

the thermometer only registered to 160°. There was more mud than scoria on the western shore, among which were several hot springs. It was very pleasant and warm in the crater, a welcome contrast to the climate of an hour before, and we smoked our pipes for half an hour with the boiling spluttering springs around us. At 1.30 we started on our return journey, taking with us a canful of water from the lake—a prize that gave us some satisfaction, as I believe we are the first who have descended to the lake or obtained water from it. We left the top at 2.15. The wind was now cold, and blowing in strong gusts down the mountain-side, and we had to be careful of our footing, and we appreciated the value of our iron-shod poles. We crossed the snow-fields in three-quarters of an hour, having been six hours on the snow.

We had a spell on reaching the rocks, and there made an interesting discovery. In the morning I had remarked that I thought steam was rising from the hillside across the gully, now it was unmistakable. We lit our pipes and watched. From a slip not much below the snow on the western peak the steam rose in intermittent puffs every three to five minutes, sometimes in quite a large volume, and further down on the side of the spur steam rose from two other places from among the rocks. This was likewise intermittent, and the intervals being much longer. The last volume of steam rose some 100ft., and hid the rocks behind it, but it seemed to have spent all its energy in this final effort, for we waited twenty minutes longer, and no more steam came from the lower steam-vents, while the upper one at the slip was pretty constant. We got back to camp at 5.30 p.m., after being eleven hours away.

It will be well here to sum up some of the reliable information that has been obtained on Ruapehu of late years. Mr. L. Cussen first erected a trig. station on the northern part of the mountain, but I have not seen his report on that occasion. In, I think, April of 1886 Mr. L. Cussen again made an ascent, and reported steam issuing from the lake. In the same year (1886) I made two ascents—first in January, with Mr. Parkes of the Geological Department, when no steam came from the lake; and again in May, when as much steam was coming from the lake as at the present time. In June or July of the same year Mr. A. D. Wilson reported seeing a column of steam rise from the crater of Ruapehu. Several times since then newspapers have published reports of steam rising from Ruapehu, but these must be accepted with great caution, as many men form too hasty conclusions, fog often being mistaken for steam. Even on a clear day fog-clouds often hang about the mountain, and perhaps from the opposite side from the observer they will arise above the mountain, appearing as if steam from the crater (his side being quite free from fog). Several reliable ascents have been recorded, all, I think, describing the lake as cold.

Ruapehu, on the 10th March, 1895, as if now to dispel all doubt, threw up a column of steam at least 1,000ft. above the crater, on a scale befitting the "great monarch of the North Island." The fog which had veiled the mountain in the morning cleared away as if to reveal this fine display of thermal activity. This lasted several days, the volume of steam rapidly diminishing, till it no longer rose above the crater. Undoubtedly, on the 10th March, and several succeeding days, the whole crater lake (about 10 chains by 12 chains) was a caldron of boiling water.

Until late years Ngauruhoe has been considered the terminal point of action of the great thermal belt commencing at White Island, its high cone emitting a continuous volume of steam, forming a befitting terminus to so fine a stretch of thermal country. The great mountain of Ruapehu, in its cold solitary grandeur, seemed to reign "King of the North," its snowy heights unconquered by thermal power. As the mountain has become better known its real nature has been revealed, and it must now be considered as the great safety-valve of the southern extremity of the thermal belt.

That thermal force does accumulate and find vent by increased activity in the springs in some portion of the volcanic zone has been abundantly demonstrated, and the termini, White Island and the Tongariro Range, appear to be the most active and erratic; but so long as the great valves keep free there is no likelihood of danger.

I think there are always many boiling springs in the crater of Ruapehu, but their action is not sufficient to heat so great a body of water, but, as I have never seen the lake frozen, they probably always keep it slightly warm. The phenomena displayed by the Wangaehu River during the increased action on Ruapehu seems to confirm my supposition in last year's report that it issues from the crater, or is a deviation from the same thermal springs that at times disturb the lake.

The reports published in some papers that fire and smoke rose from Ruapehu, and that large rocks, together with mud, had been thrown out of the crater, I knew to be false before my ascent, but I thought possibly the lake had gone, and some mud been ejected. However, this was not so, and the discoloration of the snow on the mountain-side was due to the fine summer and autumn having melted the snow to a lower depth than usual, in many places nearly to the ground, leaving only dirty snow, which had misled many who saw it from afar. The steam I have described as coming from the mountain-side may be of old duration, but I believe had not been seen before, and I believe there are more places where it escapes than the three seen. It is likely some may be found on the west side of the mountain, at the head of the Manganui-o-te-ao Stream.

I should have taken further time to explore, but next morning it blew a gale of wind and rain, and I should have had to wait too long for fine weather. It is now demonstrated beyond doubt that Ruapehu is subject to thermal action, even to hot springs on its sides. My two men, C. A. Goodger and E. Noonan, willingly undertook their onerous task, and would have surmounted greater difficulties than came in our way had it been necessary. It will be seen that I followed the advice given by me last year to those intending to reach the lake, and any one following it would have met with success. Samples of crater-water are forwarded.*

WALTER H. DUNNAGE.

* The quantity sent is too small for analysis.—EDITOR.