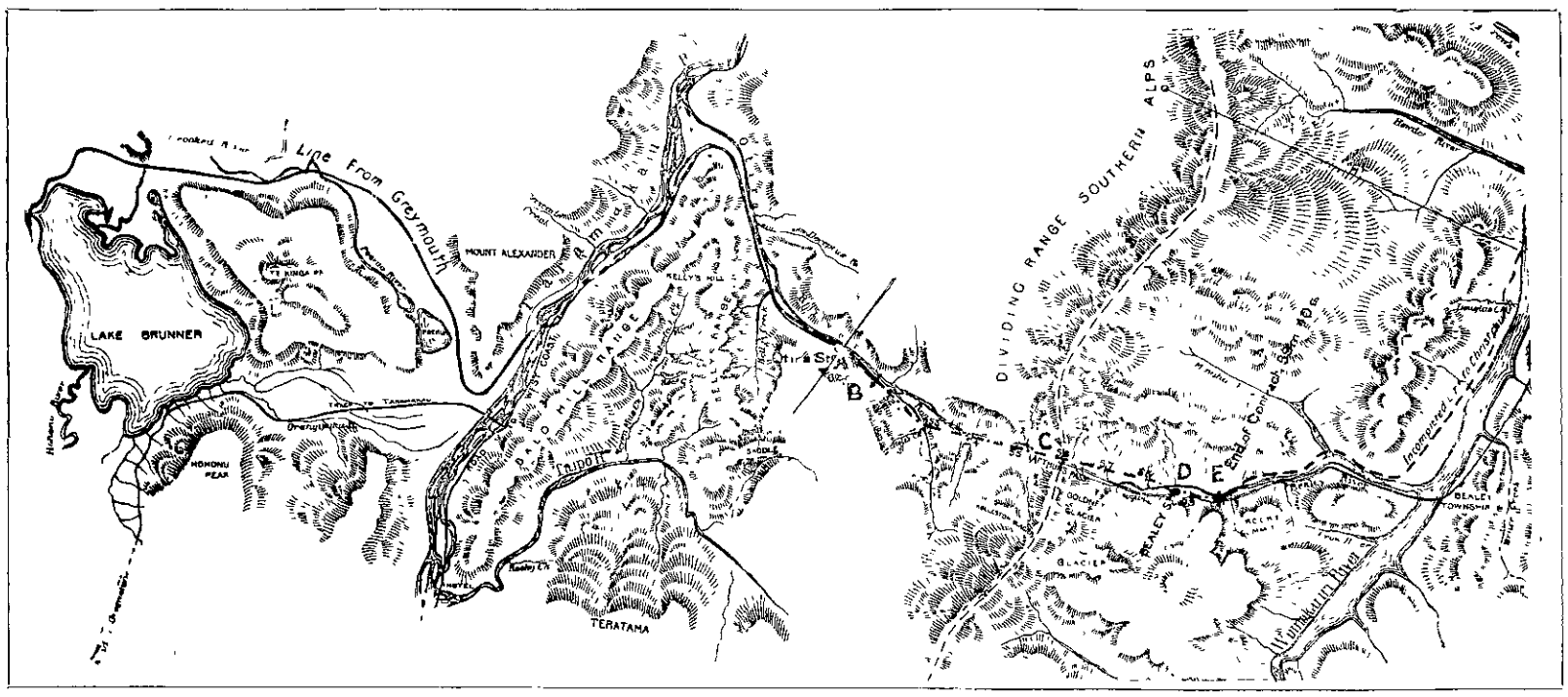


LOCALITY PLAN.—*A*—Otira railway station, *B*—Commencement of contract, 51 miles 49 chains from Greymouth; *C*—Arthur's Pass; *D*—Bealey railway station, *E*—End of contract, 59 miles 40 chains.

Arthur's Pass is the link between the sections of the Midland line—as the cross line has been for years called. The work of constructing it has just been let to the Messrs. McLean, and the Government is completing the line from Otira on the west, and from Broken river on the east, to the west and east ends of the tunnel as fast as it can.

The tunnel was not always in the minds of the engineers of this line. In the beginning, as soon as men began to realise the difficulties before the cross project, they felt that, if possible, they must eliminate the enormous cost of a summit tunnel True, any system of crossing the mountains instead of piercing them would be expensive for all time. Still, by concentrating the heavy haulage in the centre and keeping the grades flat on both sides they thought it might be possible to make a profitable line. The Abt and the Fell systems had each their advocates. For a time the war between them raged high. At last the matter was referred to experts, and it was definitely settled that the cost of operating either the Abt or the Fell system at Arthur's Pass would be extremely high, that in fact, as neither of these presented any escape from the bulk of first cost, they would both be extravagantly expensive in operation. This conclusion received later on the cordial approval of Mr. Bogue, the very capable and experienced American constructing engineer who reported on the whole question of the tunnel through the Pass.

It was in 1902 that Mr Bogue undertook the task of pronouncing on the various schemes recommended by the Commission for piercing the Alps with a tunnel. He went thoroughly into the subject, and reported in favour of the construction of a line with moderately easy gradients approaching the "Divide," concentrating the heaviest works at Arthur's Pass, and piercing the range by a long summit tunnel. Mr. P. S. Hay, the late Engineer-in-Chief of the colony who was one of the Commission of Engineers referred to above, and who had accompanied Mr. Bogue in his examination of the country, also reported on the problem, suggesting a slight modification of Mr. Bogue's line with a considerably longer summit tunnel. Mr. Bogue subsequently concurred, and the suggestion was ultimately adopted. Mr. Hay accordingly prepared the plans and specifications for the tunnel.

The geology of the Pass is thus described in a memorandum of the Government Geologist, Mr. Alexander McKay, at the request of Mr Bogue, which is as follows:—

Wellington, 15th February, 1902.

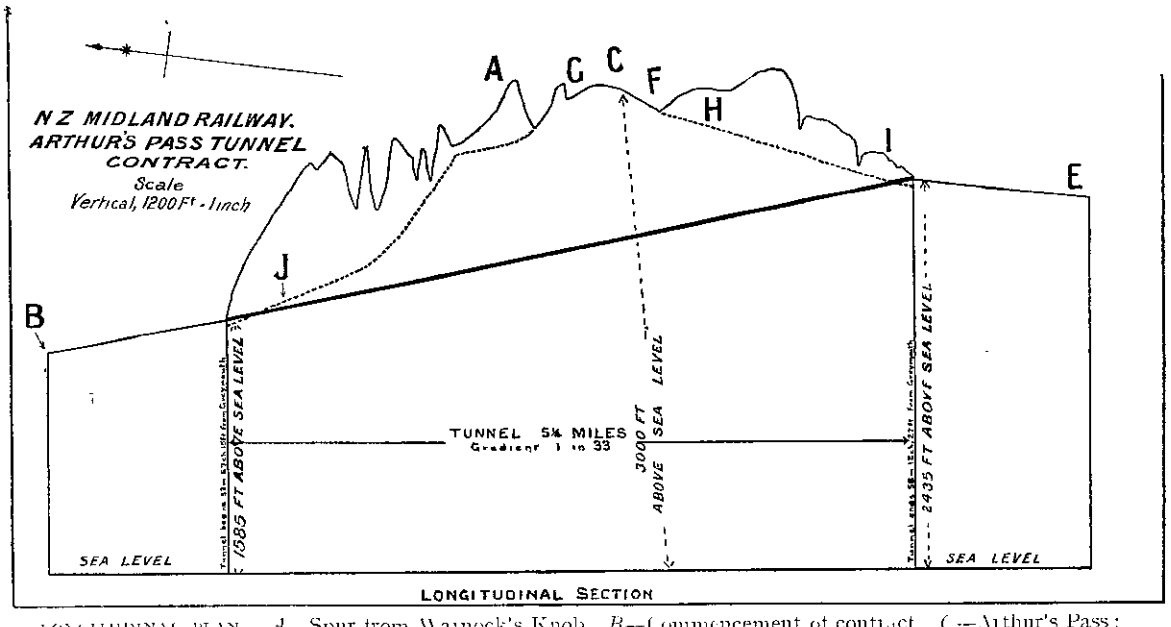
Sir—"At the request of Mr. V. G. Bogue, C.E., I have the honour to forward you for his information some account of the geology of the Arthur's Pass and the mountains through which the Otira Gorge has been cut.

"Approaching Arthur's Pass from the east, the rocks are alternations of sandstone and shales that are either of Permian or Carboniferous age.

"The general dip is to the north-west, and, apart from surface slips (which are not common), I anticipate they will form good standing ground on being mined or tunnelled into.

"On Arthur's Pass the dip changes to the south-east, and there is also some change in the character of the rock, the bare sandstone expanding to a much greater thickness than what shows along the Bealey river. There is an absence of deep sagging slips, and from the Bealey to the Otira the rock should prove sound and safe driving-ground, at even an inconsiderable depth from the surface. The principal rock is a hard, grey, or greenish-grey, sandstone, with which are associated bands and thick masses of dark slaty shales, and there is an absence of the greyish, drossy, and pulverent thin-bedded shales and sandstones which have proved so troublesome (as running ground) in the neighbourhood of Wellington, and in the Rimutaka and Ruahine ranges. At the upper end of the Otira Gorge the rocks revert to the thinner-bedded sandstone sand shales, but continue to be good standing country, as proved by the siding at the road at Cape Horn, in the deeper part of the Gorge. The same character of rock continues to the west end of the Otira Gorge and the junction of Rolleston Creek with the Otira.

"On the crest of Hill's Peak a fissure of great depth has been formed, and this is by some regarded as an extended earthquake fissure. Whatever it may be, for I have not examined it, there is no indication of its being continued in depth to the level of the Otira above the zig-zag, nor continued in the mountains on the west side of the Gorge and upper valley of the Otira. At the time of examining the district, I had discovered most of the great fault-lines that run to great distances



LONGITUDINAL PLAN.—*A*—Spur from Warnock's Knob, *B*—Commencement of contract, *C*—Arthur's Pass; *E*—End of contract, *J*—Road and Bealey river, *G*—Otira river; *H*—Bed of Bealey river; *I*—Punch Bowl creek; *J*—Bed of Otira river