

# The Pico del Oro Plateau Caving Expedition in 2024

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10<sup>th</sup> August – 13<sup>th</sup> 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 m<sup>3</sup>/s median up to 35 m<sup>3</sup>/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.cuevaselperu.org](http://www.cuevaselperu.org); Nord Perú 2018, 2019, 2022, 2023).

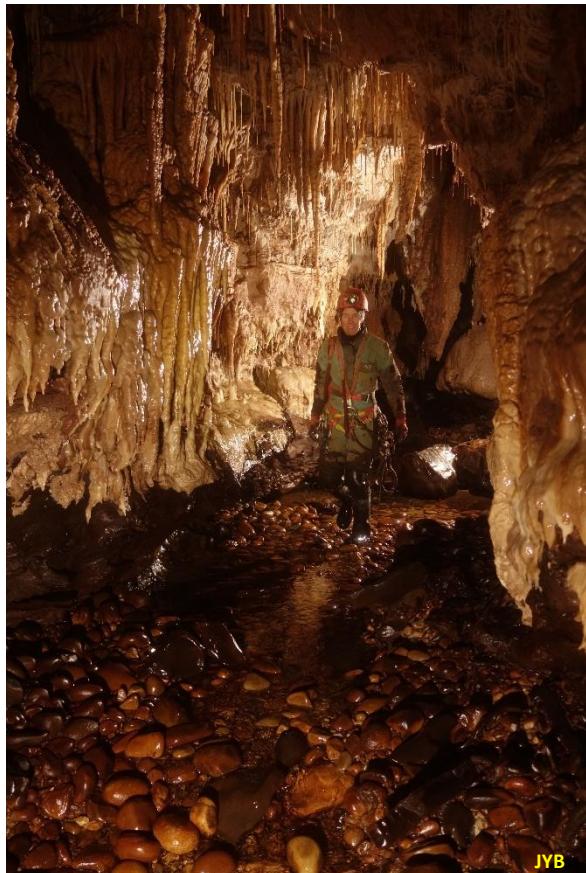
The 2024 expedition involved 27 cavers from 7 countries, who were organised into 3 groups. The first group of 8 cavers returned to the vertical pits of Lorenzo's Left and Right Eyes, using a new camp located close to their entrances. Exploration and rigging of both vertical caves proceeded well until 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.

## 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

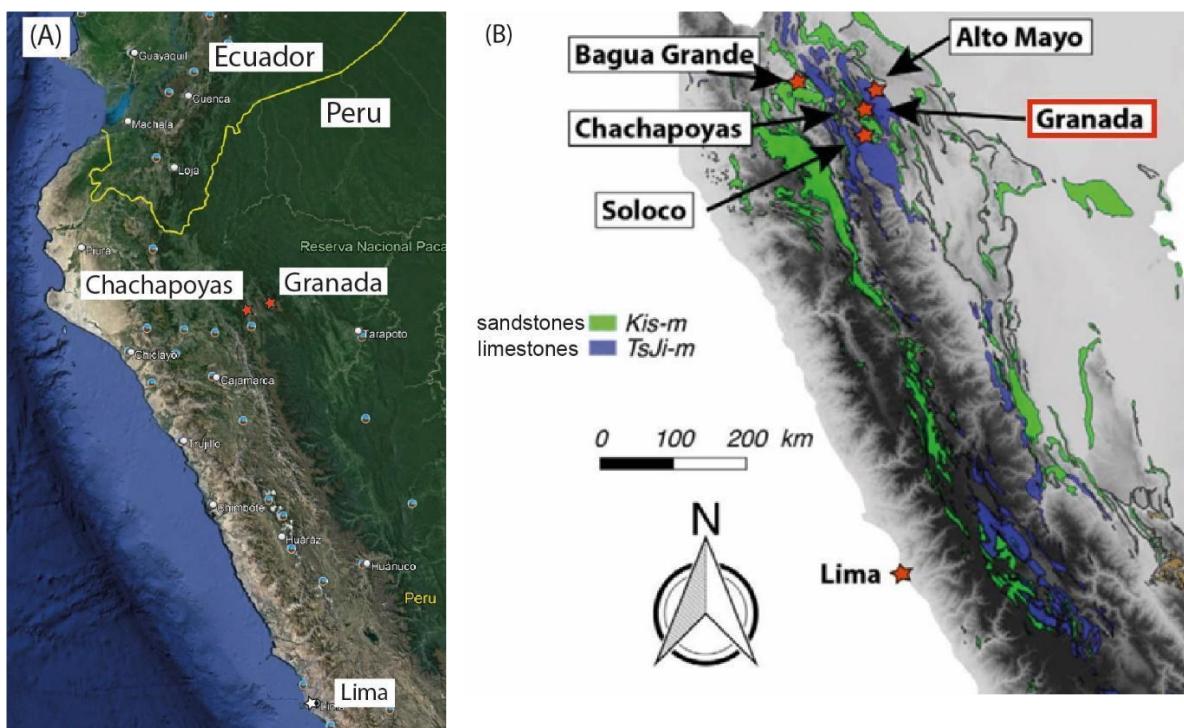
provided food and the horses that carried much of the equipment onto the high plateau.

### Background to the Pico del Oro (Granada) Plateau

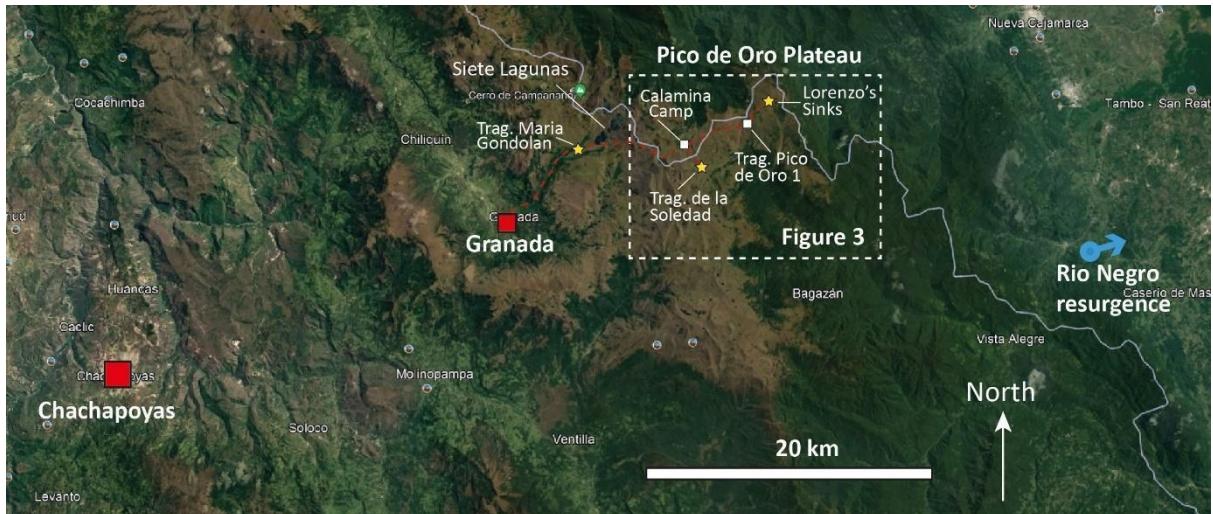
The expedition area was located in Northern Perú (Figs. 1 to 3). The area comprises a high (~3,300 to 3,700 m) plateau that is located to the east of the town of Granada, and bounded on its eastern side by a steep escarpment with over 2,500m of relief above the Moyobamba Plain (Fig. 4). The correct name 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 Jaén (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 María 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).



**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.

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.cuevasdel Perú.org](http://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

~24 m<sup>3</sup>/s, with much higher flow (up to 35 m<sup>3</sup>/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 ~23 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 ~12-15 km, so this distance is also world class.

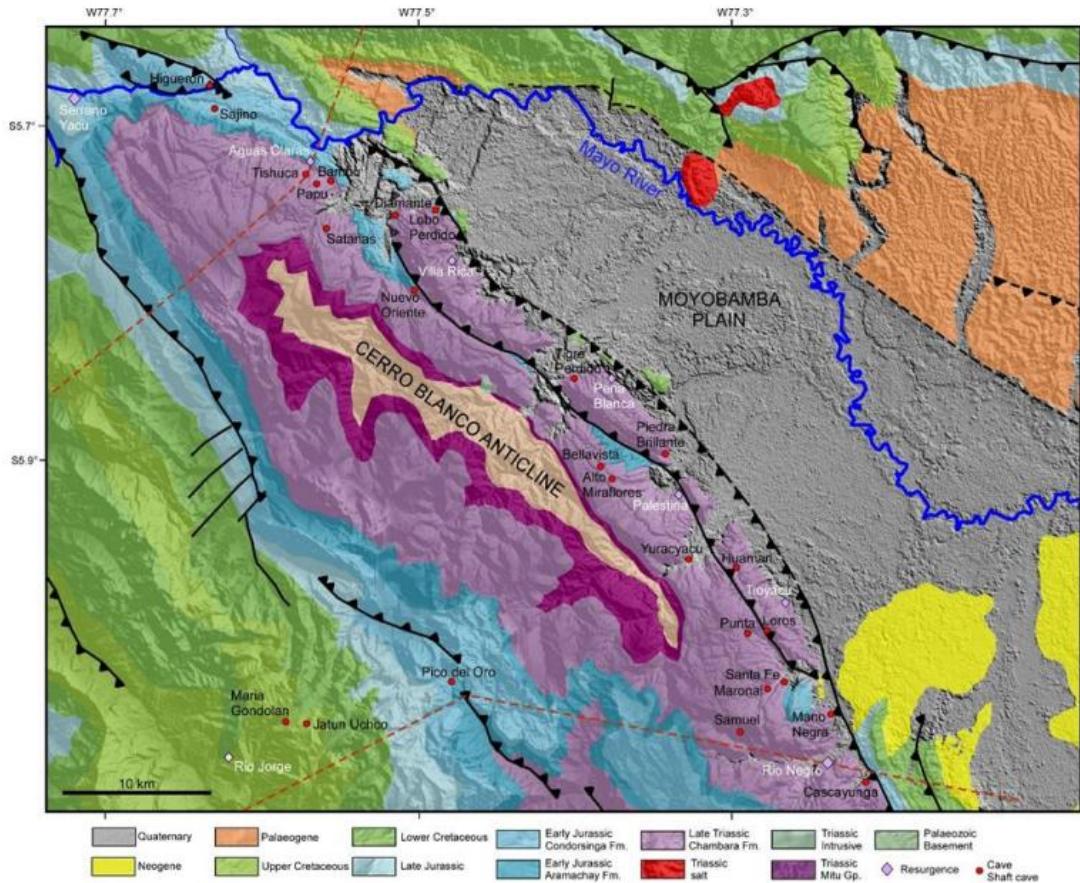


An excellent and detailed summary of the geology and hydrology of the Pico del Oro Plateau is provided by Baby (2023), setting out this world-class potential for deep caves (Figs 4 and 5; also see Baby et al., 2020; and Bigot et al., 2018). A brief summary of these previous publications follows (Figs 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<sub>i-o</sub> and J<sub>s-s</sub> 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<sub>i-a</sub> and J<sub>i-c</sub> in Fig. 6). These limestone rich units are underlain by Triassic units (T<sub>s-ch</sub>) which are described contradictorily as either as limestone-rich

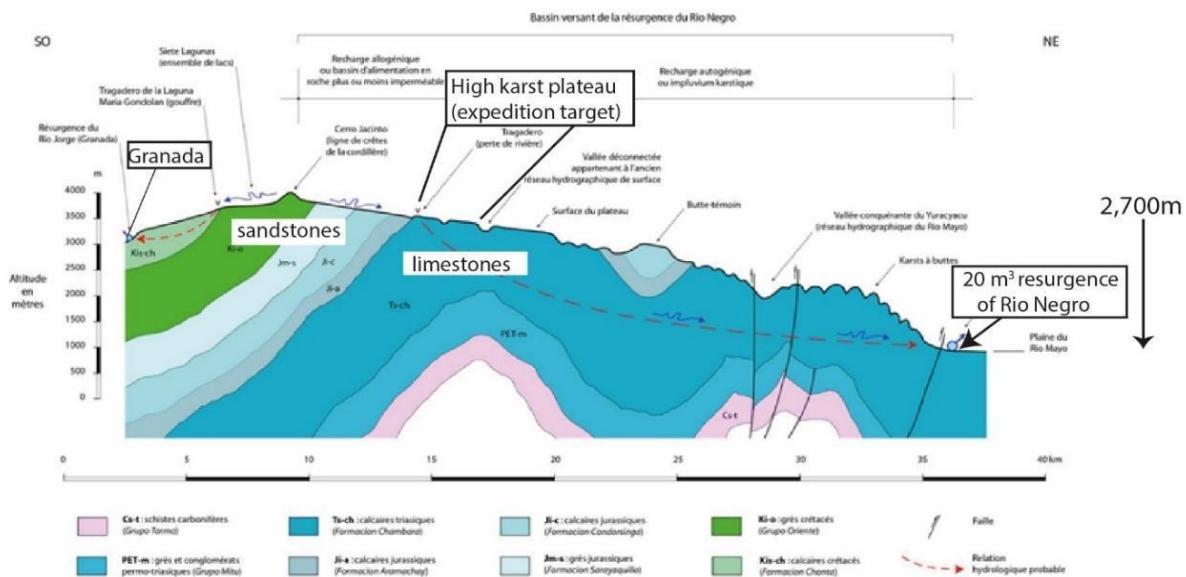
(1:50,000 geology maps) or sandstone and mudstone rich (1:100,000 geology maps). But structural cross sections extending from river sinks on the Pico del Oro Plateau and to Rio Negro may suggest they are connected (Fig. 5).

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.

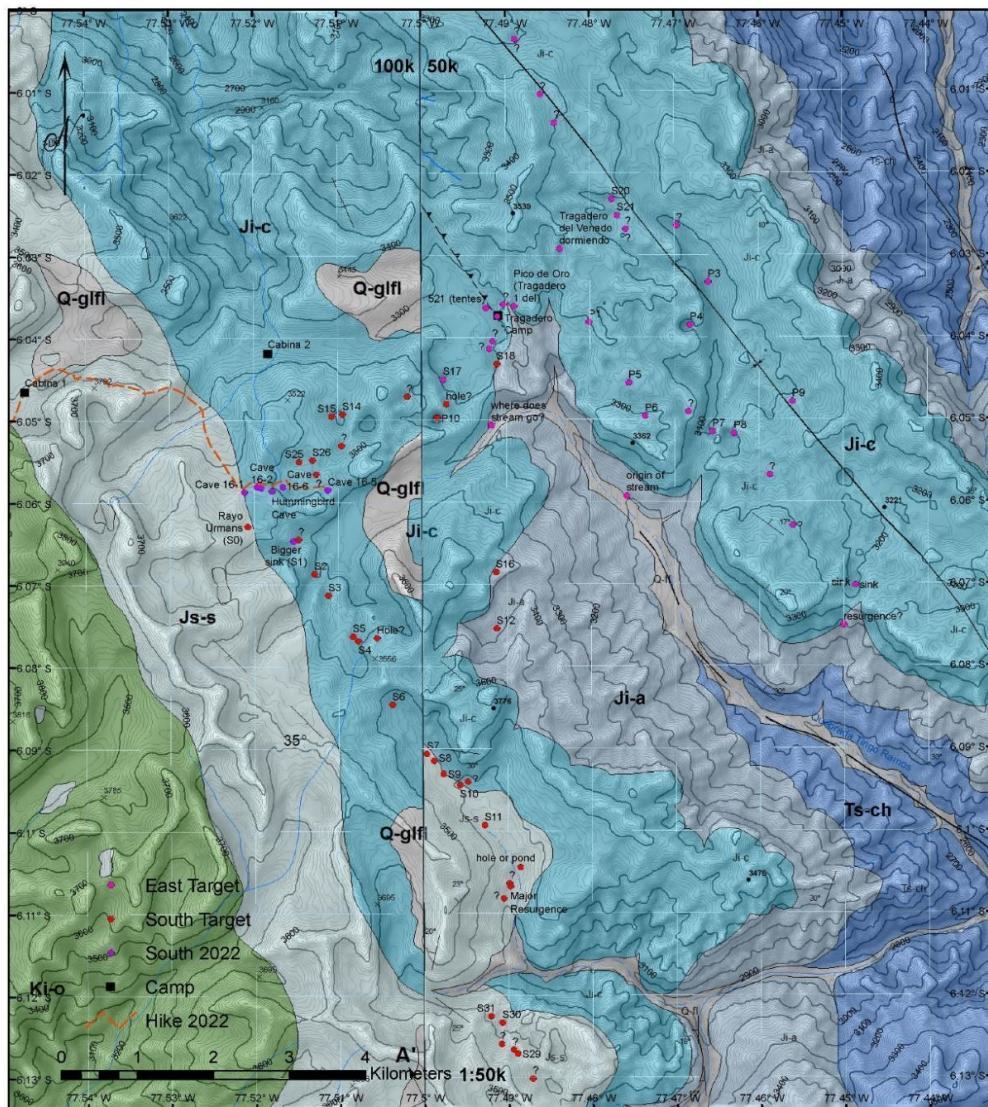
The elevation above sea-level of the end of the streamway (~3,095 m) in Tragadero de la Soledad system is also much higher than any known sump on the plateau, and this water must also drain to a lower resurgence. It is also not clear where the water originates in that largest of the two streamways (Pisco 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<sub>s-ch</sub>) 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 Nego (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).**



100k	Formación Sarayaquillo	Js-s	Areniscas rojizas moradas de grano fino a grueso, microconglomerática, presenta intercalaciones de limolitas y arcillas.
	Formación Condorsinga	Ji-c	Calizas con delgados niveles de areniscas, con algunas intercalaciones de cineritas, margas y con ocasional contenido de chert.
	Formación Aramachay	Ji-a	Calizas arenosas negras, bituminosas con olor fétido, capas delgadas, intercaladas con areniscas calcáreas parduzcas.
	Formación Chambará	Ts-ch	Areniscas grises con contenido de materia orgánica, intercalada con limoarcillas marrones a pardas y arcillosas.
50k	Grupo Mitu	PET-m	Andesitas porfíricas de naturaleza plagiocífrica
	Formación Condorsinga		Calizas masivas de color gris blanquesina en estratos de 20 a 60 cm.
	Formación Aramachay		Caliza gris amarillentas, intercaladas con limoarcillas de color marrón oscuro con ammonites.
Pucará	Formación Chambará		Calizas estratificadas masivas en estratos de 1 a 3 m. de coloración gris oscura.
	Ji-c		100k map: Reddish purple fine to coarse grained sandstones, microconglomeratic, presents intercalations of siltstones, clay.
	Ji-a		50k map: Fine-grained to medium reddish-brown sandstones and are cross-bedded with levels of red shales, green shales and red siltstones.
Pucará	Ts-ch		100k map: Limestone with thin levels of sandstone, with some intercalations of cineritas, marls and with occasional content of chert.
	Ji-c		50k map: Massive whitish gray limestone in 20 to 60 cm strata.
	Ji-a		100k map: Black sandy limestone, bituminous with fetid smell, thin layers, interspersed with calcareous sandstones brownish.
Pucará	Ts-ch		50k map: Yellowish gray limestone, interspersed with brownish siltstones dark with ammonites.
			100k map: 100k map: Gray sandstones with organic matter content, interspersed with brown to brown siltstones and clayey.
			50k map: Massive stratified limestone in layers of 1 to 3 m. of gray coloring dark.

**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.

## Tragadero de la Soledad

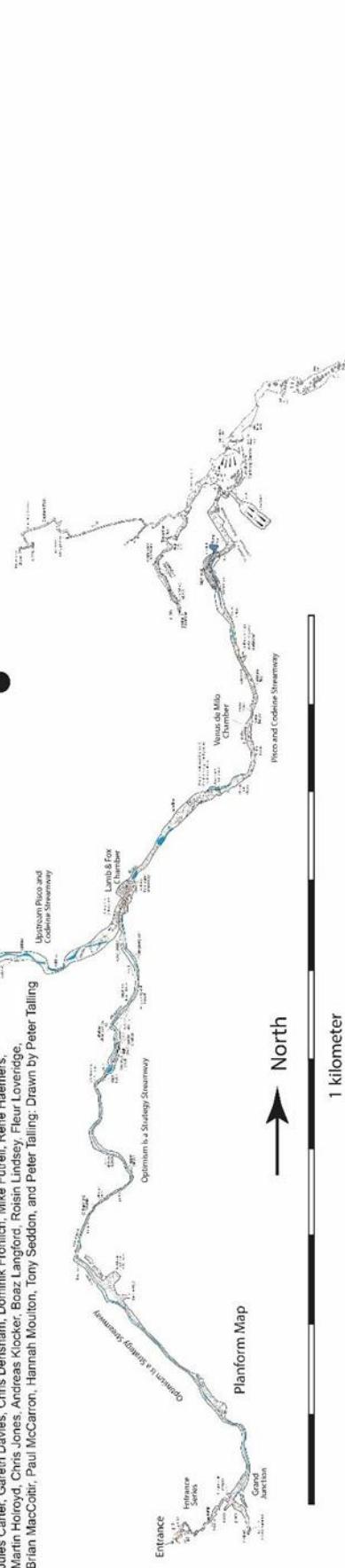
Vista Alegre, Rodríguez de Mendoza, Amazonas, Perú.

-6.606477° South, -77.51528° West  
Entrance altitude: 3,409 m  
Length: 4,187 m  
Depth: 323 m

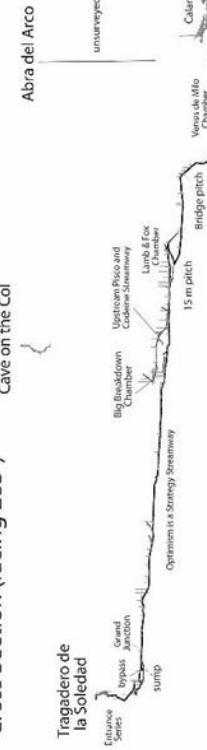
Surveyed in 2023 and 2024 by Petit Barry, Jean-Yves Bigot, Aileen Brown, Antonio De Pomar Cáceres,

Jules Carter, Gareth Davies, Chris Densham, Domink Frolík, Mike Fultell, René Haines, Martin Holroyd, Chris Jones, Andreas Klockner, Boaz Langford, Róisín Lindsey, Fleur Loveridge, Brian MacCottril, Paul McCarron, Hannah Moulton, Tony Seddon, and Peter Talling  
Drawn by Peter Talling

Abra del Arco

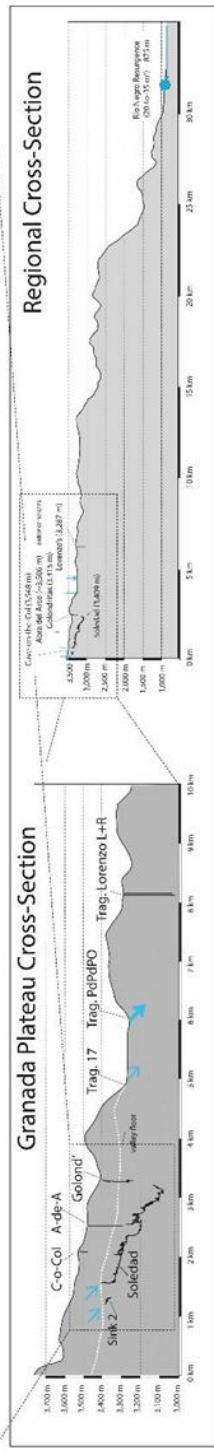
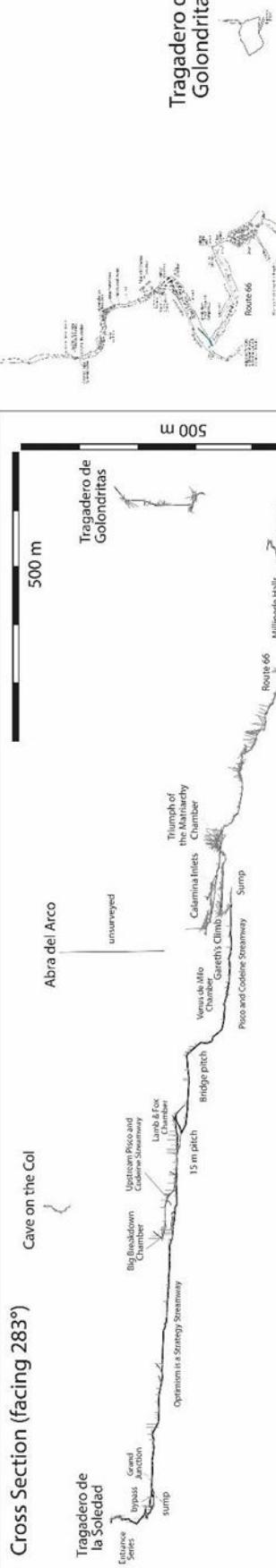


Cross Section (facing 283°) Cave on the Col



Cross Section (facing 283°)

Cave on the Col



Plano y perfil del Tragadero de la Soledad (Big Sink)

## 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 Golondinitas 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. 93). 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. 94). Uncertain projects are always the most interesting and exciting, and who knows what future expeditions to this area may discover.....

## Granada Plateau Cross-Section

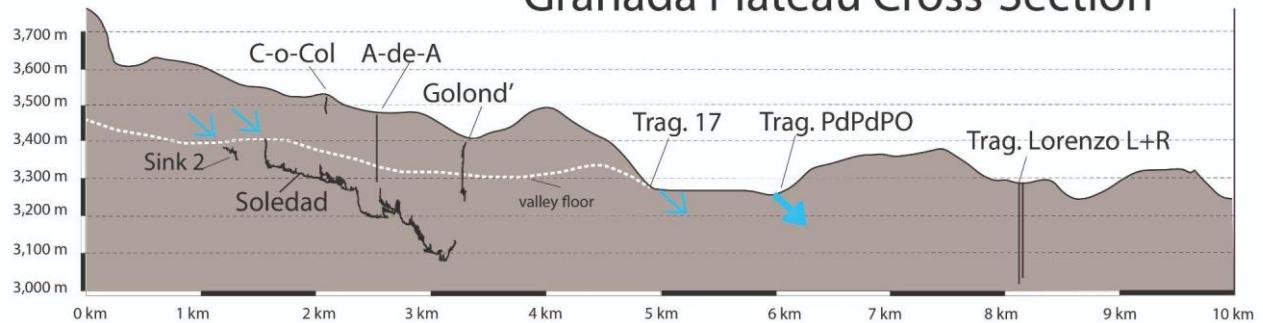


Figure 93. Cross section of the topography of the Pico de Oro Plateau showing the extended elevations of selected caves, and major river sinks.

## Regional Cross-Section

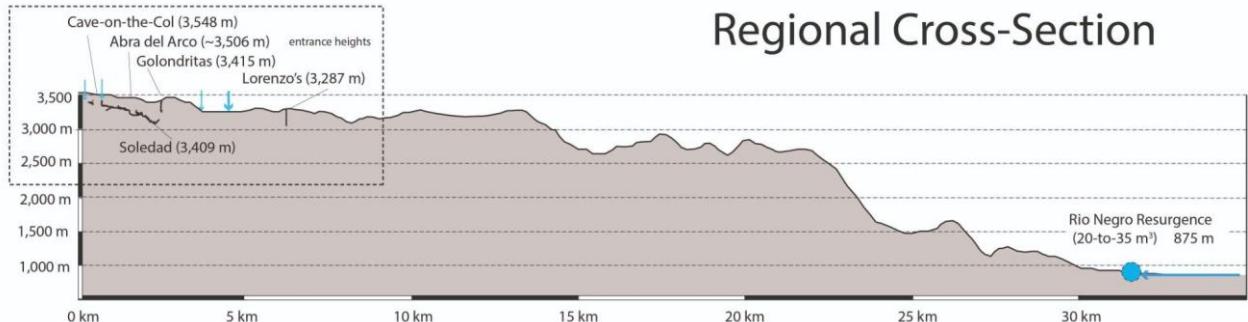


Figure 94. Cross section of the topography from the Pico de Oro Plateau to the Rio Negro Resurgence, showing the extended elevations of selected caves, and major river sinks. The area shown in Figure 93 is indicated by the dotted box.

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