

HOLIDAY GEOLOGY

Copper Canyon, Mexico

Cut deep into the Sierra Madre Occidental in northwestern Mexico, the Copper Canyon is one of a handful around the world that each claim to be deeper or larger than the Grand Canyon of Arizona. Which of the contenders is the winner depends on which parameter or dimension is chosen. But it matters not, and the Barrancas del Cobre, to use its real name, is certainly a very spectacular, and very deep, canyon.

Copper Canyon is just the deepest and best-known of a dendritic system whereby six major canyons drain the pine-forested, dissected plateau of the Sierra Tarahumara, which stands around 2500 metres higher than the outlet into the Pacific Ocean near Los Mochis. The visual impact of the canyons is enhanced by their rims that are formed in a strong, sub-horizontal, pale-coloured rock. But unlike the limestone rim of the Grand Canyon, this is an ignimbrite. And therein lies the most remarkable feature of the canyon's geology. The ignimbrite is part of a volcanic series more than 1000 metres thick covering an area that is 1200 km long and 300 km wide, and constituting the world's largest silicic volcanic province.

This enormous mass of ignimbrite overlies another giant group of volcanic rocks dominated by andesitic lavas and pyroclastics. Both groups are of Palaeogene age. The older group represents island arcs developed over a major subduction zone, but that phase of plate convergence was followed by an extensional regime that allowed the younger group of silicic volcanics to emerge through massive fissure systems. Activity lasted for about 10 Ma, and the sheer volume of erupted rock suggests that there were more than 200 caldera vents. These eruptions were from what are referred to as graben calderas based on the normal faults, as distinct from the circular calderas usually associated with ignimbrites. To date, only 15 of these centres have yet been recognised in a mountain range that is not well mapped due to its difficulties of access.

The grand view of Copper Canyon from the lookout next to the Divisadero train station.



Bedded ignimbrites along the road to Batopilas.

The volcanic province is also the world's largest source of silver minerals, deposited at low temperature in epithermal veins within the lower volcanics at the time the upper volcanics were being erupted. These were worked in numerous mines, most of which were along and close above the canyon floors, where the mineralized lower volcanics were exposed. But that generation of rich mining in the Copper Canyon was all over by the early 1900s. Currently, three of the world's



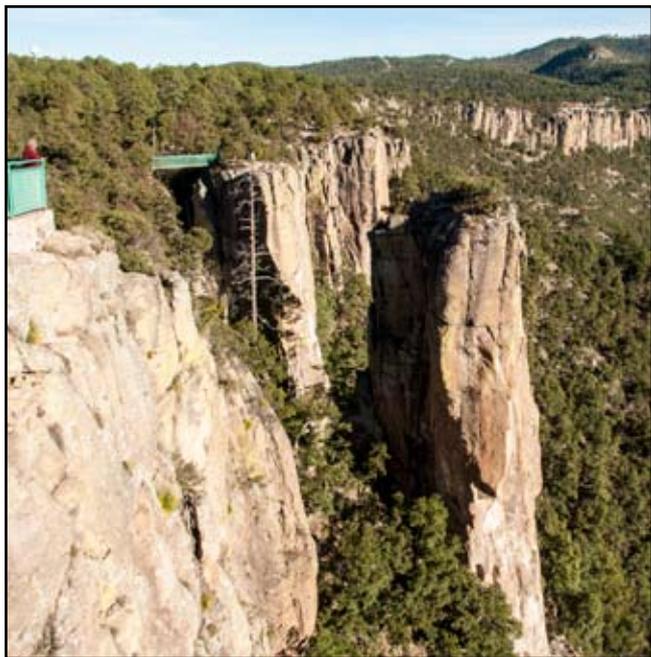
Outline map of the volcanic province around Copper Canyon within the mountains of the Sierra Madre Occidental.

ten largest silver mines lie southeast of Durango, still within the same volcanic province. And a new generation of mines is following renewed exploration in the Canyon area, with production of silver, gold and copper already in progress. The name of the Copper Canyon derived from the first Spanish into the area who thought they had found outcrops of green copper mineral; but these turned out to be lichen. The silver riches followed on.

Most visitors reach Copper Canyon via the Chihuahua Pacific Railway, which was built as a freight outlet but still carries one passenger train each day. This spectacular line is 650 km long, climbs from the coast to an altitude of 2400 metres and then descends 1000 metres into the Chihuahua desert. Its ascent through and up out of the lower canyon is visually splendid, and the



Mushroom rocks formed in ignimbrites of varying strengths in the Valle de los Hongos, near Creel.



The rim of the Copper Canyon at Divisadero, with its vertical wall formed in a strong ignimbrite. The red-roofed buildings in the distance are beside the railway station.

train has a prolonged stop at Divisadero beside the best viewpoint from the canyon rim. But much more can be seen by being based in Creel or Divisadero with a car rented out of Chihuahua. The new road to the canyon floor at Batopilas offers an amazing journey, ending at a night in the delightful Casa Real de Minas, the old miners' lodge.

Since the original mines closed down, the canyon's isolated communities have had to survive on the drugs trade. Snow is common on the canyon rim, but the remote and warm depths are ideal for the cultivation of cannabis. The occasional gun-toting drugs guard is not concerned with passing tourists, and may soon become obsolete when a tourism industry supplants the drugs economy. For now, the Copper Canyon has become more accessible, still offers some spectacular terrain, is perfectly safe, has not yet succumbed to mass tourism, and exposes those world-beating ignimbrites.

Tony Waltham

The grand waterfall at Basaseachi, which drops 245 metres into another canyon, parallel to Copper Canyon, cut into the thick ignimbrite north of Creel.

