

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

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PETROLOGY OF OUTCROP AND DRILL-
CORE SPECIMENS FROM THE
KINGOONYA DISTRICT SOUTH
AUSTRALIA

GEOLOGICAL SURVEY

by

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DISTRICT SOUTH AUSTRALIA

ABSTRACT

Specimens of surface outcrop and core from drill holes ERD 1-9 from the vicinity of Mt Eba and Wallabyng Range near Kingoonya include dacites, dolerites, trachyandesite, talcose serpentinites, lithic sandstones of the Labyrinth Formation and brecciated and recrystallised cherts.

INTRODUCTION

Five specimens of outcrop and eight of drill core, together with thirteen thin sections were received for examination and brief description from Wayne Cowley of the Regional Geology Branch.

PETROGRAPHY

Specimen 5936 RS 164, TS C 49911

Rock name Recrystallised chert

Locality Rocky Hill, 19 km NE of Kingoonya

Field data Labyrinth Formation, Mid-Proterozoic, overlying Tarcoola Formation.

Hand specimen

The rock is essentially a purple chert with a weak bedding, visible on sawn and freshly broken surfaces, and a flaky fracture which gives it a medium grained appearance. Many cavities between about 1 mm and 5 mm across are prominent and with a hand lens the rock is seen to be porous, with cavities distributed

unevenly but throughout the fabric. Some of the larger cavities are cubic in shape and a concentration of these is visible on one surface of the specimen. They probably represent former evaporite minerals such as halite. Crystallisation of silica has taken place, sometimes in botryoidal form, on the walls of many cavities. The extent of recrystallisation throughout the rock is displayed partly by colour variation. New silica is often yellow rather than purple or red.

Thin section

The rock consists of an extensively recrystallised mosaic of interlocking quartz grains with frequent but scattered inclusions of extremely fine grained carbonate and a pervasive iron oxide in patches and dusty granules. Most of the quartz grains are less than 0.1 mm across and some patches of only slight recrystallisation are present. However, scattered patches of coarser grains include crystals of 1 mm diameter. Many of these are clearly filling cavities but some are concentrated along fractures and probably originate from the substantial recrystallisation of the chert itself. A few quartz crystals are euhedral in shape and display euhedral growth zones internally. These presumably grew in open cavities without interference and the present situation in which they are closely contained by the chert and have been embayed by it presumably indicates continued recrystallisation of the chert after the formation of cavities by dissolution of evaporite minerals and the subsequent partial filling of the cavities by later quartz.

Specimen 5936 RS 168, TS C 49912

Rock name ?Trachyandesite

Locality 9 km W of Mt Eba

Hand specimen

The specimen is a dense, grey, fine grained rock with a few rounded, whitish crystals of coarser grain size. The rock is moderately ferromagnetic.

Thin section

A definitive identification of this rock can only be obtained from chemical analysis. The groundmass minerals are too fine grained for conclusive optical identification.

The phenocrysts are of monoclinic pyroxene except for a few which are plagioclase and for rare, highly altered crystals which may have originally been olivine. Some of the pyroxenes are of low enough optic axial angle to qualify as pigeonites but the majority are augite.

The groundmass consists of plagioclase, opaque minerals and interstitial biotite which is probably abundant enough to put the rock in the category of trachyte, or at least trachyandesite. Colourless grains of high relief in the groundmass may be pyroxene. Square outlines in many opaque grains indicate probable magnetite.

The plagioclase occurs as thin laths with a tendency towards preferred orientation which produces a pronounced, though undulating, flow structure. The rock is probably a lava but may possibly be an ash flow tuff.

Specimen 5936 RS 169, TS C 50032

Rock name Brecciated chert

Locality 3 km SW of Mt Eba

Hand specimen

The rock consists of a brecciated chert invaded by fine grained silica, possibly a second generation of chert.

The original rock is dark coloured and finely laminated. The fragments vary between .1 mm and 35 mm and the degree of disturbance varies between microfaulting with no movement to total disruption with wedging apart of approximately 1 cm and rotation of fragments of close to 90°. The hand specimen displays a pattern of 'tenting' which generally indicates dessication.

The material filling fractures and forming a matrix for the more disrupted fragments is white and porcellanous without a detectable fine structure.

Thin section

In transmitted light the chert which appears dark in hand specimen is bright because it is recrystallised and light passes through with minimal diffusion. The white, interstitial material in hand specimen is dark in transmitted light. This is partly because it is very finely divided and partly that it includes dusty, opaque granules and an indeterminate brownish staining. Coarse grains of quartz fill a few veinlets.

Patches of carbonate are thinly distributed through all parts of the rock but are larger with the recrystallised quartz than in the matrix. The carbonate is interstitial to or a replacement of, silica rather than the opposite. There is no petrographic evidence that the chert is a product of carbonate replacement. However, there is no evidence to exclude this possible origin.

Specimen 5936 RS 170, TS C 50033

Rock name Brecciated chert

Locality 3 km SW of Mt Eba

Hand specimen

Thin beds of dark chert, not laminated in this specimen, have been gently warped into an open fold, fractured and surrounded by a brown matrix.

Thin section

The chert fragments are not greatly displaced and are again clearer than the matrix in this specimen because of a coarser recrystallisation. The contrast is stronger in RS 170 than in RS 169 because in much of the matrix of RS 170 the iron has oxidised and hydrated to limonite. The matrix also contains chlorite in flakes up to 0.3 mm across. The chlorite is almost isotropic in places but elsewhere is moderately birefringent and may tend

towards a poorly crystalline mica. It is stained with limonite to a greater or lesser degree and in places where the brown colour is strong and the birefringence is high the chlorite possibly grades into jarosite.

There is evidence of more than one episode of movement in the interstitial matrix. Elongated aggregates of quartz grains which may have formed the filling of thin veins at an early stage of fracture have been broken off and drawn out into schlieren of subparallel stained and elongated grains.

There is no evidence of a carbonate precursor.

Specimen 5936 RS 171, TS C 50034

Rock name Altered dolerite

Locality 1.5 km SE of Mt Eba

Field data Dyke about 2 m thick intruded into lithic sandstone of Labyrinth Formation.

Hand specimen

The specimen is a heavy, dark, close textured, fine grained rock with coarser grained crystals of a red brown colour. The weathered surface is pitted with cavities where soluble minerals had been. The rock attracts strongly a hand magnet.

Thin section

The rock is a strongly altered, porphyritic dolerite (from the field relationships).

The groundmass consists of sericitised and saussuritised plagioclase laths and fine grained patches of a faintly green, isotropic chlorite which probably represents former ferromagnesian minerals. Abundant opaque grains, many of which are square in cross section, are mainly or entirely magnetite on the evidence of the ferromagnetism of the specimen.

Much of the groundmass is made up of irregular patches of carbonate replacement.

The phenocrysts are also largely replaced by carbonate but traces of pyroxene remain. A few crystals are replaced by antigorite and may have been olivine originally. The refractive indices of some of the carbonate appear to be high enough for magnesite.

Specimen 5936 RS 172, TS C 50035

Rock name Dacite

Locality Drillhole ERD 1, 39.45 m. 0.8 km NW of Mt Eba.

Hand specimen

The rock consists of a dark red brown groundmass with red phenocrysts.

Thin section

The rock is probably a dacite but identification of the feldspars is not absolutely certain and the quartz content is low. Chemical analysis would give a more precise identification.

The phenocrysts are mainly feldspathic but some are altered ferromagnesian minerals. The feldspars are deeply embayed and strongly altered to clays, mica and chlorite. Twinning is never well displayed and in some crystals no twinning is visible. The assumption is made that at least some of these are potash feldspars. Quartz phenocrysts are rare.

The ferromagnesian phenocrysts consist of relict pyroxene, amphibole and chlorite but may originally have all been pyroxene.

A few phenocrysts consist of opaque minerals.

The groundmass consists of fine laths of plagioclase with indeterminate interstitial material deeply stained by iron oxide.

Specimen 5936 RS 173, TS C 50036

Rock name Quartz-lithic sandstone

Locality Drillhole ERD 2, 16.92 m, 1.5 km SE of Mt Eba.

Field data Labyrinth Formation lithic sandstone.

Hand specimen

The specimen is a mainly pink sandstone with bedding produced by grain size variation and colour changes from purple to yellow.

Thin section

The section consists of a sandstone with very high lithic content. While sorting is generally poor the section displays a progressive change in overall grain size from coarse in one corner to fine in the opposite corner. Preferred orientation is weakly displayed by elongated grains and marks the direction of bedding but there is an imposed fabric at about 80° to the bedding. This is manifest in the section by a thin, irregular vein filled with opaque material and in hand specimen by the broken surfaces at the ends of the section of core.

The framework consists mainly of quartz and lithic fragments. Proportions vary but on the average quartz appears to be somewhat more abundant. Many of the lithic fragments are sericitised to the extent that some merge with the matrix. They may originally have been argillaceous or feldspathic. A smaller proportion of the clasts are recognisably feldspathic and include both plagioclase and microcline. Many clasts consist of siliceous sediments and are not altered. A few clasts are composed of coarse muscovite flakes.

The matrix is abundant and much of the sediment is matrix-supported. It consists of sericite and clay minerals. Matrix has invaded fractures and cleavage in some clasts and apparently replaces clasts at the margins. Opaque iron oxide occurs as grains and patches in some beds and translucent red oxide is common as a stain and in interstitial patches.

Specimen 5936 RS 174, TS C 50037

Rock name Talc-chlorite rock

Locality Drillhole ERD 3, 46.1 m, 3 km SE of Mt Eba.

Hand specimen

The rock is dense, compact, grey in colour and without identifiable structures. When scratched the specimen produces a soft, talcose powder.

Thin section

The major part of the specimen consists of a mass of fine flakes and acicular prisms of talc in random orientations. Frequent patches within the mass of talc are composed of chlorite flakes which are often consistently oriented with respect to adjacent flakes but the patches of which are randomly oriented. Minor phases include a carbonate which is probably magnesite and an acicular mineral associated with the chlorite which is probably anthophyllite.

Occasional thin veins contain carbonate or quartz.

It is very likely that the rock is of ultramafic origin. The alternative is not a basic rock but a metamorphosed magnesium carbonate.

Specimen 5936 RS 175, TS C 50038

Rock name Talcose serpentinite

Locality Drillhole ERD 3, 47.85 m

Hand specimen

The rock is a grey, featureless, compact and fine grained material, similar to specimen RS 174.

Thin section

Talc is less abundant in this specimen and occurs as tufts included in a mineral of low birefringence which is probably antigorite. The same chlorite as occurs in RS 174 is present in RS 175 but in lesser amounts. Several small quartz veins have been introduced and have been subject to minor deformation.

Veins and small patches of carbonate are present. Minor anthophyllite is also present. Large patches of sulphide, probably pyrite, occur in the margin of a thin vein of chlorite and limonite.

It appears that hydrothermal alteration has affected the already altered assemblage.

Specimen 5936 RS 176, TS C 50039

Rock name Dacite

Locality Drillhole ERD 4, 16.95 m, 1.5 km NW of Wallabyng Range

Hand specimen

The rock is dark and fine grained with a few larger crystals visible with a hand lens and a network of a small veinlets filled with red material.

Thin section

Phenocrysts are small and not abundant. Most of those which are present are plagioclase. The rare exceptions are orthoclase, quartz, ferromagnesian minerals and opaque grains.

The groundmass is microcrystalline and consists of plagioclase laths, opaque grains and indeterminate material of low birefringence.

Fine veinlets are filled with limonite and carbonate.

Dacite is the identification indicated by optical examination but chemical analysis would provide firmer evidence for classification. No flow textures were observed but the fine grain size suggests a lava flow.

Specimen 5936 RS 177, TS C 50040

Rock name Lithic sandstone

Locality Drillhole ERD 5, 91.5 m, 5 km NW of Wallabyng Range.

Hand specimen

The specimen is a compact, dark grey rock with a slight greenish tint. Grains are not sharply distinct and sizes are poorly sorted. Mica flakes reflect the light and pyrite grains of both coarse and fine sizes are present.

Thin section

The sandstone is immature both physically and chemically. Grain size varies between about 1 mm and 0.05 mm, the grains are angular to subangular and include muscovite, plagioclase and microcline.

Lithic fragments are more abundant than quartz in this specimen and include quartzites with strained grains as well as those with unstrained quartz. Chert clasts are common and clasts with grains of intermediate sizes may be detrital sandstones or recrystallised cherts. Grain boundaries within the clasts vary from sharply defined to vague and transitional.

Plagioclase clasts are abundant and are often almost completely fresh. Microcline grains are rarer but are also fresh. Many clasts consist of sericitic mica and may originally have been feldspars or feldspathic ash.

Muscovite flakes are common and do not exhibit a preferred orientation.

Fine grains of high birefringence are frequent and include both zircon and sphene.

Much of the interstitial space between the larger clasts is filled by the finer grained clastic material but a large proportion of this space is filled with a disorganised material which appears to include both sericite and chlorite. This matrix is abundant and is responsible for the green tint of the hand specimen. It tends to merge with the margins of many of the framework grains and may have reacted with, and partially replaced, a proportion of the framework.

It is probable that both this specimen and RS 173 are variants of the Labyrinth Formation and represent the rapid stripping and sedimentation of an uplifted terrain. The land surface exposed old metamorphic rocks and sediments rather than

new volcanics and the sediment is close to, but not quite, a greywacke in the strict sense. However, it is more basic in composition than RS 173.

Specimen 5936 RS 178, TS C 50041

Rock name Foliated and dolomitised sericitic sandstone.

Locality Drillhole ERD 8, 69.1 m, 7 km NW of Wallabyng Range.

Field data Labyrinth Formation with small pebbles. Incipient foliation more prominent than very weak bedding.

Hand specimen

The specimen is closer in appearance to RS 173 than to RS 177. It is pink rather than greenish and the grains are more sharply defined. However, it does not display the graded bedding of RS 173 and is coarse grained, though poorly sorted. Clasts measure up to 10 mm across. It is foliated, as noted in the field, and the stress which produced a weak fracturing in RS 173 has led to elongation of clasts and the introduction of lenses of carbonate in RS 178.

Thin section

Bedding is possibly visible in outcrop but in thin section the fabric imposed by stress has either obliterated traces of bedding on the fine scale or has reinforced any earlier fabric by overprinting with the same orientation. The stress has promoted much recrystallisation of clasts and of matrix and there has been considerable introduction of carbonate.

Elongation of quartz grains is accompanied by residual strain in the crystals and is probably the product of recrystallisation under stress rather than of sedimentation. If any feldspar was originally present, it has been entirely replaced by sericite and carbonate. Most of the lithic fragments have also been replaced and partial replacement of quartz is

evident. Fine grained zircon remains. Opaque grains and patches are consistently oriented and have probably been introduced. In places amorphous oxide forms schlieren and is seen to have replaced mica clasts.

The matrix has been substantially expanded by the corrosion and replacement of the framework. Sericite is abundant but the main matrix component is introduced carbonate, probably dolomite. As noted in hand specimen, the carbonate also forms lenticular schlieren along the foliation.

The specimen is another variant of the Labyrinth Formation. It has been subjected to what must be a localised episode of stress.

Specimen 5936 RS 179, TS C 50042

Rock name Dolerite

Locality Drillhole ERD 9, 23.15 m, 4.5 km SE of Mt Eba.

Hand specimen

The specimen is a dense, compact, grey rock in which greenish yellow crystals may be seen. Limonitic alteration has been introduced along a complex system of fractures. The rock responds strongly to a hand magnet.

Thin section

The rock consists of a closely interlocked mesh of plagioclase crystals up to 2 mm long with interstitial pyroxene in ophitic plates up to the same diameter. These are seen in hand specimen as greenish yellow patches where they have been partially replaced by limonite.

The maximum extinction angles measured put the plagioclase in the labradorite compositional range. Apart from the introduction of limonite staining in places, the plagioclase is virtually unaltered.

The pyroxene is monoclinic and includes crystals with an optic axial angle of about 60° and others with one of about 40° . There are possibly two pyroxenes, an augite and a pigeonite. Most pyroxenes are unaltered but some ferromagnesian minerals are totally altered. These may have been olivine.

The opaque minerals are somewhat altered but are clearly ferromagnetic. Some grains are surrounded by a rim of leucoxene. The mineral is probably an ilmenomagnetite solid solution with magnetite as the dominant phase.

It is possible that the dolerite may form part of the Gairdner Dyke Swarm but the very low level of alteration raises the outside possibility that it may be part of a later basic suite, conceivably of Jurassic age.

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