1979/18. Rock instability on The Nut, Stanley.

A.T. Moon
R.C. Donaldson

Abstract

Near vertical cliffs 100 m high with a history of instability backdrop buildings and the railway near Stanley wharf. Inspection of the cliff has shown that a mass of rock weighing about 500 t is in an unstable condition and is likely to fall. It is recommended that the area under the cliff be evacuated and closed to the public.

INTRODUCTION

The Kauri Timber Company have their operations located at the base of an old quarry at the western end of the wharves at Stanley [CQ568856]. Near vertical cliffs 100 m high overlook the building and a railway line serving the wharf (plates 1, 2). The cliff has a history of instability, with previous falls of about 500 t in July 1968 and 100 t in April 1974. Smaller falls, consisting of single boulders up to one metre diameter, have also occurred. Most of the previous falls appear to have originated from a near vertical slab about 50 m above the base of the cliff. This slab is about 20 m in height. The instability appears to be caused by a continuous joint parallel to the face of the slab and about 2 to 3 m from its surface. Fragments of the slab have broken off, causing the face to retreat by 2 to 3 m.

The face was inspected on 30 April and a continuous open crack was observed running from the top to the bottom of the slab close to the edge of the most recent fall. This crack defines a mass of rock about 20 m in height, 1 to 5 m wide and 2 to 3 m thick, weighing about 500 t (plates 3, 4). This unstable mass appears to be held up by the lack of any continuous joint or crack across its narrow base. However it is considered likely that further movement of the mass (movement has already occurred causing the crack to open; plate 5) will cause cracking at the base of the slab and total failure. In view of the relatively few joints crossing the slab, the mass may break up into large individual boulders, some of which could weigh more than 100 t. After a near vertical fall of about 50 m, these boulders will be potentially highly destructive.

Such a fall could be triggered by vibrations caused by the passing of a train, a minor earthquake or heavy rain. It is not possible to predict accurately when the fall will occur, but in view of the history of failures, it is considered more likely to occur within a matter of weeks or months rather than years. After the fall, further instability is likely to develop in the slab to the west of the present crack.

RECOMMENDATIONS

Consideration has been given to long term remedial measures, but they are likely to be both dangerous and extremely expensive. In view of the size of boulders likely to fall, a fence or ditch at the base of the slope will be ineffective (plate 6). The long-term stability could be improved by the installation of many rockbolts combined with the use of heavy netting, but this dangerous operation could easily cost in excess of $100 000 and still not guarantee complete safety.

In view of the danger to those working below the cliff and the

expense and danger involved in remedial measures, it is recommended that the area under the cliff be evacuated. This would involve closure of the railway and the Kauri Timber Company's operations at Stanley. The area should then be fenced off, allowing no access to the public. At present there is real danger to the lives of people working below the cliff.

[2 May 1979]

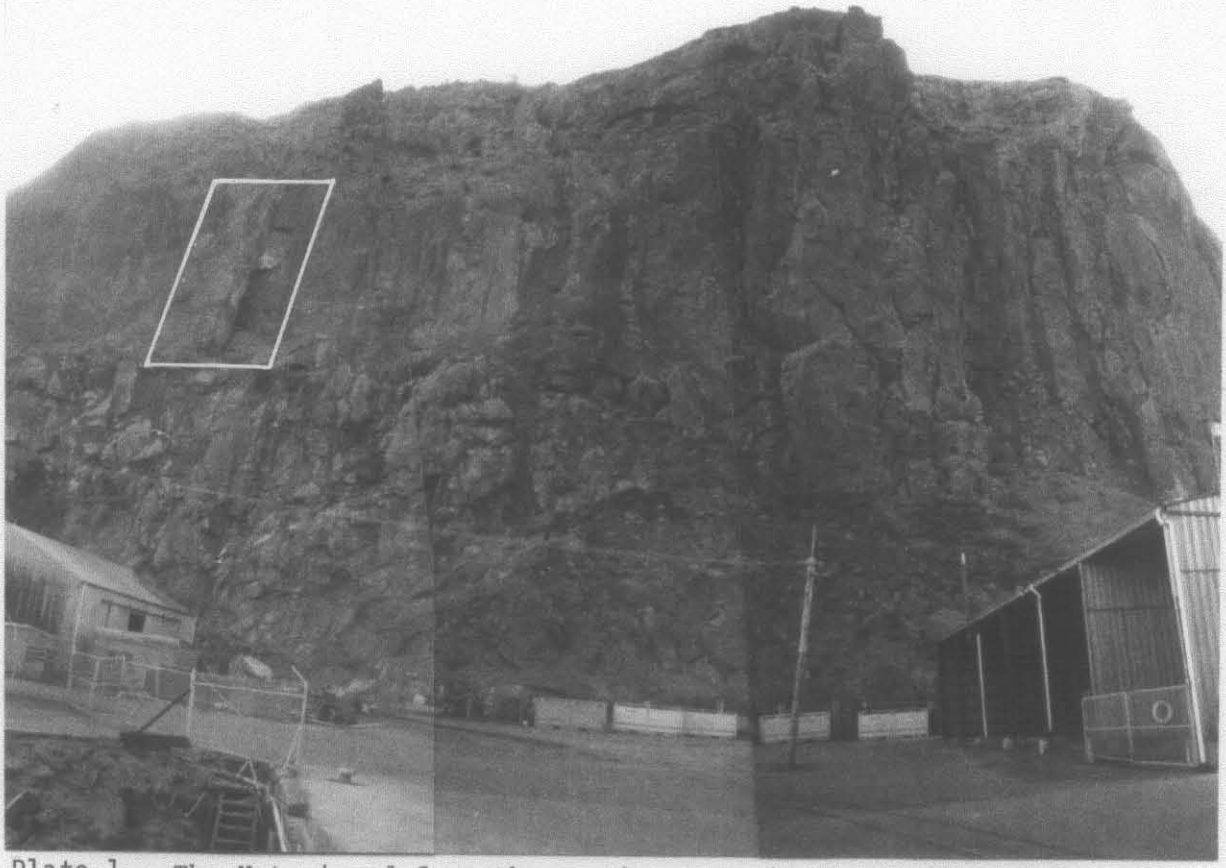

Plate 1. *The Nut viewed from the south. Face is about 100 m high. Unstable area marked.*

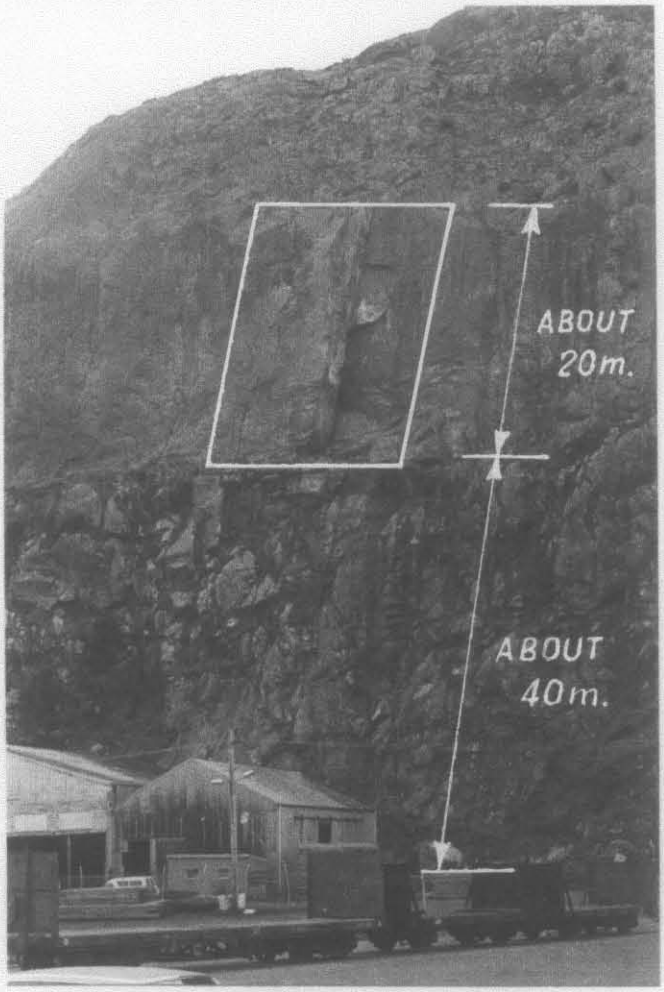

Plate 2. *Unstable face and Kauri Timber Company buildings.*

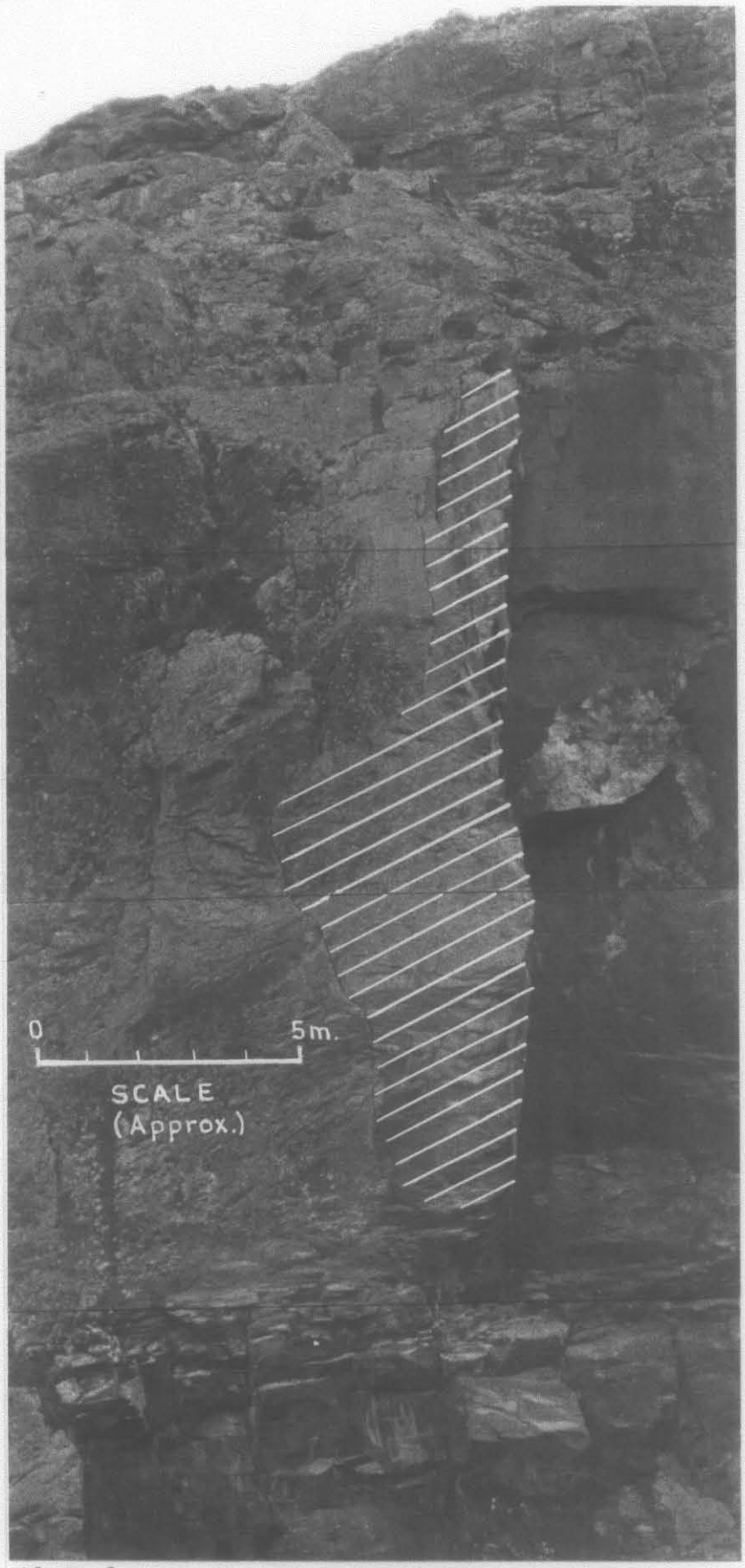

Plate 3. *Detail of unstable area from south. Unstable face (shaded) is about 20 m high and up to 5 m wide.*

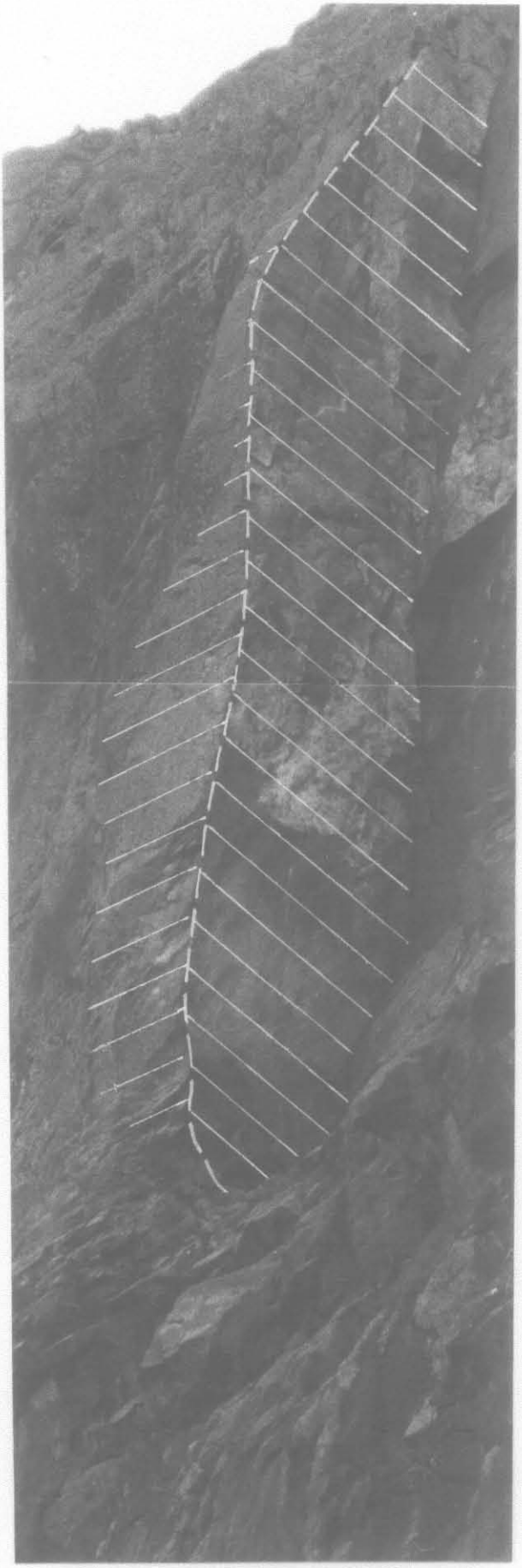

Plate 4. *Detail of unstable area from south-east. Unstable face is 2 - 3 m thick.*

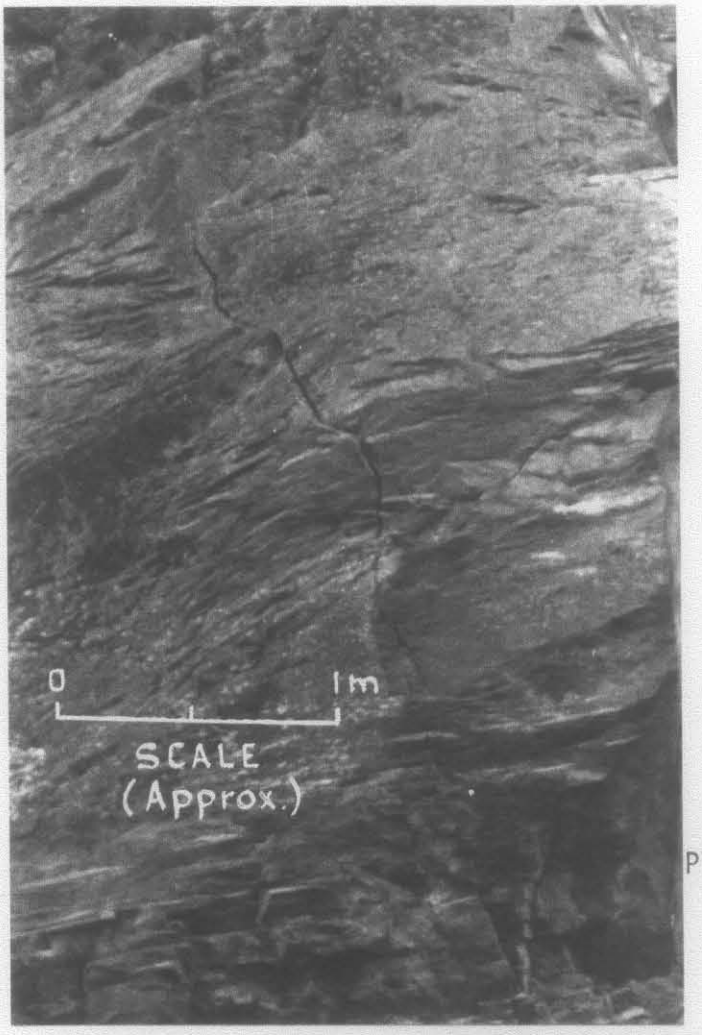

Plate 5. *Detail of open crack. Crack width about 20 mm.*

Plate 6. *Base of cliff below unstable area showing large boulders (up to 50 t) and proximity of warehouse and railway.*