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Big Ben: the fire beneath the ice

A spectacular night-time eruption of Heard Island's Big Ben in February 2001, following a summer of plume and vapour sightings, was an emphatic reminder that this volcano remains well and truly active.

From the outset of the 2000-2001 Heard Island summer season, vapour was seen coming from the Mawson Peak summit (2745 m) of Big Ben - Australia's highest mountain outside Australian Antarctic Territory. This was followed by a series of observations at most times when cloud lifted from the summit:

- 19 - 20 October: fumes over several hours seen from *Aurora Australis* off northern coast.
- 28 October: Strong plume seen from near Red Island.
- 9 November: Close-up observations of gases venting through ice dome at summit and at location 250m down southern slopes.
- 13 November: Brown fumes seen from Fairchild Beach, northeast coast.
- 14 November: Plume estimated to approach 300m high observed from moraine crest east of Browns Lagoon, from which summit is hidden by 2,300 m-high ridge 2.5 km downwind.

Observations reached a spectacular finale from the evening of 2 February 2001 until early the following morning. Witnesses at Atlas Cove saw orange-coloured light reflecting off high cloud. The diameter of the illuminated area was estimated to vary from 1km to 4km, depending on passing cloud. Plumes were strongly back-lit, making them visually dramatic. At least two distinctive glows from red lava were observed (see photo above). Emissions appeared to diminish about 1am on 3 February, cloud finally obscuring the view.



Night-time view of Big Ben erupting on 3 February 2001, viewed from Atlas Cove.

Stu Fitch

Venting had subsided considerably by daylight. From a high point on Laurens Peninsula, what seemed to be a black lava flow was seen on Mawson Peak, about 15km away. It was estimated to be about 100m wide by 1500m long, but size estimates were complicated by distance, lack of a comparative scale and an acute viewing angle.

The ups and downs of Australia's highest peak

It is hard to put Big Ben's eruptions into perspective because visits are so intermittent, but the 2000-2001 observations add useful new data to the record. Included in these observations were changes to Big Ben's form and height.

The first full ascent in 1965 revealed a furrow at the summit 7.6 m deep, 23 m across and 76 m long. In 1983 climbers found a rocky summit from which steam was being emitted. The 1986-87 ANARE expedition found a cylindrical crater 40-50 m in diameter and 50-70m deep containing a lava lake. But by 1992 a split in the summit cone had formed a wedge about 150m deep, releasing lava down the southern flank of the mountain. The next summit observation in in January 2000 revealed a vent 10 m long from which smoke billowed continuously.

On 9 November 2000, inspection by helicopter revealed the summit to have assumed the form of a steep, irregular ice dome festooned with massive mushrooms of overhanging rime. Gases were seen venting through the apex of the dome. Clean white ice separated this spectacular steaming white peak from a second emission point lower on the southern slope. Following the spectacular eruption of 2-3 February 2001, the summit topography of Big Ben may have changed again. As if surveyors do not already have enough problems trying to determine the altitude of such a weatherbound and remote mountain!

How many vents?

The 2000-2001 field work brought new insights into a persistent issue about the number of volcanic vents on Big Ben. In January 1950 and February 1952 up to three distinct red glows were reported, one from the summit and the others attributed to vents on the southern flank. Similarly, two distinct red glows were observed from Nella Dan in October 1985, suggesting that a second vent existed. But when detailed inspections in 1986-87 failed to find additional vents, the previously-seen multiple glows were attributed to magma ponded in the summit crater and spilling down the mountain flanks.

However, small vents may come and go, especially if they are rootless vents such as leaks (honitos) fed by shallow lava tubes, or lateral breaches under the walls of a cone. The heavy snowfall high on Big Ben will quickly bury and hide areas where venting may have ceased. Results from the recent work indicate at least two vents indeed exist, one at the summit of Mawson Peak and at least one separate, lower vent in the vicinity of the 1985 flow.

The observations from near Red Island on 28 October 2000 suggested the presence of a second emission point on the southern slopes, well below the steaming summit. This was confirmed during the inspection by helicopter on 9 November 2000 when a distinctly separate area of activity was found about 250m below Mawson Peak near the head of Lied Glacier. Gases were issuing from crevices in a belt of exposed rocks at this site, which was separated from the summit vent by several hundred meters of clean, white ice.

The exact points from which lava erupted on 2-3 February 2001 were obscured from view by the high shoulder of Big Ben. Nevertheless, two vents appeared to be involved, one possibly at the summit of Mawson Peak and at least one other lower down. Estimates from Atlas Cove suggested the main vent was perhaps 300 vertical metres below the summit, and the two vents were estimated to be about a kilometre apart. This is broadly consistent with the observations obtained at the summit two months earlier. Some witnesses to the February eruption considered

emissions may also have been coming from a third vent, based on observations made the following day from Laurens Peninsula. A third vent would be consistent with some observations from Atlas Cove between January 1950 and February 1954, but there is no evidence for a third vent in photographs from the January 2000 eruption.

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