THE VALE OF BELVOIR, NW TASMANIA – OVERVIEW OF GEOLOGY, GEOMORPHOLOGY, VEGETATION AND HUMAN HISTORY

by Keith D. Corbett and Elizabeth (Sib) Corbett

(with two text-figures and ten plates)

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The Vale of Belvoir is a large open grassy valley of striking appearance located northwest of Cradle Mountain. At 800 m altitude, it is Tasmania's only subalpine limestone valley. The unusual geology and human history have combined to give the valley its unique character. The three main geological elements are: the folded Ordovician limestone bedrock, which produced the synclinal valley and numerous sink holes; lava flows of Cenozoic basalt, which have covered parts of the valley floor; and Pleistocene glaciations, which have delivered large amounts of bouldery till to mantle much of the valley floor and redistribute much of the basalt into the glacial deposits to add to the fertility of the soils. The glacial deposits have disrupted the drainage of the valley, so that the Lea River and Lake Lea now drain northwards out of the valley, while the Vale River drains most of the valley and flows southwards to the Pieman system. Dolerite erratics in the glacials indicate that the ice came from the Cradle Mountain area.

The Vale has one of the most extensive and diverse areas of montane grassland in the state and contains several threatened vegetation communities and plant species. The valley provided Tasmanian Aboriginal people with abundant wildlife and shelter, and their burning practices maintained its grassy nature and remnant patches of rainforest. Europeans arrived in the 1820s and grazed cattle from the 1850s onwards; their practice of patch burning the grasslands has been continued by the current owners, the Tasmanian Land Conservancy.

Key Words: Vale of Belvoir, Tasmania, geology, geomorphology, vegetation, glacial history, human history, Aboriginal burning.

INTRODUCTION

The Vale of Belvoir is a large open limestone-floored valley located about 15 km NNW of Cradle Mountain, between the Black Bluff Range to the west and Bonds Range to the east (fig. 1). It is about 10 km long and 2 km wide, and trends northeast–southwest. It is crossed by the Belvoir Road and a power transmission line, but no other major infrastructure or permanent habitation exists. The valley has an open grassy floor flanked by patches of rainforest and eucalypt forest (pl. 1). The shallow Lake Lea lies near the northern end of the valley, and drains northwards via the Lea River, while the main part of the valley drains southwards via the Vale River.

There are many unusual and important aspects to the valley, including its geology, geomorphology, human history, vegetation and fauna. It was probably an important place for the first Tasmanians for many thousands of years, and Europeans have summer-grazed cattle on the native grasses at 'the Vale' for over 150 years. The Tasmanian Land Conservancy (TLC) purchased the freehold grazing leases (476 ha) in the centre of the valley in 2008, and grazing has continued while research has been conducted on its effects.

While not covered here, the Vale also has a diverse fauna community including several state and nationally listed threatened species, and apparently Thylacine *Thylacinus cynocephalus* were once common (Charleston 2008). A comprehensive list of fauna is contained in the BushBlitz 2010 report (https://tasland.org.au/reserves/vale-of-belvoir-reserve/). The TLC has a strong program of research and monitoring of the natural values of the Vale including the impacts of cattle grazing and invasive species (Tasmanian Land Conservancy 2013, 2017, 2019).

The authors have explored the valley numerous times and have updated the geology as previously mapped (Barton *et al.* 1966, Pemberton & Vicary 1988, Vicary & Pemberton 1988), mainly by establishing that much of what had been shown as basalt is glacial till rich in basalt boulders (fig.1). This paper is partly based on an earlier article in the *Tasmanian Naturalist* (Corbett 2012).

Physiography and drainage

The floor of the valley is mainly undulating to flat, with sink holes scattered throughout. A low hill of basalt, Daisy Hill (fig. 1), extends across the eastern half of the valley in the central part, and a smaller hill about 1.5 km to the southwest of this is also capped with basalt. The northern end of the valley is defined by several larger basalt hills to the north of Lake Lea. The valley narrows to the south, and disappears at the Fourways (fig. 1), where the Vale River is joined by two tributaries (Speeler and Fleece creeks) and turns abruptly southwest.

Drainage of the valley is unusual and involves two rivers, one flowing north and the other south. The Lea River

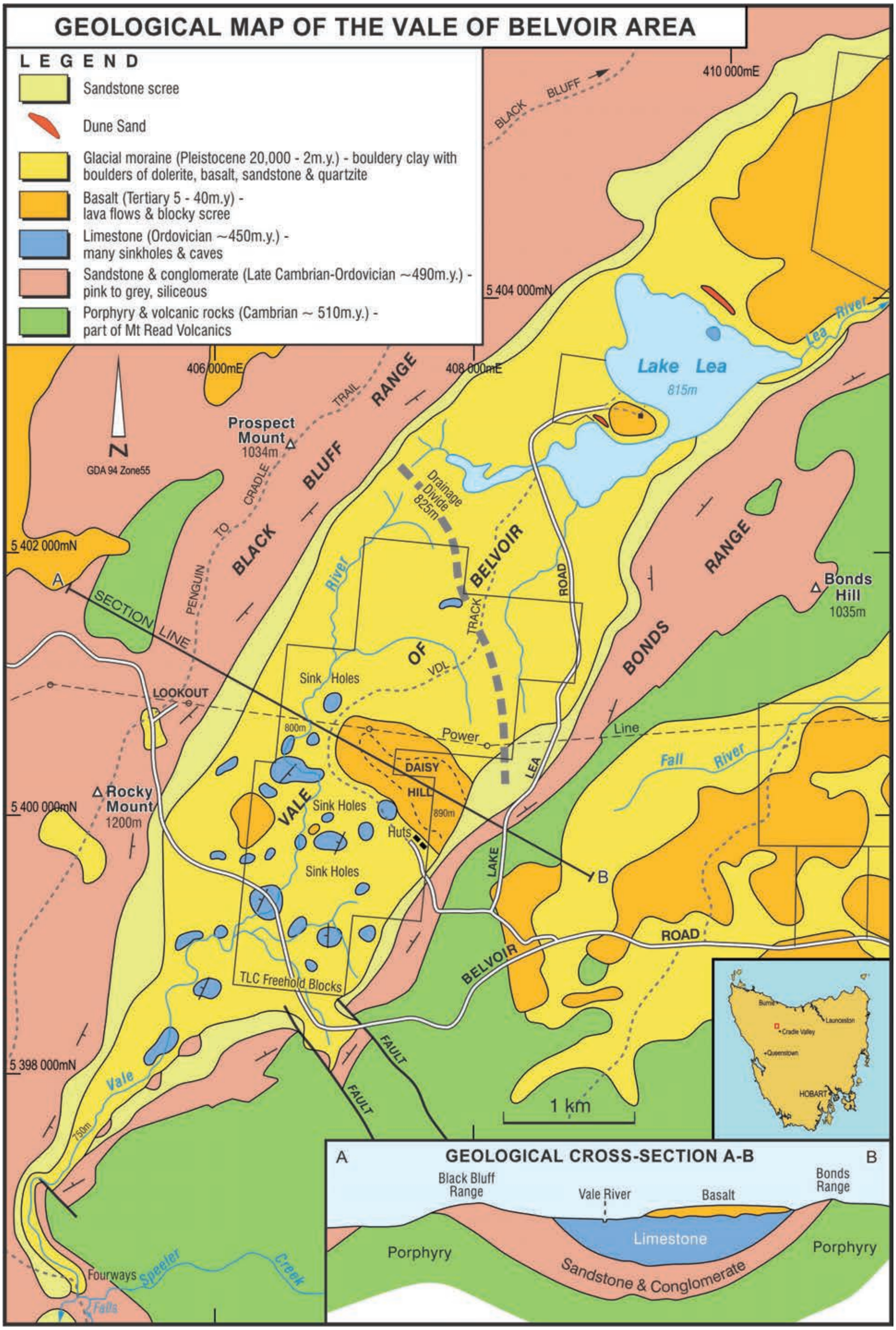

FIGURE 1 — Geological map of the Vale of Belvoir area. Modified after Pemberton & Vicary (1988) and Vicary & Pemberton (1988).

drains from the northeast corner of Lake Lea, and flows northeast through a narrow gorge, joining the Iris and then the Wilmot (via Lake Gairdner) and eventually the Forth to debouch into Bass Strait. A broad low (10 m) rise in glacial till just south of Lake Lea Lagoon separates this system from the headwater streams of the Vale River, which flows south on a meandering course through the main part of the valley. The Vale River exits the southern end of the valley via a waterfall, then flows southwest through a 5-km-long sandstone gorge, over the 25-m Reynolds Falls, before joining with the Fury River to flow into the head of Lake Mackintosh – and eventually via the Pieman River to the Southern Ocean.

The opposing drainage system is the result of the deposition of Pleistocene till, particularly in the area just south of Lake Lea. The lake was probably formed at this stage also, although there may have been an earlier lake formed because of the basalt flows in the Cenozoic.

GEOLOGY

The geology of the valley was first mapped by Threader (1963), in a survey to determine the limestone resources present. This work was part of the regional mapping of the Mackintosh Sheet (1:63 360 scale) for the Geological Survey in the 1960s (Barton *et al.* 1966, Collins *et al.* 1981). The area was mapped in more detail (1:25 000 scale) as part of the Mt Read Volcanics Project within the Geological Survey in the 1980s (Pemberton & Vicary 1988, Vicary & Pemberton 1988, Pemberton *et al.* 1991).

The three basic geological components are: (i) the *Pleistocene glacial deposits*, which cover most of the floor of the valley; (ii) the *Cenozoic basalt*, which forms Daisy Hill and the smaller hill to the southwest and is abundant in the glacial deposits in many areas; and (iii) the *Ordovician limestone*, which underlies the valley and is the primary reason for its existence (fig. 1).

A sandstone and conglomerate sequence, pink to grey in colour, underlies the limestone, and crops out extensively along the Black Bluff Range and Bonds Range. This sequence is an extension of the siliceous rocks, known generally as the Owen Conglomerate or Owen Group, which form the West Coast Range (Corbett *et al.* 2014), although with more sandstone. The sequence becomes thinner to the east on Bonds Range, where it mostly consists of a distinctive grey sandstone with abundant worm burrows known as the Moina Sandstone (Pemberton *et al.* 1991). The Moina Formation is of Middle Ordovician age (~470 Ma), whereas the underlying pink sandstone-conglomerate sequence exposed on Black Bluff Range to the west is part of the Upper Owen Sandstone and of Late Cambrian age (~490 Ma, Pemberton *et al.* 1991, Corbett *et al.* 2014).

Cambrian volcanic rocks belonging to the widespread Mt Read Volcanics succession underlie the sandstone-conglomerate and are exposed in several 'windows' on Black Bluff Range, and on the eastern slopes of Bonds Range. The sequence in the latter area consists mostly of

PLATE 1 — View north from Daisy Hill to Lake Lea, showing summer flowering of daisies (Orange Everlastings and white Grassland Paperdaisy) and rainforest on valley margin.

PLATE 2 — Vale River flowing through limestone outcrops and riverine sedgeland, looking south.

PLATE 3 — Sink hole in glacial moraine north of Daisy Hill.

a large intrusive body of quartz-feldspar porphyry known as the Bonds Range Porphyry (Pemberton *et al.* 1991).

Ordovician limestone

The Ordovician limestone (about 450 Ma) is the same 'Gordon Limestone' which forms most of the other large limestone valleys in Tasmania, for example at Mole Creek, Gunns Plains and the Florentine Valley. However, unlike the Vale, these are all lowland valleys at around 400 m altitude. The limestone is a grey, hard rock which is seen as scattered low knolls of outcrop, and as smaller outcrops along creeks and in sink holes (pl. 2). Bedding is usually visible and solution features are abundant, presumably formed when the land surface was at a higher level. Fossil worm tubes are seen on a few bedding planes, but fossils are otherwise uncommon. Chert nodules are present in the limestone outcrops on the north side of the small basalt hill on the western side of the Vale River.

The presence of a limestone substrate is clearly indicated by the hundreds of sink holes across the valley floor. These are typically 10 to 20 m across, with grassy to muddy walls and floor where the surface material – soil or till or basalt boulders mostly – has collapsed into the top of the cave beneath. Many contain wombat burrows indicating the very large population of these mammals in the valley (Tasmanian Land Conservancy 2013). Some sinkholes have exposed limestone sides, and others have permanent ponds or small lakes in them. Those on the valley floor north of Daisy Hill tend to be larger, up to 40 m across, and some have semi-permanent water (pl. 3). Sink holes within basalt scree persist up the slopes of the basalt hills in some areas. Some caves are known at deeper levels in the limestone but are generally difficult of access (Tasmanian Land Conservancy 2013).

The limestone and sandstone–conglomerate units (and the underlying volcanic rocks) have been folded into a broad *syncline* or elongate basin, which forms the valley, with *anticlines* of the siliceous rocks rising on either side to form the Black Bluff Range and Bonds Range (fig. 1 cross-section). The keel of the syncline is evident to the south, where the valley narrows to the point, at the Fourways, where only the rocks underlying the limestone are present at surface. Bedding in the limestone dips westward along the eastern and central parts of the valley, forming the eastern flank of the syncline, and gently eastward along the western side. A strong sub-vertical cleavage is evident in the few western outcrops, suggesting the possibility of a major fault along the western side of the fold, which occurred during the middle Devonian Tabberabberan Orogeny (360–390 Ma) (Seymour 1980, Corbett 2019).

Cenozoic basalt

Cenozoic basalt flows (10–50 Ma) have buried part of the irregular limestone surface on the valley floor. The basalt flows form the 100-m-high dome-shaped Daisy Hill in the middle part of the valley, the smaller hill to the southwest, a small round knoll of outcrop between these two, and the larger hills at the northern end (fig. 1).

The basalt on Daisy Hill is about 60 m thick, although the base is obscured. The rock is hard, dark grey and fine-grained. The eruptive source is not known, but the shape of the hill suggests the flow(s) may have come from the southeast, outside the valley, where there is abundant other basalt, and flowed down the slope into the valley. The small hill of basalt to the southwest, and the very small (5 m across) outcrop to its northeast, appear to be remnants of a (thin?) flow which has mostly been removed by glacial erosion. The small outcrop has sub-horizontal columnar jointing, indicating cooling from the side. This suggests the basalt may have flowed into, and cooled within, a subcircular depression, such as a sink hole. The overlying part of the flow must have been removed by ice.

Pleistocene glacial deposits

Pleistocene glacial deposits (20 ka–2 Ma) cover most of the valley as an irregular superficial layer ranging in thickness from about 1 m to over 6 m. It is evident in most places as a scattering of erratic boulders of different kinds on the surface and is seen in many sink holes and creek banks as a mixture of boulders and smaller clasts in a clayey matrix (pl. 3). Some of the boulders are over 3 m in diameter and can only have been carried there by ice. The dominant rock type making up the boulders varies from place to place. Basalt is the most common (pl. 4), but there are areas where dolerite (pl. 5), grey Moina sandstone, pink pebbly sandstone and fine conglomerate, volcanic rock types from the Mt Read Volcanics, and irregular ironstone material are dominant.

The thickest morainal deposit appears to be in the area between Daisy Hill and the lagoon of Lake Lea, particularly west of the Van Diemen's Land (VDL) Company track, where a broad low rise of morainal material forms the divide between the north-flowing and south-flowing drainage (fig 1). Basalt boulders are prominent over much of this rise (pl. 4). A similar low rise forms the divide east of the VDL track, but dolerite and sandstone are the dominant boulder types in this area (pl. 5). These surface boulders do not show any clear weathering rinds, but exposures in a creek bank 40 m west of the track in this area show completely decomposed basalt clasts up to 10 cm in diameter (pl. 6), suggesting at least some of the moraine is relatively old (Kiernan 1990).

The widespread and abundant basalt boulders in the till indicate that a considerable amount of the original flow has been eroded and re-distributed by glacial ice flowing across the valley. This erosion appears to have been greatest in the area to the south and west of Daisy Hill, where there are numerous low rounded outcrops of limestone and just a couple of remnants of the original basalt lava flow(s) (fig. 1). The area to the east and north of Daisy Hill, by contrast, has been one of glacial deposition, and the only limestone seen in this area was in several adjacent sink holes beneath a cover of till. This may indicate that some of the ice flowing northwest across the southern part of the valley has been deflected northwards around Daisy Hill.

PLATE 4 — Abundant basalt erratics in glacial moraine, with *Diplarrena* rushland, about 1 km north of Daisy Hill. This area was previously mapped as basalt.

PLATE 5 — Large dolerite erratics in glacial moraine 800 m north of Daisy Hill, looking NW across the valley.

PLATE 6 — Deeply weathered clasts of basalt in glacial moraine, creek bed 1 km north of Daisy Hill.

Blocks of ironstone, or ferricrete, up to several m long lie on the surface of the moraine just south of Lake Lea. They appear to be derived from an area in the northern part of the valley where similar ironstone is exposed in cuttings on the Lake Lea Road. These outcrops suggest that the ferricrete may have been developed on a section of the original limestone sequence which has been deeply weathered and oxidised (possibly during the Cenozoic), rather than being within the glacial deposits. This may explain the pre-Pliocene magnetic age for the ferricrete obtained by Augustinus and Idnurm (1993), in attempting to date the glacial deposits, and the uncertain U/Th dates on the ferricretes recorded by Augustinus *et al.* (1997).

The presence of dolerite in the moraine indicates that the main direction of ice flow has been from the Cradle Mountain area to the southeast – the nearest upslope source of dolerite (as previously inferred by Derbyshire 1968), and that ice has flowed over the lower part of the Bonds Range and diagonally across the valley. Small patches of boulder moraine are found on top of the Black Bluff Range (including along the Belvoir Road near the lookout), indicating that some of the ice flowed out of the valley and over the range to the west. Most of the deposition, however, appears to have been in the valley. Several possible end moraines, in the form of low northeast trending ridges rich in basalt and pink sandstone clasts, were noted against the bottom of the slope just southwest of the Lake Lea Lagoon. These suggest that ice may have piled up against the bottom of the slope in this area.

Other superficial deposits

Two small areas of clean coarse sand have been mapped near Lake Lea (fig. 1) and appear to be remnants of former dunes (Pemberton & Vicary 1988, Vicary & Pemberton 1988). The larger one is approximately 100 m north of the northern shore of the lake, and is vegetated, about 1.5 m high and 100 m long. The smaller one is located on the southern side of the basalt isthmus on the western side of the lake and is not as well preserved. Their location on the north side of stretches of open water suggests a relationship to a prevailing southerly wind, and they probably record a period of wind erosion (deflation) in the late Pleistocene, similar to the Pleistocene dune features seen in many parts of inland and coastal Tasmania (Colhoun 2014). Lake Lea itself, however, is thought to be mainly due to damming by glacial deposits and possibly basalt.

A thin layer of sandstone scree is present along the foot of the slope of the ranges on both sides of the valley and appears to overlie the glacial deposits. Small areas of alluvial sand and silt are present along the Vale River and in places around Lake Lea but have not been separately mapped.

We have not examined the soils in the Vale of Belvoir, but it is likely that most are derived from glacial deposits and would be influenced by the composition of the till – particularly the presence of abundant basalt. Actual alkaline limestone soils could be mainly restricted to streamside areas and limestone outcrops lacking the glacial cover.

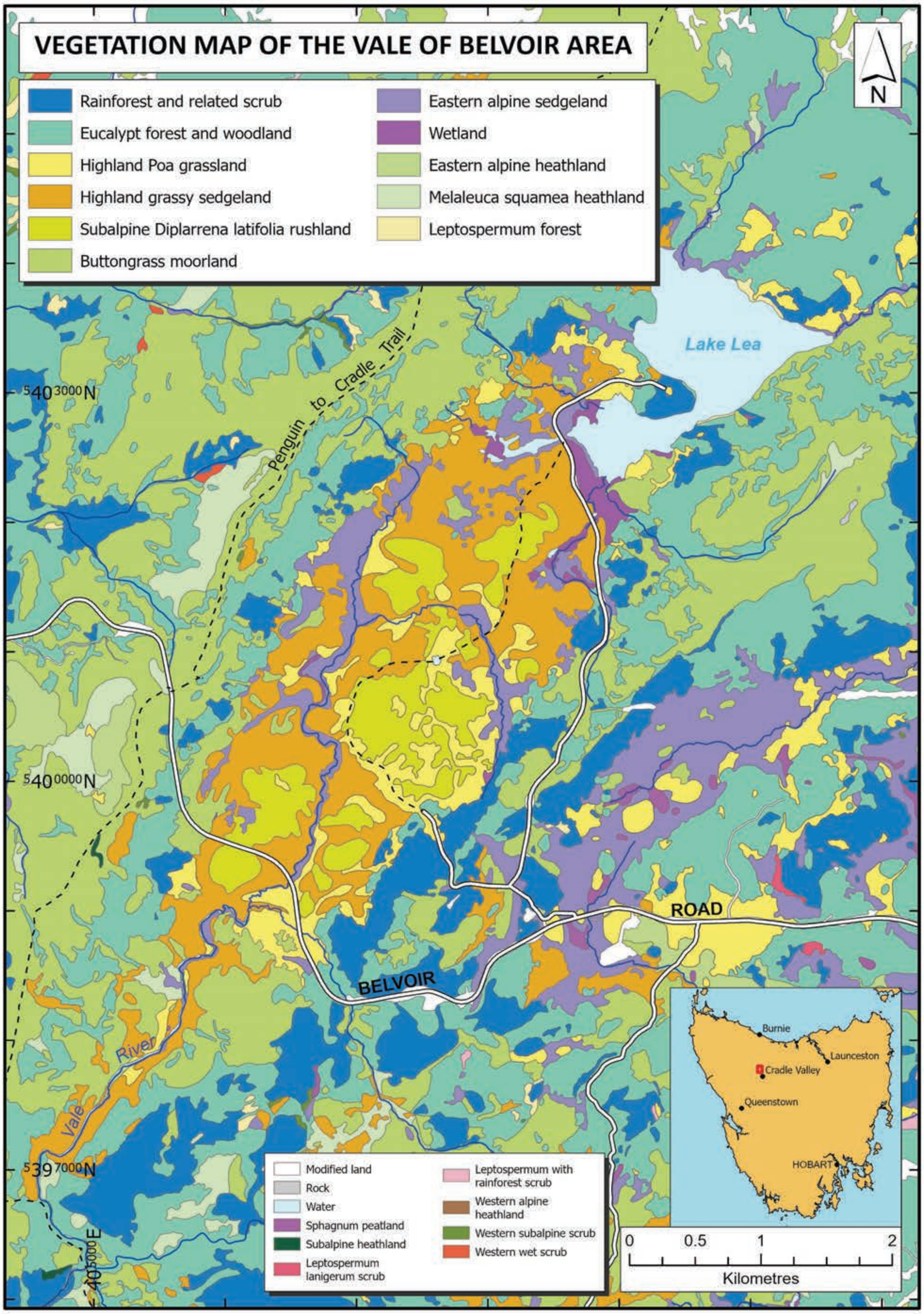

FIGURE 2 — Vegetation map of Vale of Belvoir area. Prepared from TASVEG LIVE data by L. Mitchell for the authors. Original TASVEG mapping by Sib Corbett.

VEGETATION

The Vale of Belvoir is one of the most extensive and intact highland grassland ecosystems in Tasmania, with exceptional floristic diversity compared to other Tasmanian highland grasslands (Tasmanian Land Conservancy 2013). It includes considerable areas of threatened and rare communities and at least eight rare and threatened plant species, in addition to many spectacular flowering plants. The grassy communities occur mostly on the treeless valley floor, extending over approximately 10^2 km (fig. 2). Narrow patches of rainforest and eucalypt forest border the grasslands on the sides of the valley, merging into buttongrass and heathy to scrubby moorland on the slopes and tops of the ranges. Buttongrass is also present in parts of the valley (pl. 7).

The Vale provides perhaps the most spectacular flowering of mountain daisies anywhere in Tasmania, mostly due to the swathes of Orange Everlastings *Xerochrysum subundulatum*, which blaze across the valley floor and on Daisy Hill in late January–February (pl. 1). In places these are mixed with sweeps of the rare white Grassland Paperdaisy, *Leucochrysum albicans* ssp. *tricolor*.

Over 12 vegetation communities occur at the Vale (TASVEG 4 and TASVEG Live mapping), of which five are listed as threatened under the Tasmanian *Nature Conservation Act 2002* (Tasmanian Land Conservancy 2013; CR Dickson, pers. comm. 2022). Three of the threatened communities, Highland Poa Grassland, Highland Sedgy Grassland, and Subalpine *Diplarrena latifolia* Rushland, (fig. 2), are concentrated in the central part of the valley between Lake Lea and Belvoir Road.

Vegetation communities

The Highland Poa Grassland is dominated by *Poa labillardierei* Silver Tussockgrass and *Poa gunnii* Gunns Snowgrass, with other grass and sedge species and some important inter-tussock herbs such as *Stylidium graminifolium*, *Viola hederacea*, *Gentianella diemensis* and *Euphrasia collina.* This grassland community is best developed around the Daisy Hill area (pl. 7), where it inter-grades with *Diplarrena* rushland.

The Highland grassy sedgeland is the most abundant vegetation community and is best developed in the lower parts of the valley floor, particularly in the north around the Lake Lea Lagoon (pl. 8). It is dominated by the sedges *Lepidosperma filiforme* and *Carex gaudichaudiana*, with the rush species *Baloskian australe* and *Eurychorda complanata*, plus *Poa* spp and *Gleichenia alpina* (Alpine Coral Fern).

Subalpine *Diplarrena latifolia* rushland is dominated by the white-flowering Western Flag-iris *Diplarrena latifolia* and appears to favour the slightly higher and better-drained areas of the valley floor. There may also be a preference for areas with more basalt in the substrate, such as around Daisy Hill (pl. 7), the basalt hill to the southwest of this, and the basalt-rich areas of moraine to the northwest (fig. 2, pl. 4). Grasses, Mountain Rocket *Bellendena montana* and other small flowering plants can be present between the tussocks.

Wetland is another threatened community and occurs mainly around the southern shores of Lake Lea and as small patches along the Vale River. *Lepidosperma*, *Carex* and *Baloskian* are typical, with thickets of *Richea scoparia* in places. There is a close spatial relationship to the Eastern Alpine Sedgeland, which forms strips along the river (pl. 2) and some of the creeks in places. A few small patches of Alpine sphagnum bog are present on some drainage lines, but too small to be seen on figure 2.

Nothofagus-Atherosperma rainforest occurs as patches along the valley sides and at Lake Lea, with sharp boundaries to the adjacent grassy areas in many places. These cool, shaded forests are typically open callidendrous, with mixed-age Myrtle *Nothofagus cunninghamii*, including some ancient trees. The forests provide cover for the many marsupials which graze the valley, and their distribution suggests they could be remnant patches after long-continued Aboriginal burning.

Eucalypt forest and woodland tends to alternate with the rainforest patches along the valley sides, and in places forms a fringe to the rainforest. Included within this type are patches of *Eucalyptus gunnii* woodland of significant conservation value. Important understorey species include Mountain Pepper *Tasmannia lanceolata*, Mountain Currant *Coprosma nitida*, and Cheesewood *Pittosporum bicolor*.

Threatened plant species

Of the rare and endangered plant species present, the most spectacular are the Nationally Endangered daisy *Leucochrysum albicans* ssp. *tricolor* Grassland Paperdaisy, with its white flowers and pink bracts (pl. 9), and the similar rare *Rhodanthe anthemoides* Chamomile Sunray. Recent surveys indicate that the former has its largest population in the state at Daisy Hill, while the latter typically grows on limestone banks, including along the Vale River. Other rare plants include: *Stackhousia pulvinaris* Alpine Candles, a small, matted herb with star-like white flowers – quite different from the familiar upright candles – mostly found growing around the upper clayey slopes of sinkholes (pl. 10). This species was thought to be restricted to the Vale of Belvoir, and nearby Speeler Plains, but has recently also been found on the Central Plateau (James Wood pers. comm.); *Muehlenbeckia axillaris* Matted Lignum, another small groundcover with fleshy leaves and white flowers, which favours rocky sites; *Viola cunninghamii* Alpine Violet; *Argyrotegium poliochlorum* Greygreen Cottonleaf; and *Scleranthus brockiei* Mountain Knawel. A rare leek orchid *Prasophyllum tadgellianum* is also present.

COMMENTS ON ABORIGINAL HISTORY

Aboriginal bark shelters were seen in the Vale by VDL cattle drovers in the 1820s, and there is even a record of an Aboriginal bark drawing in one of these shelters of a bullock dray which had recently passed by (Haygarth 1998). Several Aboriginal rock artefacts have been found and registered by the authors in a rainforest patch on the western side of the valley.

PLATE 7 — View south from Daisy Hill showing dense *Diplarrena* rushland in foreground, cattle grazing of *Poa* grassland below, rounded outcrops of limestone, golden buttongrass further south.

PLATE 8 — Grassy sedgeland, sedgeland and wetland around Lake Lea Lagoon, looking northeast.

PLATE 9 — Grassland Paperdaisy *Leucochrysum albicans* ssp. *tricolor* at the Vale.

PLATE 10 — Alpine Candles *Stackhousia pulvinaris* from sink hole at Vale of Belvoir. Large leaves are *Velleia montana*.

However, the patches of rainforest along the edges of the valley (fig. 2, pl.1, pl. 5) appear to be remnants of a more extensive forest which likely covered more of the valley but has been reduced to remnants by long-continued burning – presumably by Aboriginal people. The patches are typically surrounded by eucalypt forest, scrub or buttongrass vegetation which is clearly related to fires. Some recent fires have followed these burnt leads from the valley floor up the slopes of the range. There are no apparent geological, edaphic or drainage factors specific to the present rainforest areas, and suitable conditions for rainforest, in the form of reasonably fertile soils (on glacial till for the most part) and moderate to good drainage, occur over a large part of the valley floor. We know that Aboriginal burning was carried out in many places in western Tasmania to encourage grass growth for wildlife (e.g., Jones 1969, Reid *et al.* 1999, Gammage 2012), and that burning of rainforest in areas of such fertile basaltic soils can result in the direct establishment of native grasses (Ellis 1985). Clearing of the rainforest and its replacement by grassland would have been a long process, and while Aboriginal burning seems the likely explanation, it may not be the only cause.

EUROPEAN HISTORY

The Vale of Belvoir was named in 1827 by Joseph Fossey, after the well-known valley of that name in Leicestershire, England. Fossey was on a surveying expedition for the VDL Company, looking for a stock route from Mole Creek to their holdings at Surrey Hills, south of Burnie. The route delineated by Fossey and Henry Hellyer, the other VDL surveyor, was via the Middlesex Plains and Vale of Belvoir, thence over the Black Bluff Range towards St Valentines Peak. The route became known as the 'Western Road' or 'VDL Road', and was used to drive cattle herds, and for general access, for about 30 years. It followed an earlier Aboriginal track, also sited to take advantage of the open country south of the belt of dense forests, with large unbridged rivers, which then extended to the north coast (Haygarth 1998). A rough 4wd track which runs down the valley is still known as the 'VDL track' (fig. 1).

Cattle were summer grazed in the area from about the 1850s, firstly by the Field family, then by George Moon (who built the first hut camp at the Vale in the 1880s), then by the Williams family from Narrawa, near Wilmot. George Williams also ran a summer dairy herd and operated a cheese factory at the Vale in about the period 1915–1935. The discarded whey from the cheese-making was apparently very popular with the local thylacines and tiger snakes! (Haygarth 1998, Charleston 2008). Another unusual venture in the area was by a Canadian, Percy Davis, who purchased land for farming at Lake Lea in the 1890s and tried (unsuccessfully) to grow wheat in ploughed ground near the southern shore.

The Charleston family from Wilmot took over the grazing leases from the Williams through the 1960s, and continued the general grazing practices, including mosaic burning of the grasslands in September to October, for between 100–300 cattle, including calves. A small house and stables, located in a sheltered side valley on the eastern side of the Vale, were established in about 1975. The annual cattle drive with horses from Wilmot and back were memorable events for the family (Charleston 2008). The family sold the 473 ha Vale property to the Tasmanian Land Conservancy in 2008, retaining the right to continue summer grazing as part of the agreement (Tasmanian Land Conservancy 2013).

Initial research conducted by TLC and the Parks and Wildlife Service on the impact of grazing and burning on the grasslands showed that the practices were generally beneficial to biodiversity, in part by maintaining the openness between the tussocks which allows the smaller flowering plants to thrive. Further research has shown that burning is the most important factor on species richness, with grazing having a smaller influence (Leonard & Kingdom 2017, Tasmanian Land Conservancy 2017). This fact, combined with some negative aspects, such as trampling of wetlands, led to a decision to review the grazing activity in 2018. The area around the freehold blocks is now incorporated into the Vale of Belvoir Conservation Area, established in 2000, managed by PWS (Tasmanian Land Conservancy 2013).

Prospectors have searched the Vale and surrounding areas for gold and other minerals since the mid-1800s, with several small mines established on the slopes of the Black Bluff Range further north (Haygarth 1998). Surviving remnants at the Vale from this time include a 100-m-long trench dug through glacial moraine in rainforest on the eastern side of the valley 1.5 km south of Daisy Hill, and a small adit just west of the Charleston's house.

CONCLUSIONS

The striking appearance of the Vale of Belvoir, with its treeless grassy floor bordered by rainforest and eucalypt forest, is the result of its unusual geology and human history. The valley was originally formed by solution weathering of the limestone, and this accounts for the mosaic of sink holes. Basalt flowed into the valley in the Cenozoic and may have covered much of the floor. Much of this was then removed by glacial ice in the Pleistocene, and re-distributed through the valley. The ice flowed out from the Cradle Mountain area multiple times and diagonally across the valley. Maximum deposition was in the area just south of Lake Lea, forming a low divide and causing the bi-directional drainage. The presence of abundant basalt in the glacial deposits may have 'sweetened' the soil and encouraged the development of native grasses when burning of the valley was carried out by Tasmanian Aborigines over a long period. This seems the most likely explanation for the remnant patches of rain-forest. European graziers have continued the practice of patch-burning the grasses to maintain the botanical diversity and appearance of this special place.

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