Paricutin Volcano - one of the Seven Natural Wonders of the World

Paricutin Field Trip: 2-5 November 2003

- organised in conjunction with the Regional Geomorphology Conference, Mexico City, 27-31 October 2003

On cool morning of 2 November, near the famous subsiding cathedral of Mexico City, two Mexican hosts (Jose Lugo-Hubp and Narcisso Barrera-Bassols) and a group of fifteen distinguished foreign geomorphologists, including a Polish mafia (6 people) and the past IAG President, boarded a luxury coach, waved to the participants of two other field trips and left for one of the highlights of volcanic geomorphology worldwide, the Paricutin volcano. The volcano itself was born only 60 years ago amidst a corn field in west-central Mexico and in a few years grew up to an imposing height of more than 200 m. While doing so, it also transformed the surrounding countryside into a wasteland covered by lava, pumice and ash. Hence, the trip provided us with the opportunity not only to see one of the youngest volcanoes on Earth, but also the geomorphological and biological recovery of the area affected by the eruption.

The Paricutin volcano belongs to the W-E trending Trans-Mexican Volcanic belt, and to the monogenetic volcanic field of Michoacan- Guanajuato specifically. The latter consists mainly of cinder cones, the density of which attains its maximum in the Paricutin area and is 11-19 volcanoes per 100 sq. km.
The birth of the volcano took place on a flat corn field of Mr Dionisio Pulido, on 20 February 1943. It began with a small explosion from a long existing vent and was followed by steam and sulphur exhalations, as well as ash ejection. The growth of the newborn volcano was very rapid. The cone was 6 m high at midnight, 30 m high the next day, and reached 167 m by the end of the week. A year after the activity started, the Paricutin cone towered above the devastated countryside by 325 m and attained its maximum height of 410 m above the pre-eruptive surface in 1952, when the activity eventually ceased.
In the first stage, volcanic activity of the Paricutin involved the ejection of pyroclastic materials, with volumes up to 6,000,000 cubic metres per day. Initially large-size clasts were dominant, but fine ash and lapilli gradually took over during the so-called cinder phase between mid-March to early June 1943. Much volcanic ash deposition took place in the surroundings, covering the ground, burying vegetation and damaging infrastructure.
Lava outflow was relatively minor in the first phase, largely because of a very high rate of cone build-up. However, a few flows were initiated from the base of the cone, accompanied by slumping and landsliding. In October 1943 a parasitic cone of Sapichu rose on the north-eastern flank of the volcano, yielding an almost 2 km long flow to the north-east in November- December 1943. However, the main period of lava flow activity was in the year 1944. The longest of these flows, the 10 km long San Juan flow, travelled initially to the east, then north-east and finally to the north-west, where it reached the town of San Juan Parangaricutiro in May 1944, destroying it completely a month later. It is only the church towers and remnants of the choir that protrude from the 15-20 m thick cover of lava. Another flow, named the Paricutin flow, advanced from the cone to the north, overwhelming the village of Paricutin. Altogether, lava fields spread over an area of almost 25 sq. km and are up to 250 m thick near the cone. In the years 1947-1952 the activity of the Paricutin was less intense and it eventually terminated in late February 1952, nine years after it had commenced.

Summarised after:

- Inbar M., Lugo Hubp J., Villers Ruiz L., 1994. The geomorphological evolution of the Paricutin cone and lava flows, Mexico, 1943-1990. Geomorphology 9: 57-76.
- Paricutin Volcano and Surroundings. Field Trip Guide. With contributions by Jose Lugo, Narcisso Barrera, Alejandro Velazquez, Victor Garduno, Gabriel Legorreta, Gerardo Bocco and Lorenzo Vazquez. International Association of Geomorphologists, Regional Geomorphology Conference, Mexico 2003, 22 pp.

Further information can be found in:

- Foshag W.F., Gonzales Reyna J., 1956. Birth and development of Paricutin volcano, Mexico. USGS Bull. 965-D: 355-489.

• Krauskopf K.B., 1948. Lava movement at Paricutin volcano, Mexico. Bull. Geol. Soc. Amer. 59: 1267-1283. Segerstrom K., 1950. Erosion studies at Paricutin, state of Michoacan, Mexico. USGS Bull. 965-A: 1-164.

Links:
- Volcano World
- Volcán Parícutin - una de las Doce Maravillas del Mundo

The Day 1 was spent mainly on travelling, as Paricutin is about 400 km westwards from Mexico City and there are interesting places to visit on the way. We left heading west, through Toluca and along the Acambay Graben towards the city of Morelia.

Photo 1 Cuitzeo Lake, the second largest in Mexico, seen from the highway from Mexico City to Morelia.

Photo 2 Architectural heritage of Morelia.

En route, we had a chance to see examples of severe soil erosion (gullying and shallow landsliding), various tectonic landforms, the Cuitzeo Lake of tectonic origin with the surrounding wetlands [Photo 1], and of course a plenty of volcanic cones. That because the entire area crossed and visited belongs to the Trans-Mexican Volcanic Zone, where hundreds of Tertiary and Quaternary volcanoes exist. In early afternoon we reached Morelia and after a short visit to the branch of the Institute of Geography of UNAM, where we were joined by two other Mexican colleagues, Gerardo Bocco and Alejandro Velazquez, spent an hour marvelling at cultural heritage of Morelia. It is a typical colonial town, laid down on a rectangular grid, with an imposing cathedral in the main square [Photo 2]. While some of us used every single minute to see more churches and arcaded buildings, others enjoyed local coffee, apparently gaining strength for the later visit to Tsintzuntzan.

Photo 3 On the occasion of the Day of the Dead graves become richly decorated, as this one in the local graveyard in Tsintzuntzan.

Tsintzuntzan is a little town on the eastern shore of the Patzcuaro Lake, famous for its pre-Hispanic ruins of a ceremonial centre of the Taraskan Indians, as well as for elaborate decorations of graves, dressed so on the occasion of the Day of the Dead. We were lucky to see both these places, although negotiations to open the archaeological site lasted a while. A visit to the Tarascan temple gave us also the opportunity to have a look at the lake and surrounding volcanoes, while Narcisso was competently explaining how the Indians had perceived their natural environment and how controversial the issue of dating soil erosion in the area is. On the slope opposite to the site we could see ancient agricultural terraces, abandoned after the conquest, an evident proof that indigenous people did know how to manage the fragile landscape around them. Later we visited the graveyard [Photo 3], the

Franciscan convent, and a local market. One hour drive finally brought us to the town of Uruapan, where we stayed overnight.

The next day (Day 2) was the time of closer encounter with the Paricutin volcano, although the actual climb to its crater was scheduled for the day 3. It also was the day of various surprises.

Photo 4 In order to successfully negotiate local forest roads around the Paricutin, in Nuevo San Juan we had to move from our big luxury coach into a small one.

In the morning we left Uruapan and travelled through avocado orchards and a small 'brickyard district' to the town of Nuevo San Juan, which as the name suggests, is a new settlement built after the old San Juan Parangaricutiro town had been buried by Paricutin lava flows in mid-1944. In the main square we could see a model showing what happened after the eruption. It included the volcano itself, church towers surrounded by blocks of lava, and a column of horse-drawn wagons of the evacuees. And then came the first surprise of the day. We had to leave our luxury coach and board a small bus instead [Photo 4], otherwise we would not have made the country forest roads which led to the Paricutin. We hardly believed the small bus could accommodate us all, not to speak about our oversized luggage. But somehow we squeezed in and went into the mountains, with the destination Panzingo Cabins.

At stop 1, somewhere en route, we looked at a soil section showing a brown palaeosol covered by 60 cm thick layer of ash fall deposit from 1943-44 Paricutin eruption, very typical for the wider surrounding of the volcano [Photo 5]. Looking at new pine plantation on the other side of the road, Alex Velazquez introduced us to problems of land use and ownership, forestry and biological recovery in the aftermath of the eruption. We learned that new trees are planted in the holes dug through the Paricutin ash down to the pre-eruption soil, to ensure for their proper growth.

Photo 5 A palaeosol covered by ash fall deposits.

Photo 6 Very rough lava flow surface and pioneer vegetation along the road from Panzingo to the former town of San Juan Parangaricutiro.

Photo 7 Steep, c. 20 m high front of a lava flow in the northern part of the volcanic field.

After leaving the luggage in Panzingo, we continued in now more comfortable conditions to the northern part of the lava flows where a few further stops were scheduled.

We had a chance to look and touch (some of us in a rather painful way) the incredibly sharp and jagged lava surfaces, sculpted into a maze of small ridges, boulders, crevices, holes, scarcely vegetated and almost impossible to walk across [Photo 6]. At the same time we observed how vegetation re-colonizes lava surfaces, starting with lichens and mosses, followed by ferns and small bushes, and eventually by pines. The road itself was following the steep front of a younger lava flow superimposed onto an older flow [Photo 7] and at its end there was a true highlight of the day: remains of the church, once the central place of the now gone San Juan Parangaricutiro town. It was an unforgettable experience to have lunch on the lava surface, in the shadow of the half-buried church tower. Not very much has been left of the church: the façade, a tower, foundations of another one, and parts of the choir. In the distance we could see the Paricutin itself, located 5 km away as the crow flies [Photos 8-10].

Photo 8 The former church in San Juan Parangaricutiro seen from a distance.

Photo 9 The church tower amidst black lava surfaces, with the cone of the Paricutin in the far distance.

Photo 10 The front side of the church is buried under lava up to about 15 m.

What happened next was another surprise.

The clouds that were building up since the morning accumulated enough water to initiate quite a heavy rainfall, accompanied by isolated lightning. It became dark, wet and generally rather unpleasant, hence we reluctantly skipped the next stop, which was an old cone of Capatzun bypassed by the Paricutin flows. It is an interesting geomorphological phenomenon but it also acts as an oasis of green amidst the wasteland of lava, from which plant dispersal over lava flows has started anew. However, at the time we reached the last stop outside the lava area, it cleared a bit and we could discuss the origin and significance of llanos. 'Llanos' are flat areas inside and around the lava field, with substantial thickness of ash deposits and subsequent sediments. Looking at ash-covered surface we were discussing various techniques used by local people to remove ash layer and reach pre-eruptive soil

Photo 11 An ash-covered llano surface near Panzingo. Note the low ash ridge on the left, which is the product of removal and piling up the ash, in order to reach the former soil and re-plant the forest.

level. Piles of ash within the llano were clear indicators of the amount of work done at the site we visited [Photo 11]. While we walked back to the Panzingo base, a few curiously sculpted oaks and pines attracted our attention. As Alex explained, these strange shapes indicated that those trees were survivors of the eruption blast but their growth was either temporarily suppressed or they lost their top parts. Watching red deer being currently re-introduced into the forests around the Paricutin completed the scientific programme of a most interesting day, but a most delicious, home cooked dinner was still ahead.

The Day 3 began in a rather miserable way. Thick fog enshrouded everything in the surrounding of the Panzingo station and we could only dream about seeing the Paricutin. Perspectives for a wide panorama from the top of the volcano looked grim. However, as we were driving towards the starting point of the climb, the fog began to melt and the eastern front of the lava field with the distant Paricutin showed up in its full glory [Photo 12]. We were following one of the drainage lines around the lava field, with clear evidence of recent runoff (probably from the night before) accomplished in a braided pattern [Photo 13]. Next came a big challenge, not so much to us, who were asked to leave and walk, but definitely to our little bus. Steep uphill drive inside a winding road already transformed into a gully full of potholes caused some doubts about our further journey and prompted one of us to comment that 'I would think twice before taking my four-wheel to this road'. But the bus somehow managed to reach the destination; possibly the driver was a veteran of Camel Trophy or the like [Photo 14]. Finally we reached the exit point for the Paricutin and began the hike.

Photo 12 Eastern margin of the Paricutin lava field, seen in the morning of 4 November after the fog disappeared.

Photo 13 One of many braided channels formed around the Paricutin lava field.

Photo 14 It was hard to believe the little bus could make it...

Undoubtedly, this hike was one of the most pleasant activities in our four-day agenda. First within a marginal gully with signs of recent mass movements, then along the steep southern edge of the Paricutin lava field, across an ash alluvial fan, to a large meadow with a splendid view towards the volcano. Morning fog was luckily a distant recollection by then [Photo 15].

After some marvelling at small but impressive examples of gully propagation within ash deposits we began the strenuous climb to the top. It involved crossing an incredibly confusing lava flow surface, descent into a former lava flow channel with a few fumaroles, and then a pretty nasty walk to the crater rim, straight up the cone built of loosely packed pumice and scoria. The meaning of an angle of repose suddenly became very clear to us as we were negotiating the 'path' running almost at the right angle to the contours. [Photos 16-17] The top and the views over the entire area affected by the eruption, including the distant buried church in San Juan Parangaricutiro, did not disappoint us, but the amount of garbage inside the crater unfortunately did. The crater itself is now 30 m deep and its bottom can be easily reached; therefore it was reached by a few of us [Photos 18-19]. Science behind the Paricutin was expertly explained by Gerardo (geomorphology) and Alex (biology, land use). Heavily dissected and vegetated older cones in the vicinity gave us an insight into the future fate of the Paricutin, to be transformed by erosional processes and biological succession [Photo 20]. On the way back we realised how lucky we were: as on the previous day, clouds started to built up very quickly and at the time we were approaching our bus it was already raining quite heavily. Our Camel Trophy driver showed his skills once again as we were sliding down the gully and going across braided streams on the way back to Panzingo. [Photo 21]

Photo 15 The Paricutin cone from the south.

Photo 16 Beginning of the climb. Getting lost in the maze of lava features was very easy.

Photo 17 A former lava channel and the actual cone in the background. Steep path to the rim is seen on the left side of the cone.

Photo 18 The rim of the crater, with occasional fumaroles.

Photo 19 On the rim of the Paricutin crater. Gerardo Bocco, Christine Embleton-Hamann, Elena Franzinelli and Olav Slaymaker are missing on the

Photo 20 An older, partly dissected

Photo 21 It was raining both

photo. *and largely vegetated scoria cone to the west of the Paricutin.* *outside and inside the little bus.*

The afternoon programme included the return to Nuevo San Juan, and then the drive through Uruapan, with flash flood on its main street, to Patzcuaro, for the last overnight stay.

Patzcuaro has the reputation of being one of the most pleasant provincial towns in Mexico and we were very grateful to our guides that we could spend morning hours of the Day 4 wandering around the town, admiring its architectural heritage and buying local craft [Photo 22]. This was also the way to overcome the morning fog which, if present, would severely upset the visit to the only excursion stop during the last day. We won over fog and at the time we reached an observation terrace on the slope of an extinct El Estribo volcano, it was almost gone. From the terrace we had a wonderful view over the Patzcuaro basin, while Narcisso was developing a most fascinating story about human-landscape interactions within the lake basin from pre-Hispanic times until the present. [Photo 23-24] Realising that we were not in hurry, we began to climb 365 steps to the top of the cone, to see old quarries of volcanic material and to enjoy even better views of the lake and the town of Patzcuaro.

Photo 22 Main square in Patzcuaro.

Photo 23 Patzcuaro Lake from the slope of El Estribo volcano. The island of Janitzio is in the middle of the picture.

Photo 24 Narcisso Barrera-Bassols explains the cultural landscape around Lake Patzcuaro.

And the visit to El Estribo was unfortunately the last stop in the programme, which we enjoyed so much. We had hoped to see exciting volcanic geomorphology and one of the youngest volcanoes on Earth; this we did. But we actually received much more than this. Our geomorphological expertise has been supplemented by the wealth of information about biology, local history and culture, land use and environmental management problems. It was an excellent trip and all its leaders are warmly thanked and congratulated for their efforts.

Piotr Migon