
International flights (UK/EU to Lima) – 20 cavers	73.35 tCO ₂ e

Internal flights (Lima to Chiclayo or Cajamarca) – 20 cavers	7.9 tCO ₂ e
Local buses (Chiclayo or Cajamarca to Chachapoyas and then to Granada) – 21 cavers	0.116 tCO ₂ e
<i>Carbon Footprint of Expedition (21 persons; 20 international and 1 Peruvian caver)</i>	
International flights (UK/EU to Lima) – 20 cavers	73.35 tCO ₂ e
Internal flights (Lima to Chiclayo or Cajamarca) – 20 cavers	7.9 tCO ₂ e
Local buses (Chiclayo or Cajamarca to Chachapoyas and then to Granada) – 21 cavers	0.116 tCO ₂ e

There were indeed 20 international cavers (Groups 1 and 2) and 1 Peruvian caver in the team. Carbon offsetting or carbon reduction measures included travelling via local bus from Chiclayo and Cajamarca to/from Chachapoyas, and a variety of UK-based carbon-offsetting schemes were used by individual expedition members

References

- Baby P. (2023). Le potentiel du Cerro Blanco. Bulletin ECA-GSBM, Nord Pérou 2022: 11-13.
https://www.gsbm.fr/publications/gsbm/2023_NordPerou-2022/NordPerou2022-11-13.pdf
- Baby P. (2020). Géologie des massifs karstiques du Nord-Pérou. Bulletin ECA-GSBM-GSD-GSVulcain, Nord Pérou 2019: 8-11.
https://www.gsbm.fr/publications/gsbm/2020_NordPerou-2019/NordPerou2019_008_Baby.pdf
- Klein, J-D., Guyot J.L., Robert X., Apaestegui J., and Bigot J.Y. (2019). Pérou. Spelunca, 158:1-9.
https://www.gsbm.fr/publications/perou/2019_Spelunca_153_Bigot.pdf
- Bigot, J.-Y. Approche géomorphologique du massif de Cerro Blanco. Rapport NOR PERÚ 2018 : Expédition spéléologique franco-péruvienne du 10 août au 12 septembre 2018, 71-76 (2019).
<https://www.gsbm.fr/expeditions-speleo-perou/expedition-nord-perou-2018/>
- Bigot J.-Y. (2019). Reconnaissance aux lacs de Granada. Bulletin ECA-GSBM-GSD-GSVulcain-UNAM, Nord Pérou 2018: 51-60.
http://www.gsbm.fr/publications/gsbm/2019_NordPerou-2018/NordPerou2018_051_Bigot.pdf
- Grandjouan, O. et al., 2017. Las resurgencias del Alto Mayo (San Martin, Perú): Estudio hidrológico sobre un karst tropical andino-amazónico: Sociedad Geológica del Perú, Volumen Jubilar N° 8: 83-96. <https://repositorio.igp.gob.pe/handle/20.500.12816/2177>
- Guyot, 2019. Histoire de la Spéléologie au Pérou. In 2019 Nord Perú Expedition Rapport d'expédition. https://www.gsbm.fr/publications/gsbm/2020_NordPerou2019/NordPerou2019.pdf
- NORD PERÚ 2018 Expédition spéléologique franco-péruvienne. Rapport d'expédition
<https://www.gsbm.fr/expeditions-speleo-perou/expedition-nord-perou-2018/>
- NORD PERÚ 2019 Expédition spéléologique franco-péruvienne. c.
https://www.gsbm.fr/publications/gsbm/2020_NordPerou2019/NordPerou2019.pdf
- NORD PERÚ 2022 Expédition spéléologique franco-péruvienne. Rapport d'expédition

<https://www.gsbm.fr/expeditions-speleo-perou/expedition-nord-perou-2022/>

NORD PERÚ 2023 Expédition spéléologique franco-péruvienne. Rapport d'expédition

<https://www.gsbm.fr/expeditions-speleo-perou/expedition-nord-perou-2023/>

Staccioli, G. (2023). Pico del Oro. Bulletin ECA-GSBM, Nord Pérou 2022: 32-36.

https://www.gsbm.fr/publications/gsbm/2023_NordPerou-2022/NordPerou2022-32-36.pdf

Talling, P. (2023). Big Sink / Tragadero Grande. ECA-GSBM Bulletin, Northern Perú 2022: 37-38.

https://www.gsbm.fr/publications/gsbm/2023_NordPerou-2022/NordPerou2022-37-38.pdf



Figure 90. TS experiencing the joy of being back in CXhachapoyas and not eating dehydrated meals.

GPS Coordinates of Caves Notes by 2024 Expedition

Cave	Latitude	Longitude	Altitude	Length (2024)	Total length	Depth	Dates	Observations
Group 1								
Tragadero del Ojo derecho / grande de Lorenzo	-6.02320	-77.47740	3260	270	433	-265	15-23/08/24	
Tragadero del Ojo izquierdo / pequeño de Lorenzo	-6.02510	-77.47670	3290	480	645	-275	15-27/08/24	lowermost part not surveyed due to flood risk - 30-50m deeper?
Cueva Cortada	-6.02591	-77.47051	3195	0			17/08/24	Non surveyed
Tragadero del Bloque	-6.02636	-77.46995	3188	0		-25	17/08/24	Non surveyed
Tragadero P3	-6.03396	-77.46636	3202				17/08/24	Closed
Cueva 1 cerca del campamiento	-6.02630	-77.47646	3296			-25	17/08/24	Not explored
Cueva 2 cerca del campamiento	-6.02630	-77.47646	3296			-20	17/08/24	Not explored
Tragadero P4 Hoyo Grande	-6.03844	-77.46747	3201				21-23/08/2024	Not explored
Méga doline P7	-6.03967	-77.46470	3119				23/08/24	Closed
Tragadero 1	-6.02950	-77.48822	3340				17/08/24	Impenetrable
Tragadero 2	-6.03485	-77.48406	3280				18/08/24	Closed
Tragadero 4	-6.03103	-77.48110	3340				18/08/24	Closed
Tragadero 5	-6.03070	-77.48083	3340				18/08/24	Not explored
Pozo de las Orquideas	-6.03183	-77.48355	3340	111	111	-102	26-27/08/24	Closed
Group 2								
Tragadero de la Soledad	-6.06480	-77.51530	3410	1,842	4,187	-323	30/08-10/09/24	Still ongoing
Tragadero del Paso (Col / 16-1)	-6.05870	-77.52110	3540	73	73	-46	30-31/08/2024	Still ongoing
Cueva del Colibri (16-4)	-6.05798	-77.51836	3510	0	20	-10	28/08/24	Closed
Cueva del Musgo	-6.07039	-77.51538	3530	104	104	-75	30/08-07/09/24	Still ongoing
Cueva de los Suenos de los Ancianos (Sink 2)	-6.06870	-77.51280	3410	195	390	-36	30/08-07/09/24	Still ongoing
Torridon View Cave	-6.07039	-77.51538	3522	137	137	-72	30/08-07/09/24	Still ongoing (needs hammer)
Tragadero de las Avispones (Sink 5)	-6.07690	-77.50760	3480	50	50	-28	27/08/24	Closed
Sink 6	-6.08458	-77.50250	3470	15	15	-12	28/08/24	Closed
Sink 7	-6.09083	-77.49995	3420	80	80	-28	28/08/24	Closed (very small leads)
Sink 8	-6.09154	-77.49912	3430	50	50	-32	28/08/24	Closed
Sink 9	-6.09168	-77.49887	3410					Not explored
Sink 10	-6.09175	-77.49831	3405				28/08/24	Impenetrable
Sink 11	-6.09298	-77.49771	3400					Not explored
Sink 12	-6.09401	-77.49674	3360				28/08/24	Impenetrable

Sink 13	-6.09413	-77.49656	3360					Not explored
Sink 14	-6.09927	-77.49167	3381					Not explored
Sink 15	-6.09975	-77.49198	3382				28/08/24	Not explored
Sink 16	-6.06856	-77.49123	3423					Not explored
Cueva de la Grieta	-6.09429	-77.49654	3400	30	30	-11	28/08/24	Still ongoing
Resurgencia del Este	-6.10695	-77.48958	3320				28/08/24	Impenetrable
Cueva de las Golondrinitas	-6.04958	-77.51075	3415	220	220	-140	03-07/09/24	Still ongoing
PT1	-6.05653	-77.50976	3474				04/09/24	Closed
PT2	-6.05494	-77.51029	3464				04/09/24	Not explored
PT3	-6.05311	-77.50959	3446				04/09/24	Closed
PT4	-6.05248	-77.50952	3444				04/09/24	Not explored
PT5	-6.05046	-77.50938	3415				04/09/24	Closed
PT6	-6.04932	-77.50943	3415				04/09/24	Not explored
PT8	-6.05418	-77.51159	3464				04/09/24	Not explored
PT9 (Sink 26)	-6.05485	-77.51306					04/09/24	Not explored
PT10	-6.05864	-77.51351	3463				04/09/24	Closed
PT11	-6.04814	-77.50942	3422				04/09/24	Not explored
PT13	-6.04757	-77.51172	3444				04/09/24	Closed
PT14	-6.04743	-77.51199	3450				04/09/24	Closed
CJ Large Doline	-6.05864	-77.51351					05/09/24	Not explored
CJ Doline 2	-6.05665	-77.51252					05/09/24	Not explored
Pozo de las Ortigas / Nettle Pot	-6.05511	-77.51175		0		-20	05/09/24	Ongoing – not surveyed
Hole 89 (JYB89)	-6.05608	-77.50837						Not explored
FR1	-6.05608	-77.51787					09/09/24	Closed
FR2	-6.05614	-77.51744					09/09/24	Closed
FR4	-6.05625	-77.51673				-4	09/09/24	Closed
FR5	-6.05613	-77.51652					09/09/24	Closed
FR11	-6.05636	-77.51741					09/09/24	Closed
FR6	-6.05626	-77.51643					09/09/24	Not explored
FR7	-6.05629	-77.51643					09/09/24	Not explored
FR8	-6.05613	-77.51685					09/09/24	Not explored
FR10	-6.05625	-77.51724					09/09/24	Not explored
Tragadero 6 de la Planura del Pico de Oro	-6.04500	-77.49740	3296					Impenetrable
Group 3								
Pozo del Arco	-6.05663	-77.51738	3296	0	20	-10	09/09/24	Not surveyed
Tragadero de Abra del Arco	-6.05599	-77.51720	3510	0	250	-200	09-12/09/24	Not surveyed



Figure 91. View towards Tragadero de la Planura del Pico del Oro from above Calamina Camp.

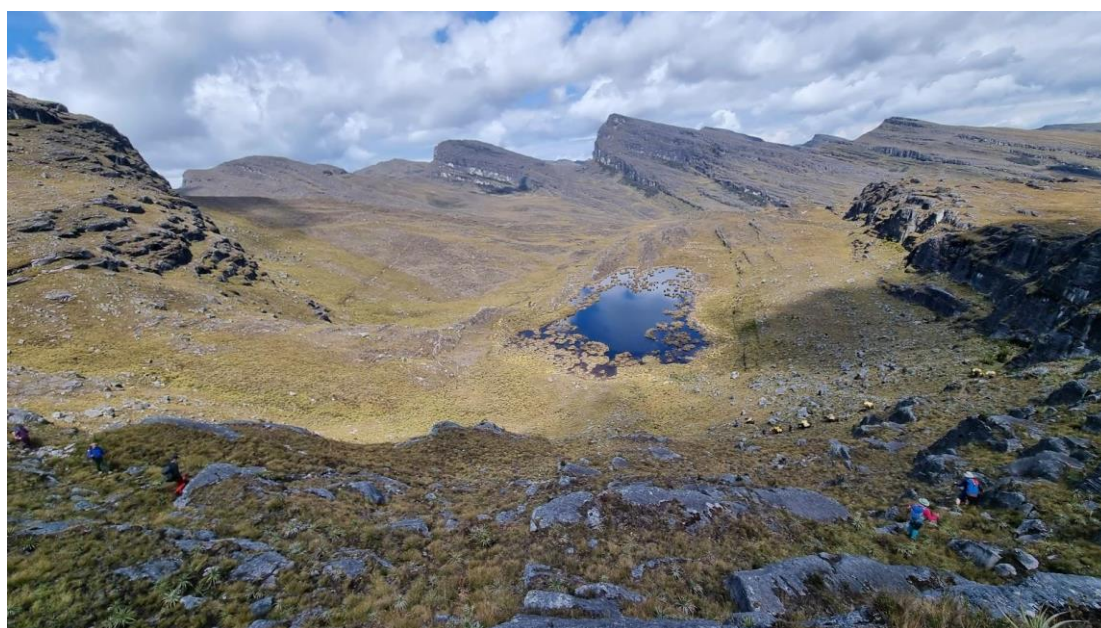


Figure 92. Horses and cavers crossing the col on the way from Granada to the camps on the plateau.

And The Future.....?

This 2024 expedition has shown again that the Pico de Oro plateau has world class cave systems. The next step is to intercept the main streamway in Tragadero de la Soledad, beyond Darkest Peru, perhaps using Tragadero de las Golondritas or Arba del Arco as a backdoor. They are heading towards the big river sink at the Tragadero de la Planura del Pico del Oro, which when combined with the existing water in the Soledad streamway, would be extremely impressive (Fig. 94). Then there is potential for cave systems that have a vertical relief of up to 2,800m, if they drain from the plateau to the huge Rio Negro resurgence at the base of the plateau (Fig. 95). Uncertain projects are always the most interesting and exciting, and who knows what future expeditions to this area may discover.....

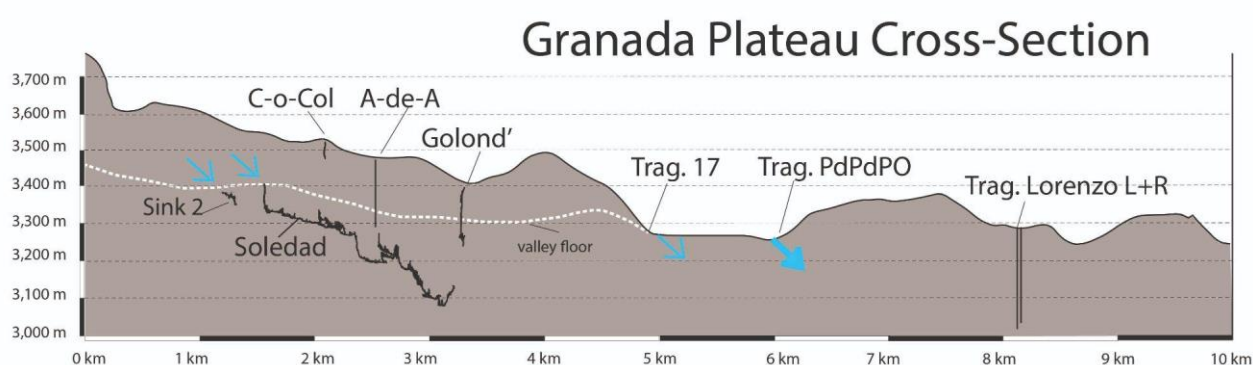


Figure 93. Cross section of the topography of the Pico de Oro Plateau showing the extended elevations of selected caves, and major river sinks.

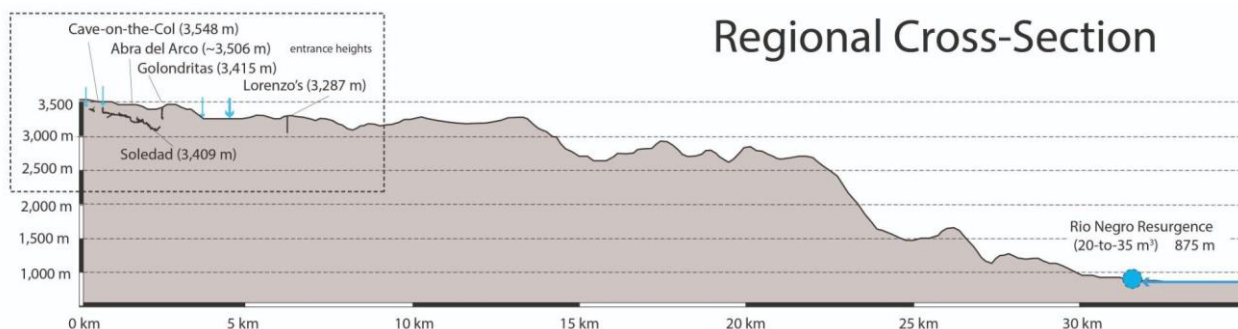


Figure 94. Cross section of the topography from the Pico de Oro Plateau to the Rio Negro Resurgence, showing the extended elevations of selected caves, and major river sinks. The area shown in Figure 93 is indicated by the dotted box.