SOUTHERN RATA (*METROSIDEROS UMBELLATA*) IN THE OMIHI HILLS, NORTH CANTERBURY

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Southern rata occurs anomalously at Mt Ararat in the Omihi Hills, far from any other southern rata. In 1969 a small reserve was established at Mt Ararat to protect the rata. In 2000, a review of the status of the rata population and its management requirements, particularly relating to the reserve, was commissioned by Project Crimson and the Department of Conservation (DoC). I was asked to carry out that review, and made several field visits. It resulted in a detailed report (Walls 2001). This article outlines the findings and is designed to complement Miles Giller's article on the vegetation of Smothering Gully in this issue of the *Canterbury Botanical Society Journal* (pages 42-48).

Most, but not all, of the southern rata in the Omihi Hills is contained within the Mt Ararat Rata Reserve (1.93 ha), administered by DoC. Another small population exists in the head of Smothering Gully, a little to the east, in a more ecologically secure situation that has just been given formal protection. The rata is in both sites because of the distinctive properties of the substrate. Otherwise, the nearest naturally-occurring southern rata is at Glentui, 50 km to the west-south-west.

The Canterbury Botanical Society visited Mt Ararat in 1997 and prepared a plant list (Anon. 1998). Plants of note that have been recorded so far include *Celmisia monroi* (a daisy) and *Hymenophyllum cupressiforme* (a filmy fern), both nearing their southern geographical limits; and *Dianella nigra* (turutu or blueberry) and *Blechnum vulcanicum* (a ground fern) that are uncommon in Canterbury.

Peter Wardle prepared the Biological Flora for southern rata (Wardle 1971) and mapped its known distribution at that time based on existing herbarium specimens and reliable reports. He stated that southern rata occurred in the headwaters of most of the rivers draining eastwards from the main divide, and that there were small stands in the Canterbury foothills, at Glentui near Oxford and between Mt Peel and Lake Coleridge. He wrote:

"Probably the most anomalous stand of *M. umbellata* is that growing at 400 m on a crag of pure quartz sandstone in Omihi State Forest, North Canterbury, under a rainfall of about 75 cm per annum. The vegetation is very open, and consists mainly of plants of *M. umbellata*, ranging from a few centimetres to 5 m in height, some of them being fully exposed to the prevailing north-west wind. The sandstone is continually crumbling, and the *M. umbellata* seedlings become established in sand-filled crevices."

The "crag of pure quartz sandstone" is a unique geological feature. The Motunau Ecological District is a zone of low hills between the downlands of North Canterbury and the coast. The simplicity of the landscape masks a high degree of geological complexity, with rocks dating from Triassic to Recent. A small lens of sandstone, oriented northeast-southwest, is wedged between Triassic greywacke inland and Miocene limestone towards the coast (Wilson 1963). The Hamilton Fault lies along its western edge. The limestone forms a prominent series of bluffs along the Mt Cass ridge. Mt Ararat (Fig 1) is the summit of the outcropping sandstone, and is particularly pure in quartz. The sandstone forms part of the stratigraphic sequence of rocks in Canterbury and is a component of the lower Tertiary coal measures. The sand deposit was formed about 70 million years ago, probably as a river delta on the coast, and was probably derived from an old weathered landmass which accounts for the very low nutrient status. It outcrops in a few other localities including the vicinity of Mt Somers where the quartz sand has been mined for glass manufacture.

Figure 1 Mt Ararat from the south-west during commercial logging operations. The Rata Reserve is the high ground only. It was strongly recommended in 2001 (and still is) that the reserve be enlarged to include the apron of land surrounding it, bounded by the road and track system. A more practical and attractive reserve would result, with far greater security for the rata.

The quartz sandstone area is extremely limited in size, measuring about 1 km by 0.5 km. It consists of two dome-shaped masses separated by a deep gorge at the head of Smothering Gully, which drains into Omihi Stream, a tributary of the Waipara River. The northern block forms a vertical cliff into Smothering Gully, while the southern block consists of several low hummocks leading to

the steep-sided dome-shaped massif known locally as Mt Ararat. It stands out as a feature in the otherwise gentle relief of the Omihi Hills. From Mt Ararat the landscape stretches west and south-west to the foothills of the Main Divide. Mt Grey in Ashley Forest is the nearest major topographic feature, but it is evident that there are no comparable structures to Mt Ararat anywhere nearby.

There is something specific about the quartz sandstone that enables rata to establish and survive. Rata seeds are small (2 mm x 0.4 mm) and very light in weight (less than 0.01 mg) and will be dispersed everywhere along the path of strong north-west winds crossing the Southern Alps. This means that potentially rata could have a more or less continuous distribution within the climate range that supports them. However, rata need bare surfaces on which to establish and do not readily tolerate shade. A search of surrounding habitats with these conditions, particularly the limestone bluffs along Mt Cass Ridge, reveals that the rata are limited to the quartz sandstone.

The sandstone is highly erodible. Water and wind together shape solid bedrock into rounded boulders lying on the surface. Such a boulder, say 40 cm across, fragments explosively into finely textured sand upon impact with another rock. This soft texture, lacking strong cohesion, means that the rock is very porous and can therefore absorb rainfall. For example, a piece of rock measuring 10 cm x 10 cm x 5 cm (500 cm^3) can absorb 0.25 litres of water in 24 hours. This translates to a staggering 500 litres in a cubic metre of rock. The water storing capacity of the rock forming Mt Ararat is indicated by water flowing from several springs around the lower flanks on the eastern and southern sides.

It is the combination of bare surface and water absorbing capacity then that creates a unique opportunity for rata to become established. Other species are inhibited by the erodible nature of the rock preventing firm roothold because their roots are too short. Southern rata roots, however, and those of other rata species and pohutukawa, are adapted for crevice penetration.

Seedlings were found located in a variety of places, in the semi-shade on moist ledges, emerging from moss pads, and growing from cracks in the sandstone (even in exposed apparently arid places). A potentially very important seedling establishment relationship is with the black solitary native bees, which bore holes literally into the solid, albeit soft rock to a depth of at least 10 cm (Fig. 2, page 37). Rata seeds undoubtedly fall or blow into these holes and are carried into the moist dark channel where germination and early growth could start (Fig. 3, page 37).

Smothering Gully

A small number (at least 30 in total) of rata seedlings, saplings and trees occur on the cliff face above Smothering Gully. A single young plant was seen on the western side of the gully. The full range of size/age classes (from seedlings to

mature trees) appeared to be represented, and plants were invariably in good condition. Because of the precipitous terrain a detailed census was not attempted. It appears that this population, although small, is fairly stable and naturally secure by virtue of the existence of the gorge. The greatest threats appear to be browsing by possums and invasion of the site by wilding exotic pines.

Also growing on the cliff is a small but mature specimen of totara (*Podocarpus totara*) which is significant because it is another example of remnant vegetation that has survived fire both of Polynesian origin (beginning about 500 years ago) and European (beginning about 150 years ago). The rata is another example of this, but in the district as a whole such relics of original vegetation are rare.

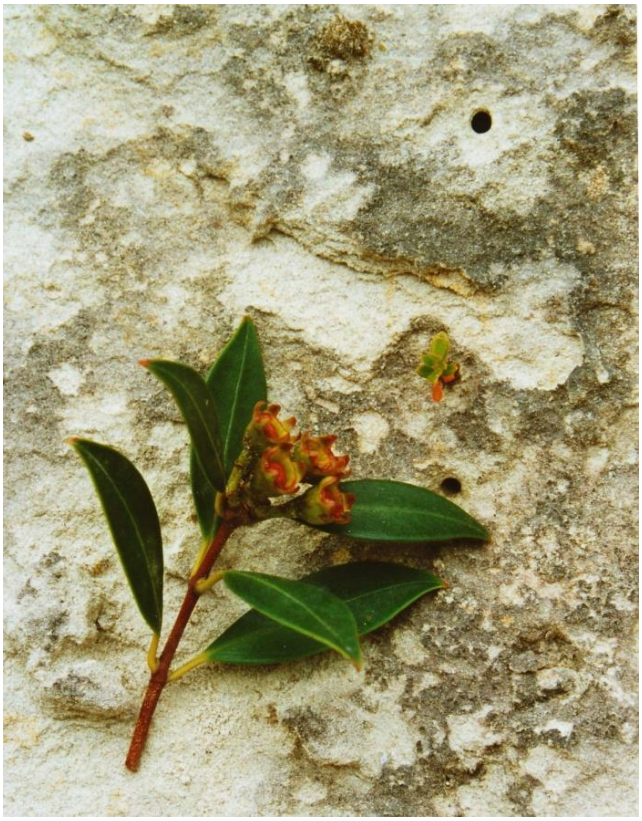

Figure 2 An important relationship between rata and native bees could exist. The exposed sandstone on Mt Ararat has burrows excavated by solitary native bees. These are potential sites for rata seeds to lodge and establish. A tiny rata seedling (upper centre) has probably germinated in an old bee burrow. Rata sprig with seed capsules for scale.

Figure 3 Another wee seedling that may have established in a disused bee burrow.

The gorge formed by Smothering Creek and the cliff above it forms a refugium. The gorge itself creates a mesic microhabitat in an otherwise seasonally dry environment (Fig. 4). Although the vegetation is dominated by large old kanuka, with an understorey of broadleaved species such as mahoe and lancewood, the ground vegetation contains numerous species of ferns, and clumps of *Astelia fragrans* that are unusual in the district. These plants grow in a soil formed by the constant "rain" of sand granules from above, mixed with fragments of mosses and lichens that grow on the cliff. Spectacular wind-eroded caverns occur. The sandstone is built up from successive strata, more or less horizontal in orientation. These strata form cracks and ledges and it is on these that most of the rata have become established (Fig. 5, Page 39).

Figure 4 The Smothering Gully rata site where the rata are growing mostly on the steep sandstone face on the opposite side of the gully.

Mt Ararat

Rata are more common on Mt Ararat (Fig. 6, page 39). Most of the population is within the boundaries of the existing reserve. The rata are found on both the sunny and shaded faces of Mt Ararat. They are larger and lusher on the shaded southern faces, and smaller in stature and more stunted on the more exposed northern faces. They are exclusively on steep rocky terrain, and are almost strictly confined to the western end of the outcropping sandstone. For the purpose of description and population census five size categories for rata plants were recorded (Table 1, page 42).

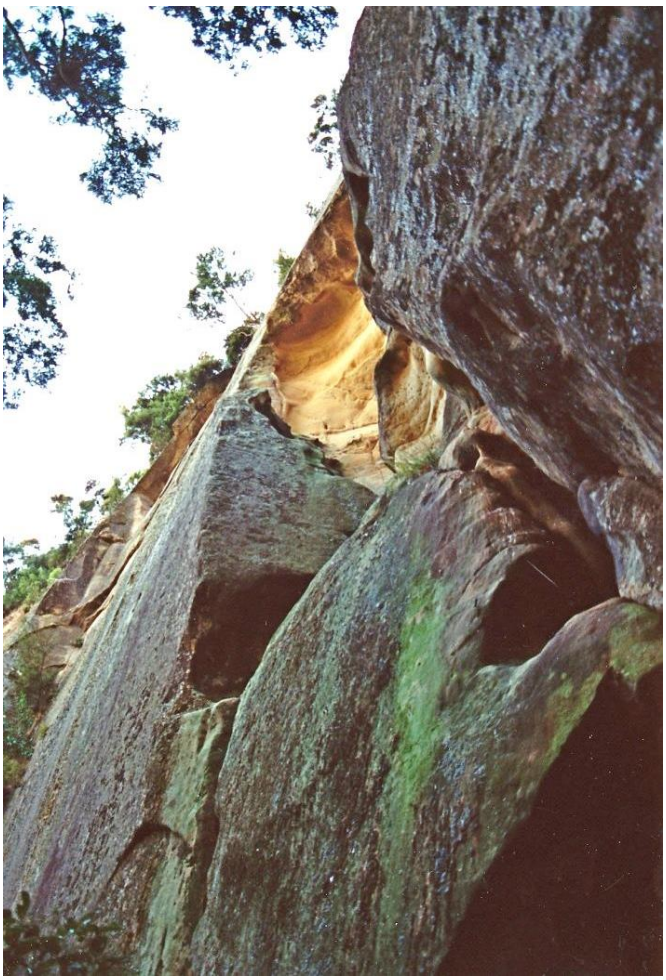

Figure 5 Near-vertical sandstone in Smothering Gully, etched by the elements. Rata trees, shrubs and seedlings are growing in the nooks and crannies.

Within the reserve, the rata population is currently quite healthy and is capable of regeneration on site, despite its isolation, small size, the relatively small maximum size of the individuals, and the marginal conditions for survival.

The rata at Mt Ararat are probably very long-lived. Ring counts done on the cross-sections of three rata stems showed that the largest stems, which measured about 150 mm in diameter, are likely to be over 100 years in age. While each main individual shoot can reach a medium age it is eventually replaced; the whole plant can probably achieve a very old age. Very few dead plants occur. New shoots can even sprout from seemingly dead branches or roots. In fact the ground surface seems to erode faster than the life cycle of a tree because roots are often seen growing on the

Figure 6 Flowers from five widely separate plants on Mt Ararat. There is no discernable difference in flower colour, suggesting that the population has a limited genetic diversity.

surface of a slope (Fig. 7). It is evident that rata roots can grow to considerable length, at least several metres, and quite possibly become deeply embedded in perpetually moist rock crevices.

Figure 7 A rata plant, probably many decades old, which has had its roots exposed over time by the erosion of the sandstone. It has capsized as a result, but is still healthily alive.

There are several threats to the rata population, both at Smothering Gully and at Mt Ararat. Natural threats include erosion, wind, snow, frost, drought, disease, invertebrate pests and vegetation succession. However, no signs of disease or invertebrate pests were detected in the field, and erosion of the rock seems to provide opportunities rather than problems for the rata, thereby helping perpetuate it. There was some accelerated erosion on Mt Ararat from the Canterbury earthquake of 4 September 2010. Southern rata is naturally tolerant of wind through its ability to branch easily and to re-sprout. Native vegetation succession does not seem to be threatening to the rata either, mainly because the rata out-competes other native plants on the quartz sandstone. Frost probably occasionally nips new growth, encouraging branching, snowfalls probably damage plants on occasion, and drought is probably highly important in limiting the rata distribution.

Other, more modern, threats are posed by weeds, browsing mammals, fire and forestry activities. The main weeds are radiata pine (*Pinus radiata*), Corsican pine (*P. nigra*), broom (*Cytisus scoparius*) and gorse (*Ulex europaeus*). They are all capable of becoming established in rock crevices and directly on the

sandstone, and are abundant at Mt Ararat, where they are a serious threat to the southern rata. They are less common at the Smothering Gully rata site. If not assiduously controlled, they will overcome much of the rata population. Browsing mammals that threaten the rata are possums, hares, rabbits, deer and goats. Of these, possums are probably of greatest concern, as they are well-documented destroyers of rata. In recent years much work has been done by DoC to keep the weeds and animal pests at bay, but in an economic climate in which DoC is hard pressed for resources, extra help might be appreciated.

It is clear that the reserve is too small to protect the rata in the long term. The most important management recommendation is to expand the reserve in area. If it was expanded to three or four times its existing size, that would vastly increase its ecological viability, allow a buffer zone of native vegetation to develop, provide habitat for rata regeneration and planting, and offer opportunities for modest development for visitors (tracks, picnic areas and the like). The Department of Conservation is raising progeny from the Mt Ararat rata for planting in the reserve or as a stepping stone between it and Smothering Gully.

Canterbury Botanical Society could play an important role in the management and future of this tiny but fascinating gem of a reserve. It would require the development of a protocol between the Society, DoC, the owners of the surrounding land (formerly Ngāi Tahu) and the forest managers (currently Rayonier / Matariki Forests). As the reserve is land-locked within a commercial exotic plantation forest, permission to visit is required both from DoC and the forest managers. What could be more delightful than a visit to this wonderful elevated site on a clear day, with its big vistas, unusual geology and vibrant population of southern rata? Especially if the rata was in flower and there was a job to do such as topping up bait stations, removing wilding pines, planting more rata or checking on existing plantings.

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Reserve, and of Mike Kwant (formerly of Carter Holt Harvey) who looked after the rata for several years.

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Table 1: Numbers of plants of southern rata (*Metrosideros umbellata*) recorded in five size classes on Mt Ararat.

Size class	Height (m)	Number
Small seedlings	<0.1	210+
Large seedlings	0.1 – 0.5	140
Saplings	0.5 – 2	101
Small trees	2 – 4	59
Large trees	4 – 8	43
Total (as at March 2001)		550+