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PERMO-TRIASSIC COVER IN SOUTHERN TASMANIA

Permo-Triassic Cover in Southern Tasmania

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To: Mr. G.F. Hudspeth. 14th July, 1958.

PERMO-TRIASSIC COVER IN SOUTHERN TASMANIA

Permian and Triassic sediments occur widely in Tasmania, generally in conjunction with the dolerite which was extensively intruded during the Jurassic. In almost all cases these sediments are exposed where the dolerite has been removed only comparatively recently. A thick cover of both dolerite and sediments occurs along the eastern boundary of the Arthur area, but dolerite is found in only one place in the south west - on Point Hobbs where Permo-Triassic sediments and dolerite were downfaulted and thus preserved.

The Permian in Tasmania started in general with the deposition of a tillite on a land surface. Then followed marine deposition, emergence, submergence, and again, emergence. During this last emergence, deposition continued in some places, other places experienced non-deposition or erosion, while coal, or shallow or fresh water facies were laid down in places. During the Triassic, non-marine sandstones and shales were deposited unconformably on the Permian strata. This closely parallels the cycle of sedimentation in the Sydney Basin, where two marine sequences were deposited, each followed by coal measures. The Triassic, non-marine sandstones and shales similar in lithology to Tasmania's Triassic, was deposited after a slight hiatus. The alternation of environments in Tasmania is thought to be roughly simultaneous with that in the Sydney Basin.

In the Jurassic, dolerite intruded these little disturbed sediments,

as both sills and dykes, also as laccoliths and even lopoliths. It intruded the Permian - Lower Palaeozoic unconformity in some cases, also various horizons throughout the Permo-Triassic sequence - the Grange Mudstone, the Woodbridge Glacial Formation, the top of the Ferntree Mudstone, the Knocklofty Sandstone and Shale, and the "Felspathic" Sandstone. Of these, the Grange Mudstone and Knocklofty Sandstone and Shale proved most incompetent and the intrusions are most irregular. Some of the sills are probably 1600 feet in thickness. Possibly the intrusion was accompanied by lava flows and tuffs at the surface. It has been noted that in the Upper Huon - Arve River area the dolerite is generally sill-like in the Triassic but dyke-like in the Permian. During the intrusion, the sediments were uplifted, often along a system of normal faults, which can be distinguished from Tertiary faulting because they do not cut the basement.

Erosion since the Jurassic has dissected the dolerite and Permo-Triassic rocks, especially in Southern Tasmania, so that now, in many places, these rocks occur only as mountain peaks, generally dolerite on top with the near-horizontal sediments lying on earlier rocks or more dolerite.

The complete Permo-Triassic sequence has been defined from various parts of Tasmania; the basal part is defined from the Florentine Valley; the Woody Island Siltstone to Dreamy Bay Tillitic Sandstone from Woody Island in the D'Entrecasteaux Channel; the Darlington Limestone from Maria Island; The Bundella Mudstone to the Ferntree Mudstone, exclusive of the Woodbridge Glacial Formation from Mount Nassau in the Hobart area and the Cygnet Coal Measures from Cygnet. The Woodbridge Glacial Formation and Triassic formations have not yet been strictly defined.

For the sequence see Table 1.

"Basal Glacial" Formation

This formation, the base of the Permian, outcrops in the Weld River valley. Tillites unconformably overlie quartzites, probably of Lower Cambrian age. These tillites contain boulders of red granite, grey quartzite, quartz, slate and mica schist. This is followed by 300 feet of conglomerate containing the Woody Island Siltstone, or a correlate, appears in this sequence, if at all, it is not known.

Woody Island Siltstone

This formation, and others up to the Dreamy Bay Tillitic Sandstone, are defined from Woody (or Satellite) Island, near Alonnah on South Bruny. Rocks from this sequence also occur in the Franklin-Glendevie area. This is a pyritic siltstone, at least 86 feet thick - the base is not exposed. It contains Eurydesma, crinoid columnals and worm burrows.

The lower member of the two found on the east side of the island is a blue-grey siltstone with rare erratics of quartz, quartzite and rare marine fossils. Bedding is thick to very thick, and cross bedding can be seen in places, from a distance. Pyrite concretions are very common, being irregular in shape and orientation but preferring elongation parallel to the bedding. Concretions of calcite up to 12 feet in diameter are also common; these are lenticular with the greatest diameter parallel to the bedding. Large lenticular concretions, apparently of siltstone with marked concentric fissility, are present in the cliffs. Alum effloresces on the cliffs in this formation. This is the result of attack by sulphuric acid, from the oxidation of pyrite, on clay minerals in the siltstone.

The upper member is well sorted, yellow to white siltstone with

rare erratics of aplite, and rare pyrite concretions. Worm tracks and burrows are common, and a few small lamellibranchs occur. This member is finely cross bedded. Arrowhead markings probably represent infilling of worm burrows.

This formation also constitutes the western part of Woody Island, which is the upthrow side of a fault. Here, it is a dark grey siltstone with large pyrite concretions, large lenticular calcareous concretions, and numerous glendonites[1] as single large crystals, stars of four crystals, or rosettes of numerous small crystals. One single crystal was 20 cm. long. These sediments on the western side of the island are included in the Woody Island Siltstone on grounds of extreme lithological similarity but ~~it~~ they probably lie below the lower member to the east, which has no glendonites.

Sunset Bay Sandstone

This formation consists of two units, making a total thickness of 21 feet. Both units are well sorted, fine-grained sandstones with a few erratics of granite and quartzite. The grains are angular. The lower unit contains quartz, the upper both quartz and felspar. Bedding in both is thick, and cross-bedding occurs in the lower unit. Both are grey or mottled dark and light grey, and contain glendonites. The upper unit has small pyrite concretions. In the lower, worm tracks and burrows are common.

Satellite Siltstone

This formation, 20 feet thick, is a richly fossiliferous siltstone with thick bedding, good sorting and rare erratics. It is medium dark grey with a blocky fracture. Fossils form at least 20% of the rock, and on the south side of Woody Island are preserved as the original skeletons. Stenopora

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[1] Glendonite: a pseudomorph of ferruginous calcite after glauberite ($Na_2SO_4.CaSO_4$) is a morphological term, not a mineral species.

forms dense mats at a slight angle to the bedding. The ramose colonies are markedly oriented, mainly to the north-east, as if by currents from the south east.

D'Entrecasteaux Tillite

This is a tillite band 6" thick. It is medium grained sandstone with angular to sub-angular grains, mainly quartz, but some felspar. The cement is kaolinitic. Sorting is poor. Sub-rounded and facetted erratics of sandstone, schist and slate are common. The rock is dark blue-grey with thick bedding. Fossils, mainly spiriferids, are rare.

Lewis Point Sandstone and Siltstone

This formation, 54 feet thick, is a rough alternation of siltstone and sandstone.

The lowest member is a coarse fossiliferous siltstone of quartz and felspar in a clayey matrix. It contains a few rounded erratics of claystone, quartz and granite, up to 8 cm. diameter. The beds are thick and the fracture is blocky. Cross-bedding and slump structures are present on a very small scale. The rock is a light blue-grey and fossils are common.

The next member is a green-grey, micaceous siltstone with lenticular clayey concretions up to 3 feet in size. Bedding is thick, fissility poor. Erratics are absent, and only a few fossils are found. Small rectangular carbonaceous fragments occur, but their origin is unknown.

A fine, micaceous, white or yellowish sandstone follows. Quartz and felspar are present, and sorting is good. The cement is clayey, so where exposed the sandstone becomes friable. Bedding is thick. The bedding surfaces with adjacent units are irregular, suggesting penecontemporaneous erosion.

Following this sandstone is 3 feet of fine-grained, well sorted, blue-grey, quartz sandstone. The rock splits massively but bedding is thin. Occasional worm tracks are the only fossils. A well sorted, fine grained, thick bedded sandstone with quartz and felspar in a clayey matrix is next. It is light grey, with rare erratics of quartz and slate. Pentagonal crinoid columnals are common, also Stenopora and lamellibranchs. These two rock types alternate for the last 10 feet of the formation.

Alonnah Sandstone

This is a glendonitic sandstone, 51 feet thick. Fossils are very common.

The lower member is a spiriferid sandstone, medium to fine grained, poorly sorted, with erratics composing up to 15% of the rock. The erratics, up to 8 inches in diameter, are of quartz, quartzite, granite, schist, sandstone and slate. The matrix is quartz (60%) and felspar. The sandstone is grey with thick bedding. The cement is clayey but is calcareous in part. Fossils, the original shells, may form up to 25% of the rock. They are mainly spiriferids.

The higher member is very similar. It is light olive-grey, and weathers to brownish-yellow. The bedding is thick but due to abundance of fenestellids some parts are laminated and others thinly bedded. Arrowhead markings are common, also fossils, which are mainly productids but fenestellids are common. Glendonites occur, as external moulds.

Dreamy Bay Tillitic Sandstone

This is a poorly sorted, erratic rich sandstone, 50 feet thick, medium grained and dark grey in colour. The grains and erratics are angular fragments of granite, limestone, quartzite and quartz. Fossils are

abundant, and frequently broken, suggesting strong current conditions. Overlying this formation on Woody Island is the Darlington Limestone (5 feet thick) and then the Bundella Mudstone.

Darlington Limestone

Synonymy: "Eurydesma" Limestone, Golden Valley Formation.

This formation is defined from the cliffs and quarry sections on the north end of Maria Island where it is 50 feet thick. It is very widespread, being known from Snug and Woody Island to Wynyard. It is generally not as thick as on Maria Island.

The sequence is an alternation of siltstone and limestone. Erratics are common, and grains of quartz, felspar, or other rock material are abumdant. Though not important economically, the Darlington Limestone is very important for correlation within the Permian of Tasmania and the rest of Australia. Fossils are abundant, especially Eurydesma, Stenopora and the foraminifer Calcitornella.

Bundella Mudstone

Synonymy: Porter Hill beds; "Porter's Hill" Siltstone; Snug Stage.

This formation consists of fissile and non-fissile siltstones and sandstone. They are yellow-grey or light olive-grey when fresh, buff when weathered. Fossils are rare in the sandstone but common in the mudstone. In the upper beds fossils become rare and the rock may be mistaken for Fermtree Mudstone. In the Upper Huon - Arve River area thin bands of tillite occur; the mudstone has alternating dark and light bands. Bedding planes in the darker mudstone are covered with muscovite flakes, similar to the Knocklofty Sandstone and Shale.

Faulkner Group

This group of seven formations has its type area around Geiss Creek near the Lyell Highway. It represents two cyclothems and is approximately equivalent to the Greta Coal Measures, the lower of the two coal measures in the Sydney Basin. It has been correlated in Tasmania with the Liffey Sandstone near Deloraine, and the Mersey, Preolenna and Mount Pelion Coal Measures.

Geiss Conglomerate. Sub-greywacke conglomerate 18" thick, with pebbles and cobbles up to 8" in diameter. No marine fossils but a few plants are found at the top. It was deposited on land, or perhaps under marine conditions with life inhibited.

Rathbones Sandstone and Siltstone. Quartz-rich sandstone and fissile siltstone, 35 feet thick. It is similar to the Knocklofty Sandstone and Shale, with slump structures and graphite in the bedding planes. Current ripples show a general northerly direction of current flow. Worm casts and plant fragments occur in the basal beds.

Byers Sandstone. Subgreywacke sandtone 2" thick. It is dusky yellow in colour, poorly sorted and unfossiliferous.

Jarvis Siltstone. Fissile and non-fissile subgreywacke siltstone, 35 feet thick. It resembles the upper Bundella Mudstone. Lithologically it is like the Ferntree Mudstone. Worm tubes occur but are uncommon.

Parramore Sandstone and Shale. Quartz sandstone and carbonaceous siltstone containing plant fragments, 20 feet thick; it is similar to the Rathbones Sandstone and Siltstone.

Altamont Conglomerate. A single bed of subgreywacke conglomerate 18" thick. It is light olive grey, poorly sorted.

Ferguson Siltstone. Fissile and non-fissile siltstones, 37 feet thick. Two of the non-fissile beds are conglomeratic. It is lithologically like the Jarvis Siltstone, the upper beds of the Bundella Mudstone and the Ferntree Mudstone. Marine fossils occur at the top.

Rayner Sandstone This sandstone is 9 feet thick and contains marine fossils. It has also been called the Bridgewater Sandstone.

Cascades Group

This is part of the upper of the two marine groups in Tasmania, and is roughly a correlate of the Maitland Group in the Sydney Basin, which is similarly the upper marine group there. The Cascades Group consists of an alternation of fissile siltstones with limestones or calcareous siltstones. The Nassau Siltstone is predominantly siltstone, as also is the Grange Mudstone, while the Berriedale Limestone is mainly limestone. Throughout the Group the CaO content of the rocks increases to some point in the Berriedale Limestone then decreases. Facies change within the groups. The Grange Mudstone always overlies the Berriedale Limestone, when the latter is present, but is very subordinate at Mount Nassau. However, going south it increases in thickness at the expense of the limestone, so the Cascade Group is of fairly constant thickness. The mudstone occupies more and more of the limestone's stratigraphic position until at Snug and other places in the south east, the Cascade Group is solely Grange Mudstone. It is possible, however, that the Berriedale Limestone was all deposited before any Grange Mudstone was deposited and areal distribution and thicknesses of the two formations are in no way related.

Nassau Siltstone Fissile siltstones with subordinate limestone. It was once called the Granton Siltstone; this was however confusing owing

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to the already named Granton Limestone. It grades up to the Berriedale Limestone, the top of the siltstone being impossible to define. The siltstone is poorly sorted with some rock and fossil fragments; the limestone consists mainly of fossil fragments with quartz grains.

Berriedale Limestone

Synonymy: Mount Wellington Limestone; Mountains Limestone; Crinoidal Zone; Granton Stage; Granton Substage; Granton Limestone and Marl; Granton Formation; Granton Limestone; Gray Stage; Peter Limestone.

The formation is mainly limestone but with some fissile siltstones. Metabentomite occurs at some horizons. The limestone is seldom pure, usually consisting of clastic material of sand size or greater, with erratics of quartz, igneous and metamorphic rocks, up to 1" in diameter. It is well sorted and contains some pyrite nodules. Much of the groundmass is recrystallised.

In all sections of the formation beds of devitrified volcanic ash occur, now altered to montmorillonite. These beds are associated with the mudstone layers. There are 13 montmorillonite bands at Glenorchy; of these two are particularly persistent in surrounding districts. One is 1" thick and is the Lower Marker Band, while the Upper Marker Band is 15 feet higher.

Fossils are abundant, both plant and animal. Almost every animal phylum is represented. The rock was probably deposited in cold water, limestone when glaciers were retreating and stream erosion produced a large supply of sediment, and mudstone with the advance of the glaciers, quiet conditions and small stream capacity.

In the Upper Huon - Arve River area there is a dark green brown shale at the transition from the underlying Bundella Mudstone, changing to

a dense, grey, massive limestone. It is richly fossiliferous and contains erratics of quartz, granite and schist. The uppermost beds are dark green, irregularly bedded, calcareous mudstone with fossils and erratics.

Beds thought to belong to this formation in the Franklin-Glendevie area (Granton Limestone, Ford 1954) were found later to be Woody Island Siltstone and contiguous formations.

Grange Mudstone

Synonymy: Fenestella Zone; Grange Stage; Grange Mudstones Substage; Grange Facies; Grange Formation.

This formation is mainly siltstone and calcareous siltstone with minor beds of limestone, dolomite and nontronite. Many beds are a creamy colour. The formation is richly fossiliferous, in some places fenestellids being so thick as to produce an appearance of lamination. It is particularly susceptible to intrusion by dolerite, with contact metamorphic effects - dark spots of chlorite, sericite and limonite are often formed. The formation increases in thickness from north to south; at Snug it comprises the whole of the Cascades Group. Near Geeveston it is a fine creamy, siliceous mudstone with rhythmic bedding, with erratics in the lower beds of granite, quartz schist and quartzite. Coarser bands similar to the Risdon Sandstone occur there, but they are more silicified and do not weather in the same way.

Woodbridge Glacial Formation

This is a conglomeratic, somewhat impure, partially recrystallised sandstone, with siltstone also. At the base is a conglomeratic sandstone with numerous erratics and fossils. 60 feet from the base (at Mount Nassau, where the thickness is 275 feet) the sediment becomes finer. Pebbles occur throughout it, but there is no really tillitic bed. At Mount Nassau, 50 feet

from the top is a very richly fossiliferous band only a few feet thick, while lenses of limestone up to 18" thick occur about 12 feet from the top. Most of the rock fragments are metamorphic, more like Precambrian than anything else.

In the Franklin-Glendevie area, this formation is a friable, porous, extremely iron-stained mudstone. Fossils are absent. Associated with it in places is a ferruginous material, consisting of limonite, hematite and vitreous hydrated iron minerals, with a gossanous outctop. This may have been formed by leaching and concentration of the iron in various parts of the rock.

In the Upper Huon - Arve River area, it is a massively bedded grey to cream mudstone with erratics of slate, schist, quartzite and granite. The lower beds have dark shale bands rich in fenestellids, and coarser bands rich in other fossils. The upper beds are grey with few fossils, though there is a richly fossiliferous band just below the Risdon Sandstone. Bands of conglomerate are common.

Though found in many places in Tasmania, the Woodbridge Glacial Formation thins towards the north-east, where it becomes glauconitic.

Risdon Sandstone

Formerly considered the basal beds of the Ferntree Mudstone. It is a felspathic sandstone, containing quartz, 20-25% plagioclase, muscovite, zircon, hematite, ilmenite, brown biotite, limonite and tourmaline. Rock fragments are not common but do occur, mainly being quartzite. Tubicolar casts occur, perpendicular, or at a high angle, to the bedding. It is resistant to weathering, outcropping as cliffs and steep slopes; on Mount Nassau it forms benches. In the Upper Huon - Arve River, it is a massive

current-bedded quartzose sandstone of very irregular grain-size, with erratics, mainly quartzite, up to 6" in diameter.

In the Franklin-Geeveston area, it is fine to coarse grained, with up to 30% felspar and erratics up to 6". It is generally uniform but near the old Geeveston Cemetery it is interbedded with shaley laminated sandstone, much finer than the rest, with small ironstone concretions. In the Surges Bay clay pit the sandstone has intense blue-green stains.

The quartz, in addition to the colourless variety normally present in the Permian, is represented by a variety having a bluish tinge.

Ferntree Mudstone

Synonymy: Mudstone, Zone; Upper Marine Series; Lindisfarne Stage; Lindisfarne Mudstone; .Ferntree Mudstone Stage; Ferntree Mudstone Formation; Ferntree Mudstones; Ferntree Stage; Ferntree Formation.

This mudstone is an alternation of fissile and non-fissile siltstones, lying between the Risdon Sandstone and Cygnet Coal Measures, or where the latter are absent, the Knocklofty Sandstone and Shale (Triassic). It is sparsely fossiliferous and not well sorted - it was possibly deposited in a brackish, shallow water, possibly estuarine, environment. Lithologically it is similar to the upper beds of the Bundella Mudstone, to the Jarvis Siltstone, and Fergusson Siltstone.

In the Franklin-Glendevie area, concretionary structures are common. The higher members have characteristic dark carbonaceous markings and other organic remains. Erratics are not very common.

In the Upper Huon - Arve River area the formation consists of uniformly massively bedded mudstones with small erratics, interbedded with shaley bands. Occasional large erratics of quartzite, slate, schist and

granite are present, but fossils are rare or absent. At 120 feet above the base a 30 foot band of sandstone outcrops, resembling the Risdon Sandstone. The Cygnet Coal Measures are again absent but a fine grained dark micaceous shale in the Arve River near the base of the Triassic may represent the formation.

Cygnet Coal Measures

These coal measures, the topmost beds of the Permian sequence, occur in the Cygnet area. They consist of about 200 feet of carbonaceous shales, coal seams and laminated, ripple-marked sandstone (fresh water). The thickest coal seam is 4 feet. These coal measures are approximately correlated with the Newcastle (Upper) Coal Measures of the Sydney Basin.

On the Esperance River, a coarse, loosely consolidated yellow, laminated, ferruginous sandstone with slump structures may be the equivalent of the Cygnet Coal Measures.

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Knocklofty Sandstone and Shale

This includes the Ross Sandstone and Springs Sandstone.

The basal formation of the Triassic, it lies unconformably on the eroded Permian beds. In the north, there is a conglomerate at the base, containing Permian boulders, possibly Ferntree Mudstone. At Brock Bay, cliffs along the Huon River show the boundary between Permian and Triassic to be an irregular one, with evidence of erosion, and in addition, the basal beds contain Ferntree Mudstone boulders.

The sandstone is a massive, strongly cross-bedded, fine grained, quartzose sandstone. When leached, it is very white and weathers to a uniform quartz sand. It contains up to 10% felspar of different compositions

suggesting derivation from a terrain including acid plutonic rocks. Muscovite is common and gives the bedding planes a distinctive silvery lustre. It assists fissibility producing flaggy and shaley bedding. A small amount of biotite occurs. The origin of the mica is debatable - it may be from acid plutonic rocks, or perhaps the mica schists of the Precambrian to the west. Graphite, with a metallic lustre is also common. It may have been formed by metamorphism of carbonaceous fragments in the sandstone and shale, but the Triassic sediments have never been buried very deeply. It is more likely that it is derived from graphite schists in the Precambrian. The association with muscovite bears this out.

Heavy minerals in the rock are ilmenite, zircon, rutile, magnetite and tourmaline. Colourless garnet is found at Big Marsh, while in the south-east, pink to red melanite garnet forms red bands and patches.

The cementing material is usually argillaceous, while frequently limonite or hematite produces the yellow, brown or red colour. On the Nive River calcite is the cementing material, forming a "Fontainebleau" sandstone.

Halite and epsomite occur in a number of places. Salt pans in the Midlands apparently derive their salt from the sandstone. These minerals suggest a high rate of evaporation during part of the time of deposition of the Knocklofty Sandstone and Shale.

Lithology: Fine conglomerates are common near the base, or, in the north, a breccia. They are mainly quartz conglomerates, with fine to coarse boulders in a predominant matrix of sandstone. Waterworn boulders of both reef quartz and quartzite are the most common. The conglomerates may occur up to 50 feet from the base.

Higher in the sequence are prominent beds of clay-pellet or intraformational conglomerates. The pellets may be rounded, angular or twisted, and up to 6" long. They indicate periodic exposure of the lake floor to air, and suggest deposition in very shallow water.

There are red, brown, purple or green shales associated with the sandstone. They are actually siliceous siltstones with shaley bedding. Mica and graphite are well developed. A few claystones occur, also siderite concretions.

Sedimentary structures: the bedding varies from laminations in the shales to shaley, flaggy and massive bedding in the sandstones. A rhythmic alternation of sandstone and shales characterises this formation. The complete rhythm is about 50 feet thick, with minor rhythms superimposed.

Current bedding is common in the coarser grained sediments. The normal type is sigmoidal, frequently showing truncation. A symmetric type, developed perpendicular to the current in restricted channels, is found in a few places. At Waddamana and Tarraleah, current bedding indicates currents from the north-west, while to the south-east of Hobart, currents came from many directions.

Slump structures suggest the floor of the lake sloped to the south-east at Waddamana, while south-east of Hobart, the slope was to the south-east, east and north-east.

The evidence therefore indicates that the sediments were derived from a land surface lying to the north-west and south-west, and were deposited in a series of small lakes in a low-lying area. The rocks on the land surface were acid plutonics, quartzites, quartz veins, dynamically metamorphosed rocks, and Permian sediments, mostly not very rugged.

Fossils are restricted to a few vertebrates (fish and labrynthodonts)

and plants which are the commoner.

"Felspathic" Sandstone

This formation includes the New Town, Langloh and Cornwall Coal Measures. It is followed unconformably by dolerite, or Tertiary lacustrine sediments or basalt.

The rock is an arkose in which quartz is relatively unimportant. Felspars may constitute up to 80% of it. Orthoclase and plagioclase are the main felspars. Muscovite is not nearly so common as in the Knocklofty Sandstone and Shale, but biotite is present, and may have been the primary mineral from which much of the chlorite was formed. Chlorite is common and the green to blue colour of the sandstone is largely due to its presence. Calcite occurs in the sandstone and associated coal measures as veins and bands. Siderite is rare. Selenite occurs associated with carbonaceous remains at Plenty.

Clay minerals are much more common than in the underlying formation. They act as cement for coarse grained beds, or form separate beds of claystone. Associated with the coal and some of the mudstones are pyrite and marcasite.

Conglomerates are known in this formation. One is reported just above an unconformity. Intraformational clay-pellet conglomerates are very common. Quartz sandstones occur throughout but are usually only thin beds.

Most Tasmanian coal belongs to this formation. It varies from sub-bituminous to anthracite, the latter due to baking by the dolerite. There are up to eight seams present in any one locality, the thickest approaching 18 feet.

Current bedding is common in the sandstone members. Concretions are also common, some up to 10 feet in length. They are generally almost

cylindrical, circular to oval in cross section, and up to 2 feet in diameter. Others are discoidal, but much smaller, being only 2-3" in diameter. The concretions are mainly felspar sandstone with a concentration of calcite.

The only fossils present are plants, which are present in large numbers.

The mode of origin of the "Felspathic" Sandstone is debatable. It may be due to the stripping of a terrain of basic to intermediate rocks of considerable relief, and deposited rapidly. However, the current bedding suggests a slowly sinking floor and strong current action. A more attractive hypothesis is that the rocks were tuffs, or largely of tuffaceous origin. The irregular shapes of the grains, and fragments of volcanic rocks, support this. They may represent an early phase of the activity associated with the later dolerite intrusion. One difficulty is the amount of quartz, some of which has inclusions of apatite and tourmaline. It seems unlikely that so much quartz, and of such a type, could have come from a doleritic magma.

General Summary

In the north and west, most of the Permo-Triassic sequence is fresh, with coal measures throughout, also occasional "Tasmanites" bands, of oil shale. So these parts of Tasmania were probably low-lying swampy areas with fairly frequent marine inundation, and during the latter part of the Permian, such swampy conditions spread over most of the state. The original distribution of the Cygnet Coal Measures may have been much wider than now, with much of them removed by the pre-Triassic erosion.

Taken generally, it appears that the Permian sediments were derived from low-lying terrain with little relief, composed of acid plutonics, metamorphic rocks and Lower Palaeozoic sediments. The angularity and freshness of many minerals reflect the glaciation affecting areas close to

Tasmania.

The glaciation in the Permian of Tasmania had at least two main pulses, each multiple. During the latter part of the period, the Hunter-Bowen orogeny influenced Tasmania indirectly through elevation of the land surface, with development of lacustrine sediments and the start of the erosion which is marked by the unconformity between the Permian and Triassic.

The Lower Triassic was apparently deposited in a lake, or series of lakes, bounded on the west by the Precambrian rocks of Western Tasmania. The lakes were shallow and probably periodically dried up to form a series of mud or sand flats. The climate probably varied from rather moist to hot and dry, when the saline deposits were formed. The floor was sinking slowly as shown by the good sorting and current bedding.

Climatic conditions apparently changed after Knocklofty times. The plants and coal measures suggest a change from an arid or monsoonal climate in the Lower Triassic to one of abundant rainfall, lacking the dry periods. The area surrounding was probably low-lying terrain with volcanoes on it, erupting periodically.

Peter Riddola.

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TABLE 1.

SEQUENCE OF PERMIAN, TRIASSIC AND JURASSIC ROCKS IN SOUTHERN TASMANIA.

	Formation	Thickness (feet)
	Erosion and Unconformity	
JURASSIC	Dolerite	
TRIASSIC	"Felspathic" Sandstone	800
	Knocklofty Sandstone and Shale	600-800
	Disconformity	
PERMIAN	Cygnet Coal Measures	200
	Ferntree Mudstone	300-600
	Risdon Sandstone	10-20
	Woodbridge Glacial Formation	100
Cascades Group	Grange Mudstone	100-300
	Berriedale Limestone	50-200+
	Nassau Siltstone	40
	Raynor Sandstone	9
	Faulkner Group	120
	Bundella Mudstone	100+
	Darlington Limestone	50
	Dreamy Bay Tillitic Mudstone	50
	Alonnah Sandstone	50
	Lewis Point Sandstona and Siltstone	55
	D'Entrecasteaux Tillite	6"
	Satellite Siltstone	20
	Sunset Bay Sandstone	20
	Woody Island Siltstone	86+
	"Basal Glacial" Formation of Weld R. valley	
	Unconformity	
	Lower and Middle Palaeozoic Rocks	

TABLE 2.

LITHOLOGY OF PERMO-TRIASSIC SEQUENCE IN SOUTHERN TASMANIA.

Formation	Thickness	Lithology	
"Felspathic" Sandstone	800 ft	Arkose, cong, coal	Lacustrine Beds
Knocklofty Sst. and Shale	600-800	Sst, cong, sh, (salt)	
			Disconformity
Cygnet Coal Measures	200	Carb. sh, coal, sst	Fresh-water
Ferntree Mudstone	300-600	Slt, (sst)	
Risdon Sandstone	10-20	Sst	
Woodbridge Glacial Formation	400	Sst, slt, (lst)	Regression
Grange Mudstone	100-300	Slt, (lst, dol)	
Berriedale Limestone	50-200+	Lst, (slt, clay)	
Naasau Siltstone	40	Slt, (lst)	Transgression
Raynor Sandstone	9	Sst	
Faulkner Group	120	Cong, sst, slt	
Bundella Mudstone	100+	Slt, sst, (tlt)	
			Regression
Darlington Limestone	50	Lst, slt	
Dreamy Bay Tillitic Sst.	50	Sst	
Alonnah Sandstone	50	Sst	
Lewis Point Sst. and Slt.	55	Slt, sst	
D'Entrecasteaux Tillite	6"	Tlt	
			Transgression
Satellite Siltstone	20	Slt	
Sunset Bay Sandstone	20	Sst	
Woody Island Siltstone	86+	Slt	
"Basal Glacial" Formation		Tlt, cong, mst	

ABBREVIATIONS

carb -- carbonaceous
cong -- conglomerate
dol -- dolomite
lst -- limestone
mst -- mudstone
sh -- shale
slt -- siltstone
sst -- sandstone
tlt -- tillite