DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 84/34

PETROGRAPHY OF THREE ROCKS FROM NEAR CURDIMURKA

GEOLOGICAL SURVEY

by

M.G. FARRAND

REGIONAL GEOLOGY BRANCH

MAY 1984

DME.454/82

CONTENTS | PAGE

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept. Bk. No. 84/34
D.M.E. No. 454/82
Disk No. 23

SADME Pet. Rep. 4/84
1:100 000 Sheet 6438

PETROGRAPHY OF THREE ROCKS FROM NEAR CURDIMURKA

ABSTRACT

A very mature sandstone has been cemented by limonite. There are similarities between this specimen and two specimens consisting almost entirely of hematite which suggest that the same process has been active in introducing a minor amount of iron in the one specimen and an abundance of iron in two other specimens, which were originally arenaceous sediments. Minor quantities of mica were possibly involved in the iron mineralisation process.

INTRODUCTION

Three specimens were received for petrographic description from G.W. Krieg of the Regional Geology Branch. The specimens are from sandstones at the base of the Mesozoic sequence. One specimen (6438 RS 349) is located by the Dog Fence west of Cockatoo Bore and represents the uppermost unit of Algebuckina Sandstone. It is of latest Jurassic or Early Cretaceous age. The other specimens (6438 RS 347,348) occur 5 km SSW of Finniss Springs station and represent either Cadna-owie Formation or a sandstone lens near the base of the overlying Bulldog Shale. These formations are Early Cretaceous.

PETROGRAPHY

6438 RS 349, TS C41834

Rock name: Ferruginous sandstone

Hand specimen:

The rock is a well sorted sandstone with a relatively weak cement of hydrated iron oxide. The clasts are dominantly composed of well rounded quartz. The rock is highly porous with virtually no matrix. The cement is weak enough to leave the specimen too friable to be sectioned without impregnation. Bedding traces are faintly visible in places but the specimen is mainly massive.

Thin section:

The dominance of quartz clasts is confirmed by examination in thin section. The grains are mainly between about 0.2 mm and 0.7 mm in maximum dimension with the extremes of the range between about 0.1 mm and 1.3 mm. Shapes vary between well rounded and angular with most grains sub-rounded to sub-angular. Many grains exhibit a well-rounded core separated by trains of small inclusions from a rim of authigenic quartz which occasionally produces crystal faces on grains adjacent to open pore spaces. Other grains show evidence of corrosion by pore solutions. Most grains are in contact at a few points only.

A few clasts are composed of lithic fragments but these are also dominantly of siliceous lithologies. Both medium grained quartzites and fine grained to cryptocrystalline cherts are represented and a few clasts are derived from fine-grained detrital sandstones. Feldspathic and argillaceous clasts are very rare indeed and the only other detrital components are a very few grains of tourmaline.

Fine grained mica flakes, opaque granules and acicular minerals occur as inclusions in quartz grains.

The sediment is essentially free of matrix but in rare scattered patches the intergranular pore spaces contain flakes of mica and clay minerals. It is very rare for these to fill the interstitial space completely but it is not uncommon for thin mica flakes to lie flat on the surface of detrital grains. The interstitial material is usually coloured rusty brown by limonite.

The hydrated iron oxide cement which gives a strong colour to the hand specimen is rarely seen in thin section. It probably forms a coating which is little more than a stain on most detrital grains. On some grains, however, the brown coating is substantial enough to be seen as a thin, brown, translucent layer in plane light. Between crossed polarisers the material is seen to be at least partially crystalline. A band of extinction passes through the layer as the microscope stage is rotated and moderately high polarisation colours are visible through the brown of the iron oxide. The mineral responsible must be present as fine, sub-parallel plates or fibres but the optical properties are not clearly enough displayed to permit the identification of the material. It may consist of fine mica flakes, a mineral such as jarosite or even crystalline forms of limonite itself, such as goethite or lepidocrocite.

Comment:

The sediment is well sorted and consists of quartz grains of which a large proportion were originally highly rounded. Authigenic overgrowths and corrosion by pore solutions have modified the original shape of many grains. The high degree of maturity of the sediment suggests a long erosional history but a fairly rapid and constant final deposition is indicated by the weak bedding. Massive structure is characteristic of aeolian or marine deposition rather than fluvial. The well-rounded grains support this indication.

The paucity of matrix may be the result of deposition in a high energy environment but at least in part is due to dissolution by pore solutions.

The dominant cement is limonitic but the combination of this material with highly birefringent minerals such as mica is significant. The full significance is not apparent since the identification of some of the material is uncertain. The muscovite mica indicates a moderately elevated temperature in the solutions which deposited it. The evidence of both corrosion of quartz grains and the deposition of authigenic overgrowths possibly suggests a fluctuating temperature regime with dissolution of silica clasts and clay matrix during periods of rising temperature and the deposition of quartz and mica as the temperature fell. The introduction of iron may have been independent of this cycle unless jarosite is shown to be present. In jarosite iron and potassium are chemically combined. It also indicates the involvement of oxidised sulphur in the mobilisation of iron. The identification of fine grained minerals partly concealed by limonite may perhaps be achieved by X-ray diffraction.

6438 RS 348, TS C41833

Rock name: Sandstone replaced by hematite

Hand specimen:

The dominant constituent of the specimen is amorphous haematite which varies in colour from purple to brick red. The presence of granular quartz is more apparent to the sense of touch than to that of sight. The specimen feels gritty but even under a hand lens the quartz is not prominent due to thick coatings of hematite on the grains. A pale pink, possibly argillaceous, material forms a discontinuous coating on the surface of the specimen.

Thin section:

Most of the section is opaque and only at the edges of cavities can be seen to consist of amorphous hematite. The iron oxide is translucent and deep red in colour where it is thin.

The non-opaque material of the section is restricted to corroded inclusions of detrital quartz, chlorite and some highly birefringent minerals. Some of the latter grains are identifiable as muscovite mica, possibly of detrital origin but possibly introduced after deposition, but other grains are not clearly identifiable by optical means. The possibility that these may be iron compounds is worth investigating by X-RD.

The structure of the hematite varies from massive with very few inclusions at one side of the section to more open with what appears to be a granular texture at the other side. The porous part of the specimen contains open cavities as well as frequent inclusions of non-opaque minerals and has an irregular bedded structure. It is from this part of the specimen that an inference of origin by replacement of a sediment is drawn.

Even the largest inclusions of non-opaque grains are corroded by the hematite so that no evidence of sedimentary clastic textures remains.

Comment

Although much evidence of the origin of the specimen is concealed by opaque hematite, enough remains to suggest that the rock was a quartzose sandstone, possibly with detrital mica. The rather sparse evidence of non-opaque mineralogy suggests that the introduction of hematite was accompanied by the production of a little chlorite, possibly some non-detrital muscovite and a highly briefringent mineral which may be similar to that of RS 349. If this is so, the iron mineralisation may be a more extreme variation of the process which introduced the iron cement in specimen RS 349.

6438 RS 347, TS C41832

Rock name: Feldspathic sandstone replaced by haematite.

Hand specimen:

The specimen is nodular in shape but appears to be essentially similar to RS 348. Amorphous hematite is the dominant phase present and varies in colour from purple to pinkish red. The specimen is coated in places with a soft, colourless mineral with a fibrous texture which forms sheets about 2 mm thick with the fibres perpendicular to the plane of the sheet. It is probably gypsum.

Thin section:

The rock is very similar in thin section to specimen RS 348 in that corroded relics of non-opaque detrital grains are included in locally varied concentrations in the opaque haematite.

The only significant difference in the detrital grains is that moderately abundant plagioclase accompanies the dominant quartz in this specimen. A few grains of muscovite are present.

Chlorite is a moderately abundant mineral which may be an alteration product, possibly of mica or clay and possibly associated with the introduction of the iron.

Highly birefringent material other than muscovite is not observed in this specimen, in contrast to the other two, RS 349 and 348. It may be significant that a sulphate of low birefringence, gypsum, is present in specimen RS 347. However, the coating of gypsum is a very late stage event in the history of the rock and may be irrelevant to any process involving the mobility of iron.

Comment

A sedimentary origin may be presumed for this specimen and the deposition of hematite may again have taken place by corrosion and replacement. Minor differences such as a plagioclase component in the sediment and a coating of gypsum on the surface of the specimen are probably not relevant to the iron mineralisation process.

M. Farrand.

MGF:AF

Dr. M.G. FARRAND