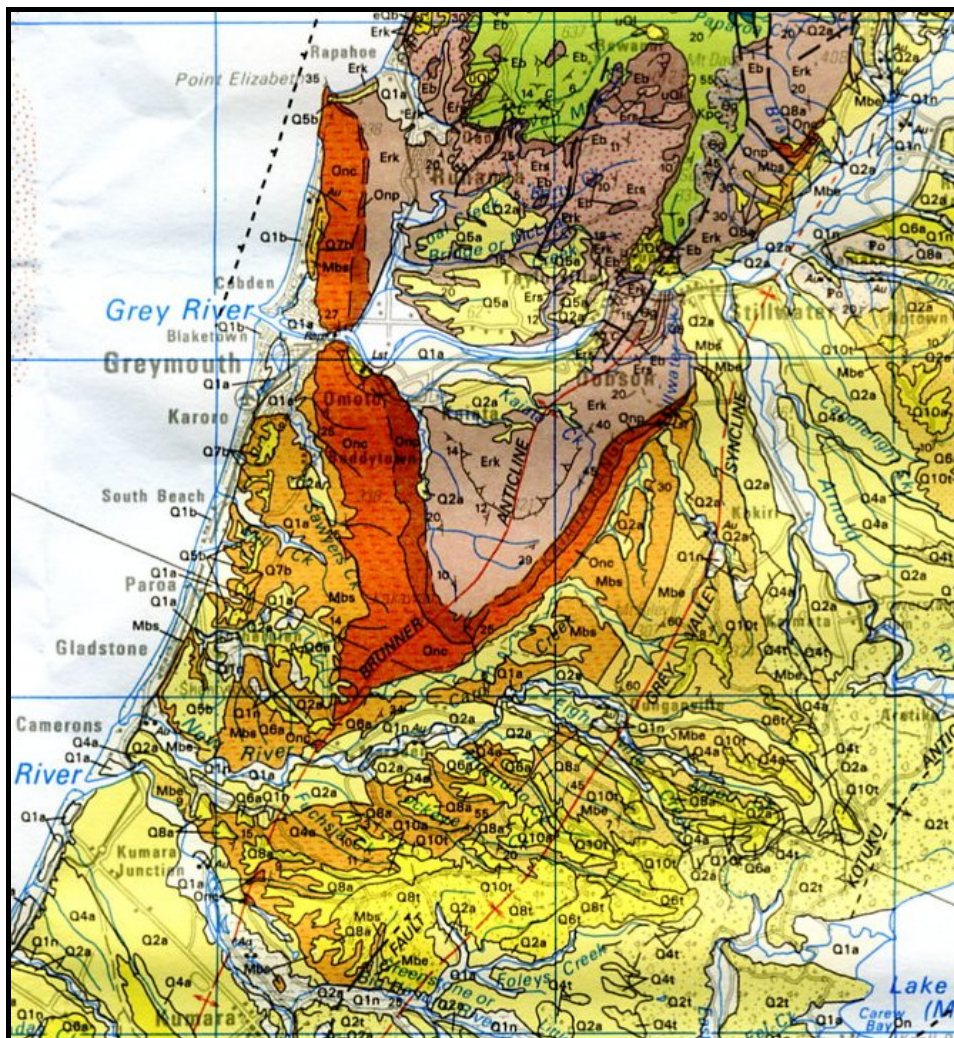


## Cave & karst management in the Grey District of the West Coast of the South Island, New Zealand

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Map: excerpt from Greymouth 1:250,000 Geological Map 2002. The Cobden Limestone forms the “horseshoe” shaped outcrop either side of the Brunner Anticline. Further south at Marsden and Cape Terrace there are other small outcrops along the axis of the anticline.

### KEY (relevant strata only)

Glacial Gravels	Q	Holocene & Quaternary Oxygen Isotope Glaciation Stages
Stillwater Mudstone	Mbs	Tertiary Marine Mudstone
Cobden Limestone	Onc	Tertiary Limestone/Nile Group
Kaiata Mudstone	Erk	Tertiary Marine Mudstone
Island Sandstone	Ers	Tertiary Marine Sandstone
Brunner Coal Measures	Eb	Tertiary Lacustrine Carbonaceous deposits

*NOTE: As the karst and caves in this area are formed from two quite different strata, this paper is in two parts.*

## **Part I: Cobden Limestone**

### **Geology**

The geology of the Cobden Limestone is perhaps better known than that of the other Oligocene Nile Group Limestones further north up the West Coast, not because the limestone is of particular interest, but because it lies between two major economic resource areas, the coal measures of the southern Paparoas and the gold bearing glacial gravels covering much of North Westland's lowlands.

In the search for coal and associated petroleum resources, over 60 wells have been drilled in North Westland since the 1930s. This has revealed that the Cobden Limestone underlies most of the area from Runanga south to the Arahura River (at least) and from the coast inland to Lake Brunner. Limestone was only absent from drill cores taken from the Kawhaka-1 Well, east of Hokitika. Geologists view the Cobden Limestone as a reliable seismic reflector in their explorations for coal, oil and gas.

The Cobden Limestone outcrops in a horseshoe shape astride the axis of the Brunner Anticline as it begins to plunge south-west. This plunge has formed an eastern limb (the Kaiata Range) and a western limb (the Peter Ridge – Rapahoe Range). These ranges are characterised by narrow steep escarpments and wider dip slopes. To the southwest, along the axis of the Brunner Anticline, there are also small limestone outcrops at Marsden and Cape Terrace, both cavernously forming.

Cobden Limestone is a variable rock, described by Nathan as "as a fine-grained creamy-white to light brown-grey muddy micritic limestone, locally containing interbedded bands of calcareous mudstone." With rare exceptions, analysed samples from throughout the formation contain less than 80% CaCO<sub>3</sub>, most being in the range 70-75% CaCO<sub>3</sub>. The exceptions have been in samples have been taken from Fireball Creek at Cape Terrace and the Lisbon - Stillwater Creek area near Stillwater. The very highest assays in the area actually come from a higher horizon, the Tindale Limestone Member within the Miocene Stillwater Formation. This highly localised polyzoan and foraminiferal limestone, containing

ample macrofossils, can be found in the Eassons Hill - Alexander Street area of Greymouth township.

A full section through the Cobden Limestone can be viewed at the Grey River Gorge where the river has cut right down through the formation (to over 50m below river level at the road bridge). This section showed sufficient diversity in 1974 for DSIR Geologist Simon Nathan to further subdivide the formation, from lowest to highest, into the Ngarimu Limestone Member (ncn: comprising 175m of interbedded muddy limestone and calcareous mudstone in thin bands), the Tarapuhi Limestone Member (nct: comprising a massive, hard, light grey to light brown muddy limestone) and the Puketahi Mudstone Member (ncp: comprising of 120m of grey, moderately hard, highly calcareous mudstone with interbedded bands of white muddy limestone).

At Point Elizabeth only the top two members are in evidence with Te Ana Puta Cave and the many sea-stacks being formed in Tarapuhi Limestone. The Puketahi Mudstone is exposed for about 800m along the coast south of Point Elizabeth. Coastal erosion here has produced some interesting coastal landforms. Karst features in the Grey River Gorge area include, on the Cobden side, Cobden Cave, the grikes and tomos behind Kells hotel and the cave behind the quarry wall. On the Greymouth side there is a creek which emerges from an unnamed cave by the rail bridge and the tomos and grikes off the Kings Park Walking Track. A cave, used as a Maori burial site was quarried away in the 1880s.

There are many other tomos and small caves in the Rapahoe Range - Peter Ridge - Kaiata Range area. While some of the tomos are quite deep (a 75m deep hole was explored behind the Cobden Cross in the 1970s) most of the caves found to date are relatively small and muddy. In some places this is both a function of the muddiness of the limestone and development such as goldmining, logging and farming. These two factors are compounded at Limestone Road where underground drainage, which emerges from Welshman's Cave as Saltwater Creek, struggles to cross the still rising Brunner Anticline (3mm/yr). The once pristine formations in the related Cleopatra's Bath are now very muddied (not to mention vandalised and covered with graffiti). A study will be carried out to survey and then monitor the underground drainage in this area.

## **History**

The karst and caves of the Cobden Limestone have been far more impacted by human endeavour than any of the other limestone areas of the West Coast region. The Maori inhabiting pa on both sides of the Grey river had only “minimal footprint” on the karst with their huts, gardens and network of foot-trails (e.g. along the Peter Ridge and around Point Elizabeth). Their only recorded use of caves was to utilise a small cave for burial purposes. The few explorers and prospectors in the area prior to 1860, many of whom relied on Maori guides and hospitality, also had minimal impact on the karst.

Then in 1864 things changed for all time. Payable gold was found at the Greenstone and by 1865 Europeans were flocking to the West Coast in droves, coming overland from Canterbury and by ship to the river ports at Hokitika and the Grey. After a number of rushes to creeks in the Hokitika area some experienced Californian miners recognised the potential of the black mineral sands on the beaches and these were rushed too. When the main beaches were exhausted of gold interest turned to the older raised beaches coast, such as Darkies Terrace on the south side of Point Elizabeth.

On June 7th 1866 an article in the Grey River Argus noted that a dam put in by miners at Darkies Terrace had failed, with all the water draining away down a “well like fissure about thirty feet deep.” Their curiosity piqued the miners lowered one another down on ropes and found “a very extensive cavern, the lofty roof of which was studded with stalactites and petrifications. The appearance of the cave is described by those who entered it as exceedingly beautiful, and well worth the trouble of reaching it.” This is the first non-Maori record of any limestone cave found on the West Coast.

The problem of getting water to work beach sands or glacial gravels directly overlying limestone meant that the workings at both Darkies Terrace and Limestone Road at the south end of the Peter Ridge were given up on rather than worked out. At both places the karst has been much impacted upon by mining. At Point Elizabeth the many gold workings, water-races and dams have probably made some changes to the caves below while mining Limestone Road was followed by farming and logging in the head of Saltwater Creek.

Further gold mining was carried at both places during the Great Depression.

By the turn of the 20th century some Greymouth people had developed an appreciation of the scenic values of the limestone hills behind the town and moves were made to protect some areas. The Rapahoe Range Scenic Reserve, including Point Elizabeth, was gazetted in 1910 and the Marsden Caves Scenic Reserve, incorporating part of the old Limestone Diggings was gazetted in 1917. The impetus for the latter came from local people desirous of protecting a small, but well decorated cave (Cleopatra’s Bath). Sadly a recommended gate was not put in place to limit access to this cave and during the 1920 – 30s the many visitors damaged formations and left an abundance of carbide graffiti. Attempts to reverse this gazettal were made in the 1950s by timber millers but this was denied by the Lands & Survey Department. In 1987 further land adjoining land was reserved by the NZ Forest Service as Card Creek Ecological Reserve. Management today here by DOC is low key and the one track up Kakawau Peak is maintained by the West Coast Alpine Club. The track climbs through a fine stand of podocarp forest and passes numerous tomos, most of which have not been explored.

One spinoff of all the goldmining around the Welshman’s – Limestone Road area were the many finds of moa and other bird bones in small caves and fissures in the limestone. Sufficient were found for the goldminers to call one area along Saltwater Creek, Moa Flat. As recently as 1977 local man Peter Neame found bones from moa, coot and kiwi in a sinkhole which were identified by the Canterbury Museum specialist Ron Scarlett.

By far the biggest impact Europeans have made is to the limestone cliffs on both sides of the Grey River Gorge. These used to come right down to water level on both sides before quarrying was carried out to create access upriver and provide rock for river-works. Sadly quarrying the Greymouth side was done at the expense of a Maori burial cave and large tomo, described in an article by Hindmarsh in the Grey River Argus, 1922 as an “extraordinary cave or great shaft-like opening in the limestone, some 50 or 60 feet deep.” Initial quarrying in 1868 opened up a cave entrance to the bottom of this tomo and canny locals made quite a good business of taking visitors through to view the stream. However

further quarrying destroyed this too in the 1870s and the only remnant of this feature today are two underground streams which emerge immediately downstream of the new rail bridge works.

The Maori burial cave did not go without dissent. Werita Tainui, last of the Poutini Ngai Tahu chiefs who sold the West Coast (barring a few hard argued native reserves) to James Mackay for 300 pounds on May 21st 1860, only gave consent after a toha was brought down from the North Island to lift the tapu on the removal of his family's remains. Access to this cave had been by climbing a tree so the cave must have been mid-cliff and of reasonable size as at least a dozen family members were buried there between 1854 and 1868. In his last years Tainui insisted that he wanted to be buried near where his ancestors had been buried so upon his death in 1880 he was entombed at the foot of the cliff near the former cave. The place today is marked with a simple iron cross at the side of the footpath.

### **Management Issues**

The following issues are directly related to the fact that most people living or working on or about the Cobden Limestone have no understanding of karst hydrology. Most do not connect the many "mine shafts" with underground streams until there is a flooding problem. Local body knowledge is also limited and some poor decisions have been made in the past because of this. Key issues are:

*The propensity of local people to treat tomos and sinkholes as rubbish pits*

This can be seen in a number of places between Point Elizabeth and the far end of the Peter Ridge. Polluted groundwater can be also be found in some places, e.g. from water emanating from the Cobden Quarry cave and in the Saltwater Creek - Limestone Road area. Dead sheep are regularly thrown into a tomo here.

*The failure to understand ground water behaviour*

For instance a creek used to drain from the face of the Cobden Quarry until it was blocked by blasting activity about 60 years ago. No great concern seems to have been placed upon this until December 7th 1953 when overnight Greymouth had 12 inches of rain. By morning so much water had backed up inside the hill behind the blocked stream exit it began to resurge from places it had

never come from before. Much flooding and damage was caused because of this in properties along Bright Street between the quarry face and Weld Street. However instead of unblocking the natural drainage the Borough Council spent thousands of dollars on the provision of new drainage should the flooding re-occur (which it has).

*The practice of building homes on the limestone hills*

This was done both for the view and to escape Grey River floods. So many problems have been encountered with this practice since the town's inception that the District Council today has a slope hazard policy which restricts building and /or further development on the limestone hills. There are records of both rockfall and slope failure, especially when clearance, then development has taken place on mudstone over limestone. The very large Omoto Slip (over 10 acres) which quietly carried off several houses overnight in October 1954, is an ongoing problem between Greymouth and Kaiata. Transit NZ recently released a report stating that that road and rail buckling will continue here as a permanent fix would be extremely costly.

*Lack of leadership from government agencies*

Despite the fact that the Greymouth- Mawheranui DOC Area Office is located in the town, and are managers of a large karst area, none of the staff have specific training in karst values. Expertise exists at the Buller - Kawhitiri DOC Area Office, but currently cave and karst assessment / management work is limited to the Buller area only..

### **Management Groups responsible for Caves & Karst in the Cobden Limestone:**

*Department of Conservation*

The Greymouth - Mawheranui Office DOC office is the largest manager of Grey District karst, including the Rapahoe Range, Omotumoutu and Marsden Scenic Reserves and the Card Creek Ecological Reserve. The office maintains only one walking track at Point Elizabeth, despite the large area under their management. Lack of resources (monetary, personnel) are a barrier to opening other tracks on the karst or carrying out any specific karst studies.

#### *Grey District Council*

The council maintains a number of short tracks to viewing points on the limestone on both sides of the river and to the Cobden Cave. There are safety issues regarding barriers around tomos and at the cave. The council has a slope hazard policy in place, which any proposed development on the limestone slopes is subject to, because of landslide risk. Heavy local downpours can cause underground drainage to overflow, causing urban flooding in both Greymouth and Cobden.

#### *West Coast Regional Council*

The Regional Council is both owner and manager of the Cobden Quarry. In February 2005 it was announced that the quarry would close and be rehabilitated in conjunction with community group "Progressive Cobden" after remaining useable rock is removed. This work will markedly improve one gateway to Greymouth.

#### *Timberlands West Coast Ltd*

Part of Timberlands pinus radiata plantings at Cape Terrace is over karst in the Stillwater - Fireball and Tansey Creek catchments. Here there are caves, tomos, gorges and a stream capture from one catchment to the other. The company are aware of the significance of this karst, having had an assessment of the area made on the DOC template, and are seeking best practice advice for future management. Sedimentation of the streams and caves has been a problem in the past.

#### *Mawhera Incorporation – Ngai Tahu*

Mawhera Inc are owners of lower Peter Ridge. They have permitted a neighbouring landowner to remove overhanging rock from their land for safety reasons. Ongoing rock removal at the site has created further instability problems. The rockfall and safety issues here, plus potential for uncovering an underground stream, need better management.

#### *Private Landowners*

Many people own properties backing onto the limestone at Cobden, up the Omotumotu Valley and out through Boddytown to Welshmans and Marsden. Much of this land has been gold-mined, logged and/or farmed without care as to karst drainage. In the past year local cavers have seen domestic rubbish, old cars, dead animals and sediment from land clearance in tomos and caves. Fossils found in the Limestone Road area are

valued by local people but their attention also needs to be drawn to other values in their karst environment.

#### **Some cave/karst features in Cobden Limestone**

Coastal Karst Point Elizabeth  
Te Ana Puta Cave, Point Elizabeth  
Rapahoe Range tomos (Cobden Cross)  
Grey River Gorge & Tainui's Cave  
Saltwater Creek - Welshmans Cave system  
Cleopatra's Bath, Limestone Road,  
Marsden Cave, Marsden  
Fireball Ck, Tansey Ck Gorges, Cape Terrace  
Whiskey Cave, Cape Terrace  
Stream capture to Tansey Ck, Cape Terrace

#### **Recommended Reading**

1. Some Cave and Water Passages in Grey District, HN McLeod, Transactions of NZ Institute, Vol. XXXVI, pp 479 – 80, 1903
2. Tales of the Golden West, "Waratah" (Hindmarsh), 1906: Chap.V, p.46, "A Ride to Point Elizabeth"
3. Guinness and His Days, FA Kitchingham, 1965
4. Te Ana Puta Cave, Pt Elizabeth, West Coast: M Trayes article, NZSS Bulletin Vol 9, No 176, 1995
5. Point Elizabeth, an Example of New Zealand's Natural Heritage, Mary Trayes, unpublished Massey Paper, 2000
6. Evolution of the New River Drainage System, Westland, Jane Soons article, NZ Journal Geology & Geophysics, 2001, Vol.44 pp 137 –143.

#### **Maps**

1. Geological Map, PG Morgan, 1911, NZ Geological Survey
2. Greymouth Geological Map & Handbook, Sheet S44, 1:63.360, Simon Nathan 1978, DSIR
3. Geology of the Kumara – Moana Area, Map & Full Text, Sheets J32 & Part K32, 1:50,000, RP Suggate & T Waight, 1994, GNS.
4. Geology of the Greymouth Area, Map & Handbook, Map 12, Q Series, 1:250,000, 2002, GNS.

#### **Part II: Island Sandstone**

##### **Geology**

An area of cavern forming Island Sandstone lies between the Twelve Apostles - Rapahoe Range and the main Paparoa Range and stretches inland from the coast at Rapahoe to Dunollie. The cavernously forming area is only a small part of this formation which overlies the Brunner Coal Measures in many places on the West Coast, e.g. in the Truman Track area at Punakaiki.

In the Dunollie area Island Sandstone overlies a thin strata of Brunner Coal Measures which in turn overlie the various horizons of the Paparoa Coal Measures. Coal from both strata has been mined over the last 100 years and the general area has long since been set aside as a State Coal Reserve. Currently the area is managed under the Crown Minerals Act by the Ministry for Economic Development.

Island Sandstone is sufficiently calcareous here to form caves with one cave in particular being quite large and robust. This is the cave into which the waters of Cavern Creek sinks. No resurgence has ever been found for this water although freshwater springs, which fishermen report offshore at Rapahoe, may be tied in with this. There are also a number of other small, fairly muddy caves including Abbey and Tramway Caves plus sinkholes and tomos. A small unnamed creek which crosses the upper end of Herd Street is often dry, its waters having sunk about 500m upstream. A spring in the back yard of the last house on the left in this street may be the resurgence for this water.

Anyone prospecting for caves in the area today will also come across a number of abandoned mines, numerous drill hole sites where coal prospecting has been carried out and the large development and infrastructure surrounding the large new mine at Spring Creek. Here modern mining techniques are being used to access coals from the Paparoa Coal measures underneath the Island Sandstone. It is planned to eventually tunnel underneath Cavern Creek in order to follow the coal down and out under the sea. This has the potential to destabilise the overlying strata and make trips into the cave unsafe.

The whole of the Greymouth Coalfield is broken up by numerous faults trending north-eastwards and mining is generally difficult because of this. There is potential for water working its way underground via the joint and bedding planes in the cavernously forming Island Sandstone to be

diverted into the mine, given the large scale of the mining and the nature of the country.

### **History**

Cavern Cave has been known of since at least the turn of the 20th century. Geologists of the NZ Geological Survey of the time were mostly charged with finding economic resources but maps and reports also included features such as caves. It is probable that prospectors looking for payable coal and some early residents (Runanga and Dunollie were built for the coal mining industry in 1905 -06) also visited Cavern Cave and perhaps came across other small caves, but there are very few records of this.

A number of adventurous locals visited the cave during the 1950 - 60s and it was surveyed in the 1970s by members of the Greymouth Caving Group led by local cave enthusiast, Graham Love. During the 1980s Greymouth High School Outdoor Educations students began visiting the cave under the guidance of Bill Gilbertson and Marc Paterson and in the early 1990s the Wild West Adventure Company began using the cave for adventure caving trips.

Clients of the tour operator are the most frequent visitors to the cave today. School and local use has dropped off as access has become more difficult. Modern safety requirements and the development surrounding the new Spring Creek Mine mean that vehicles going into the mining area must now have flashing lights. Access is further hindered by a length of fencing to keep dogs out to protect kiwi. Those going to the cave must have a key to the gate through the fence or take a long detour to go round it. Access to other caves in the area is generally less restricted.

### **Management Issues**

There are two main management issues at Cavern Cave. The first is the conflict of interest between the two main user groups in the area. Whilst Wild West have complied readily with the mining company's safety requirements about access, there is a real need for more dialogue between the two groups given that expansion of the mine has the potential to destabilise the cave and put the tour operator out of business.

A similar lack of empathy by those in mining industry toward both the environment and cave users was also shown in an incident during the mid 1990s. A drill site was located quite near to the cave entrance but rather than pumping drilling discharge (as required) to a settling pond, the drillers simply pumped it down the cave, putting cave tour operation out of action for a fortnight and preventing a scheduled visit from the Outdoor Pursuits class at Greymouth High School.

The second issue is that of safety of the cave tours. Cavern Creek can rise very quickly after heavy rain with the potential to trap people in the cave. The problem is made worse by the poor communications in the area (no cell 'phone coverage). Today whilst the potential still exists, the tour operator has purchased radios to provide emergency communications and Coast Cave & Vertical Rescue have an Evacuation Plan for the cave.

### **Management groups responsible for karst & caves in Island Sandstone:**

*Ministry for Economic Development*

Crown Minerals, within the Ministry for Economic Development has issued Solid Energy,

a NZ State Owned Enterprise, licence to mine coal at Dunollie, this being the same area as a commercial tour operator, Wild West Adventures, takes adventure cave tours. The viability of the latter enterprise is under threat as the new Spring Creek Mine expands.

### **Karst & Cave Features**

Cavern Cave, Dunollie (aka Dragons Cave)

Abbey Road Cave, Tramway Cave

Small unnamed caves Rapahoe – James Mine area

Stream sink/resurgence Herd Street Dunollie

### **Recommended Reading**

1. The Greymouth Coalfield, Bulletin 45, NZ Geological Survey, pp 44-46 by Maxwell Gage, published DSIR 1952

### **Maps**

1. Geological Map, PG Morgan, 1911, NZ Geological Survey
2. Greymouth Geological Map & Handbook, Sheet S44, 1:63,360 Simon Nathan, 1978, DSIR