

Mud Volcanoes of Azerbaijan

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Azerbaijan is a small but rather splendid country where the fold mountains of the Caucasus break through semi-desert lowlands and disappear beneath the Caspian Sea. As a nation it receives very few leisure visitors, but the geologically inclined tourist may well be drawn to its mud volcanoes. The Absheron Peninsula, adjacent to Baku, is host to a plethora of geological activity, with water, oil, gas and mud seeping to the surface through the thick pile of sediments in the Caspian basin.

Baku was in the forefront of the world's oil industry back in the 1870s, when it was matching Pennsylvania in its development. The city now stands at the heart of a second boom based on the vast oilfields of the Caspian, and the new oil provides wealth and supports industry on a grand scale in today's Azerbaijan. Oilfields surround the city, but the most important are now out into the Caspian, where platforms dot the horizon. On land, and notably out on the Absheron Peninsula, the oilfields provide some amazing industrial landscapes. There are nodding donkeys galore, slowly dragging the oil up into a network of pipelines. But the finest panoramas are of the forests of tall drilling derricks in the Ramana oilfield, east of Baku, which are reminiscent of the well-known scenes photographed on Signal Hill in Los Angeles back in the 1930s.

Surface oil seeps were recorded by Marco Polo, and are what started the exploitation boom in the 1800s. Many are still active today, and evaporation of the volatiles leaves material more akin to tar as sticky black crusts floating on ponds of rusty water that also emerges from the ground. Elsewhere, methane emerges and spontaneously ignites. The natural fires east of Baku were some of the prime sites of fire-worship in the origins of the Zoroastrian religion, but vents change over time, and most of these sites are now dead. Yanar Dag, near the Ramana oilfield, is a hillside of roaring flames popular with local people as somewhere to take tea on a cool evening.



Flames of methane on the burning hillside of Yanar Dag.

Azerbaijan has more than 400 mud volcanoes, including many on the floor of the Caspian Sea; these add up to about 70% of the world's total. The mud is mainly sourced from mid-Tertiary organic shales at depths as much as 8 km, and is largely separate from the oilfield reservoir rocks at shallower depths. Faults along anticlines, associated with the Caucasus disturbance, appear to offer the mud the necessary routes to the surface. Azeri mud volcanoes come in all shapes and sizes. Many of the smaller features (with dimensions of tens of metres) are in states of almost continuous activity, with conical edifices, advancing mudflows, growing mud domes or muddy pools on their vents. Emerging gas creates delightful bubbling mud pools on some of the vents. Many mud flows mimic the textures of lavas, notably ropey pahoehoe on the smaller scale. The mud-water ratios, the rates of extrusion and the subsequent evaporation rates determine the viscosities of the mud flows and hence the profiles of the mud volcano cones. Individual vents are typically subsidiary features on larger mud volcanoes, kilometres across and hundreds of metres high, and comparable to parasitic vents on basaltic shield volcanoes.



A forest of drilling derricks in the Ramana oilfield that is still producing on the Absheron Peninsula.

Along the Caspian coastline, south of Baku, the Firuz crater lies on a broad low shield south of Gobustan, with easy access via a long dirt road; there are numerous active adjacent vents, and lines of broken baked mudstone where flames of methane once



A small flow of viscous mud from a vent on the mud volcano of Perekishqul.

Very fluid mud flowing from an active vent on a mud volcano near Gobustan.



The extensive mudflows that emerged from Lokbatan in October 2000; note the person on the left for scale.



emerged. West of Baku, the Perekishqul shield is also capped by a fine collection of active mud vents and short mudflows. Less accessible is Turagay, a massive mud volcano over 400 m high, with a shallow caldera in its gently rounded summit dome and all its flanks scored by deep rainwater gullies. Between Baku and Gobustan, Lokbatan is a splendid mud volcano rising over 100 m, with oil derricks littered across its flanks. From its summit a mud flow extends for nearly two kilometres, with splendid arcuate pressure ridges that are comparable to those on some obsidian flows; this is now totally dry, but Lokbatan means “the place where camels get stuck”. Its upper zone is littered with blocks of baked mud that were hurled out of its vent during the eruption of October 2000. That event was marked by methane flames that reached 300 m high for about five minutes, before settling down to flames of just 15 m for a few days. This was a fantastic sight, but was only one of various methane explosions that have been recorded around Baku within historical times. Though these outbursts are rarities, at least some of the mud volcanoes are always active, and they make a short visit to Azerbaijan geologically memorable.