


**Boral Construction Materials
Materials Technical Services**

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TEST REPORT

CLIENT: P.F. Formation

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2021

TEST METHOD: i) AS1141 – Methods for Sampling and Testing Aggregates

FILE NO: 250/21

ii) TfNSW – Materials Test Methods Vol. 1

REQUEST NO: 96089

iii) ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by
Abrasion in the Micro-Deval Apparatus.

DATE TESTED: 24.9.21 to 14.10.21

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:		Coarse Sand	
Location:		Maroota Quarry	
Date Sampled:		2.9.21	
Date Received:		3.9.21	
Laboratory Sample No:		257662	
Test Method:	Test:	Spec:	Results:
AS1141.11.1*	% Passing A.S. Sieve		
	9.5mm	100*1	
	6.7mm	-	100
	4.75mm	90-100	98
	2.36mm	60-100	88
	1.18mm	30-100	74
	600 micron	15-100	55
	425 micron	-	42
	300 micron	5- 50	27
	150 micron	0- 20	6
AS1141.12	Material finer than 75 micron (%)	0- 5	2
AS1141.4	Uncompacted Bulk Density t/m ³		1.63
	Compacted Bulk Density t/m ³	Min. 1.2	1.72
RMS T262	Moisture Content (%)		3.4
AS1141.5	Particle Density (Dry) t/m ³	Min. 2.1	2.63
	Particle Density (SSD) t/m ³		2.64
	Apparent Particle Density t/m ³		2.66
	Water Absorption (%)	Max. 2.0	0.4
AS1141.24	Sodium Sulphate Soundness (Total Weighted % Loss)	Max. 6	0.5
	Fraction tested :		
	-4.75mm+2.36mm (% Loss)		1.4
	-2.36mm+1.18mm (% Loss)		0.5
	-1.18mm+600 µm (% Loss)		0.2
	-600 µm +300 µm (% Loss)		0.4

*Sample washed over 75 micron sieve as per AS1141.11.1 Clause 5.6.

*1 As per Fine Aggregate – Recommended Gradings (Table B2), AS2758.1

Page 1 of 2



Approved Signatory

15.10.21

Kamal Ali

AGG96089.KA.1

Date

Serial No.

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DATE TESTED: 24.9.21 to 14.10.21

SPECIFICATION: AS2758.1- Concrete Aggregates – Date: 7th November 2014

Sample Description:			Coarse Sand
Location:			Maroota Quarry
Date Sampled:			2.9.21
Date Received:			3.9.21
Laboratory Sample No:			257662
Test Method:	Test:	Spec:	Results:
AS1141.25.3*	Degradation Factor Fine Aggregate The wash water after using permitted 500ml was:		97 Clear
AS1141.33	Silt Content (%)		2
AS1141.34	Organic impurities other than sugar The colour assessment was made visually using coloured reference glass	Not darker than std.	Lighter than Std
RMS T279	Method of Determining Voids Content		
	% Voids		41.4
ASTM D7428	The Mean Flow Time (Sec.)		22.4
	Micro-Deval Abrasion Test % Loss The % loss of the control aggregate tested closest to the time at which the sample was tested = 19.5		5.5

*At the end of 20 min. reading the height (H) of the upper surface of the flocculate column was not possible. Reading was performed after 40 min.

Sample submitted by client

J. Graham, QC File, File



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Method for Determining Voids Content - Flow Time
RMS T279

CLIENT: P.F. FORMATION

PROJECT: Quality Control Annual Full Test of Coarse Sand ex Maroota for 2021

LAB SAMPLE NO: 257662

TEST METHOD: TfNSW – Materials Test Methods Vol.1

SAMPLE DESCRIPTION: Coarse Sand

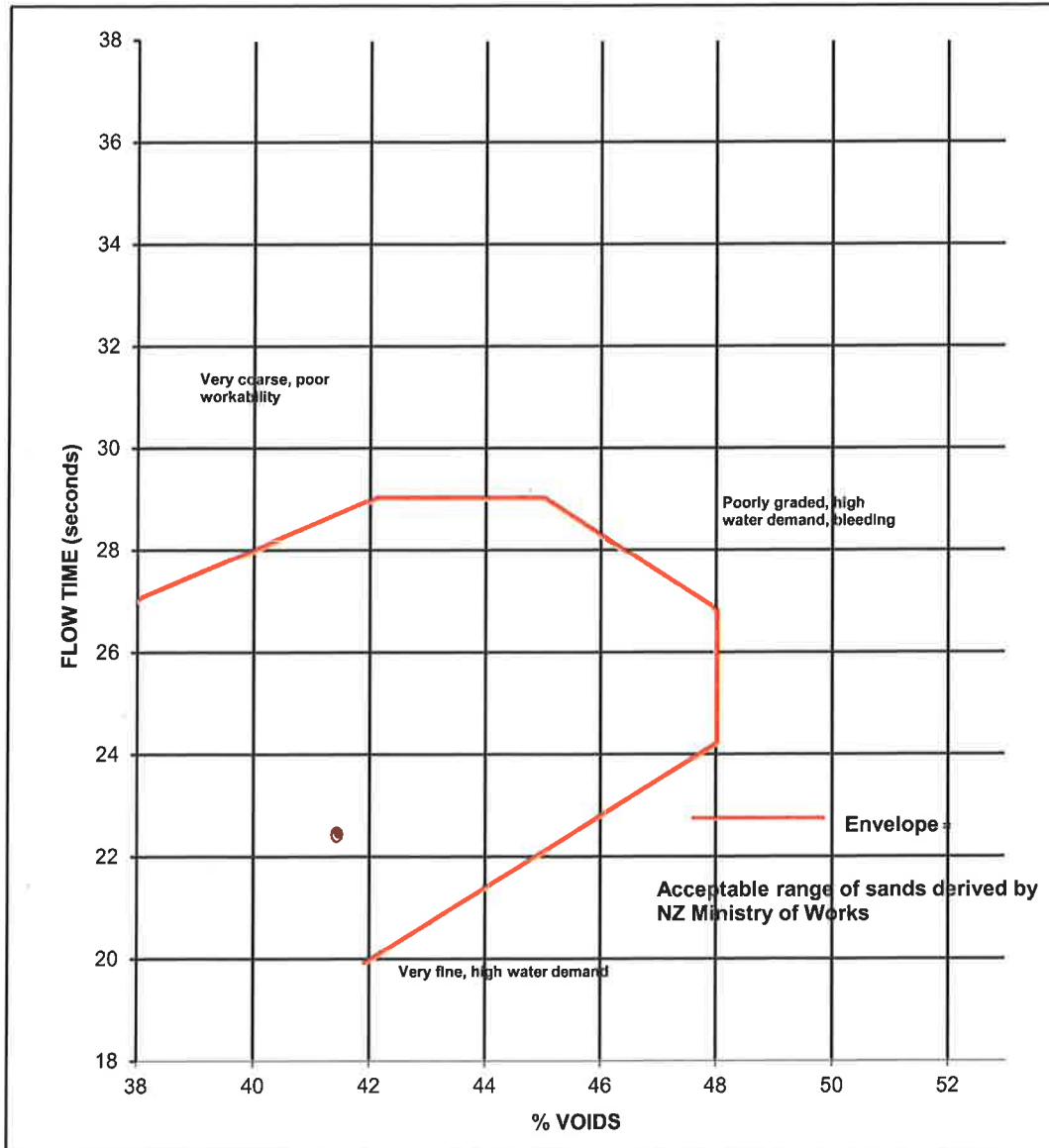
FILE NO: 250/21

REQUEST: 96089


LOCATION : P.F. Formation

DATE SAMPLED: 2.9.21

DATE TESTED: 13.10.21



Material sampled by client.

Kamal Ali 
SECTION HEAD – AGGREGATES
15th Sep 2021
J. Graham, QC File, File



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TEST REPORT

CLIENT: P.F. Formation

FILE NO: 250/21

PROJECT: Quality Control – Annual Full Test of Coarse Sand ex Maroota for 2021

REQUEST NO: 96089

TEST PROCEDURE: TEST PROCEDURE: Texas Highway Department – Materials and Tests Division –
TEX.402-A, Rev. Sept. 1999

Sample Description:		Coarse Sand
Location:		Maroota Quarry
Date Sampled:		2.9.21
Date Received:		3.9.21
Laboratory Sample No:		257662
Test Method:	Test:	Results:
TEX-402-A	Fineness Modulus of Fine Aggregate	2.62

Sample submitted by client.


Kamal Ali
Section Head – Aggregates

15th October 2021

J. Graham, QC File, File



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TEST REPORT

CLIENT: P. F. FORMATION
PROJECT: Quality Control Annual Full Test of Coarse Sand for 2021
MATERIAL: Coarse Sand from Maroota Quarry

FILE No: 250/21
REQUEST No: 96089
DATE RECEIVED: 3.9.21
DATE SAMPLED: 2.9.21
DATE TESTED: 24.9.21 to 8.10.21

Test Method AS1289.3.7.1	Results
Determination of the Sand Equivalent of a soil using a power-operated shaker	Field Sample No. 1 Laboratory Sample No. 257662
Sand Equivalent	91
Temperature of test solution (°C)	23

AS1289 - Soil Classification Tests	Results
Determination of the Liquid Limit, Plastic Limit and Plasticity Index	Field Sample No. 1 Laboratory Sample No. 257662
AS1289.3.1.1 - Liquid Limit (%) AS1289.3.2.1 - Plastic Limit (%) AS1289.3.3.1 - Plasticity Index (%)	N/A* N/A** NP
Sample history Preparation method Method used for moisture content determination	OD DS N/App
<p>N/A* - Test is not applicable due to continual slippage in bowl. Liquid Limit could not be obtained. NP - Non-plastic. N/A** - Unable to roll, plastic limit could not be obtained. N/App. - Not Applicable. Sample history:- NS = Natural state, AD = Air dried, OD = Oven dried at 50°C, UN = Unknown, AR = As received Preparation method:- WS = Wet sieved, DS = Dry sieved, AR = As received</p>	

Note: Sample provided by client.

JOSHUA GRAHAM, Q. C. FILE, FILE.



Approved Signatory Aroon Singh **Aroon Singh**

Date 08.10.21 Serial No. SOIL96089.AS.1

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TEST REPORT

CLIENT: P.F. Formation
PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2021 to AS 2758.1 Specification
FILE No.: 250 / 21
REQUEST No.: 96089

TEST PROCEDURE:

- AS 1141.12 – Material Finer than 75 micron *
- AS 1141.13 – Material Finer than 2 micron
- AS 2350.2 Clause 5.5 - Loss on Ignition (Modified)
- Tex- 612 - J - Acid Insoluble Residue for Fine Aggregate
- RMS T659 – Methylene Blue Adsorption Value of Road Construction Material

Laboratory Sample Number:	257662
Date Sampled:	2.9.21
Date Received:	3.9.21
Date Tested:	From 15.9.21 to 5.10.21
Sample Description:	Coarse Sand
Field No.:	1

TEST RESULTS:

Material Finer than 75 micron (µm) (%) *	2
Material Finer than 2 micron (µm) (%)	Not Applicable
CO ₂ by Loss on Ignition (%) #	0.03
Calcium Carbonate as CaCO ₃ (%) #	0.07
Acid Insoluble Residue (%) #	99
Methylene Blue Adsorption value (mg/g)	1
Methylene Blue Adsorption value for a Duplicate (mg/g)	1
Average Methylene Blue Adsorption value (mg/g)	1

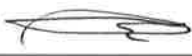
Sample was provided by the Client.

The Test method(s) were not in the current scope of NATA Accreditation for the Boral MTS Laboratory.

* The authorised signatory for AS 1141.12 is K.Ali.

Joshua Graham, Q.C.File, Mat.File, File.



Approved Signatory  K.Ali
 Date 5.10.21 Serial No. CHEM96089.SK.2

S.Krishnamoorthy

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TEST REPORT

CLIENT: P.F. Formation
PROJECT: Quality Control Annual Full Test of Coarse Sand ex. Maroota for 2021 to AS 2758.1 Specification

FILE No.: 250 / 21
REQUEST No.: 96089

TEST PROCEDURE:

- AS 1012.20.1 – Determination of Chloride and Sulfate in Hardened Concrete and Aggregates – Nitric Acid Extraction Method
- AS1012.20.2 – Determination of Water-Soluble Chloride in Aggregates and Hardened Concrete
- AS 1141.36 – Sulfur in Metallurgical Slag, Crushed Rock or other Pavement Materials
- AS 1141.31 – Determination of Light Particles
- AS 1141.35 – Detection of Sugar
- AS 1289.4.1.1 – Organic Matter content
- AS 1289.4.3.1 – Determination of the pH value of a Soil
- RMS T123 – Determination of the pH value of a Soil
- RMS T264 – Soluble Salts in Sand

Laboratory Sample No.:	257662
Date Sampled:	2.9.21
Date Received:	3.9.21
Date Tested:	From 15.9.21 to 23.9.21
Sample Description:	Coarse Sand
Field No.:	1

TEST RESULTS:

Chloride as Cl ⁻ (Acid-Soluble) (%)	0.002
Sulfate as SO ₃ (%)	0.05
Chloride as Cl ⁻ (Water-Soluble) (%)	0.001
Sulfur as S (%)	0.02
Light Particles (%)	0
Sugar	Not Detected
Organic Matter (%)	0.2
pH (AS)	6.2
pH (RMS)	6.2
Soluble Salts (%)	Free from Soluble Salts

Sample was provided by the Client.

Joshua Graham, Q.C.File, Mat.File, File.



Approved Signatory S. Krishnamoorthy S.Krishnamoorthy
 Date 30.9.21 Serial No. CHEM96089.SK.1

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TEST REPORT

CLIENT: P.F.FORMATION
1774 Wisemans Ferry Road, Maroota, NSW 2756.

FILE No:250/21

PROJECT: Quality Control Annual Full Test of Coarse Sand ex Maroota for 2021.

REQUEST No: 96089

TEST PROCEDURE: Boral In House Method 7 – Based on AS2350.2 using XRF.

Laboratory Sample No.: 257662
Date Sampled: 02/09/21
Date Received: 03/09/21
Date Tested: 21/09/21
Sample Description: Coarse Sand
Field No.: 1

TEST RESULTS

Silicon as SiO₂ (%) 98.7

Note:

- Sample was provided by the Client
- Test results relate only to the sample tested
- This report shall not be reproduced except in full without the approval of the Boral MTS Laboratory.

A handwritten signature in black ink, appearing to read "Nanthini Selvadurai".

Nanthini Selvadurai
Analytical Chemist

Joshua Graham, Q.C.File, Mat. File, File.



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Test Report

Client: P.F. FORMATION
Address: 1774 Wisemans Ferry Road Maroota, NSW 2756
Date Received: September 2021
Project: Quality Control Annual Full Test of Coarse Sand ex Maroota for 2021.
Test Method: Accelerated Mortar Bar Test for AAR Assessment - RMS T363

File No: 250/21
Req. No: 96089
Date Sampled: 02/09/2021

Lab Sample No	Sample Description	Location
257662	Coarse Sand	Maroota Quarry
N/A	Boral GP / SL Cement	Berrima

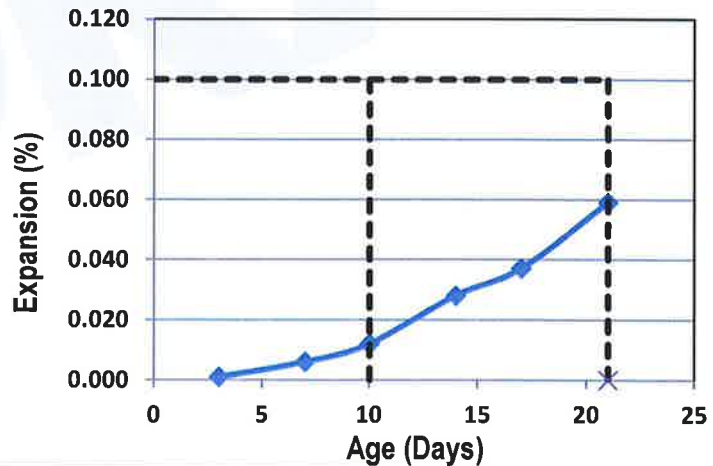
Results:

Flow (%): 16

W/C Ratio: 0.38

Date Mixed: 14/09/2021

Age (Days)	Expansion (%) Avg. of 3 specimens
3	0.001
7	0.006
10	0.012
14	0.028
17	0.037
21	0.059



Mortar Bar Expansion (E) % Duration of Specimens in 1mol/L NaOH at 80°C		RMS T363 Aggregate Reactivity Classification
10 Days	21 Days	
< 0.1*	< 0.1*	Non-Reactive
< 0.1*	≥ 0.1*	Slowly Reactive
≥ 0.1*	>> 0.1*	Reactive

* 0.15% for naturally occurring fine aggregates

Notes:

- Sample submitted by the Client.

Joshua Graham, Q.C. File, Mat. File, File

Approved Signatory Kaisar Humarhan

Date 09.10.2021 Serial No. CEM96089.KH.1



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GEOCHEMPET SERVICES

ABN 25 065 630 506

PETROGRAPHIC, GEOLOGICAL & GEOCHEMICAL CONSULTANTS

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PETROGRAPHIC REPORT ON A COARSE SAND SAMPLE (257662) FROM MAROOTA QUARRY

prepared for

**BORAL RESOURCES (NSW) PTY LTD
MATERIALS TECHNICAL SERVICES**

Purchase Order: 6434531
Invoice Number: G2210523
Client Ref: Kamal Ali

Issued by

H M Spring
H.M. Spring BSc.
13 October 2021

October, 2021

Bo211008

Page 1 of 6

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GEOCHEMPET SERVICES, BRISBANE

Sample Number: 257662 **Date Sampled:** 02/09/2021
Lab Number: G21090072 **Date Received:** 23/09/2021
Product Type: Coarse Sand
Sample Source: Maroota Quarry **Client:** P. F. Formation
Work Requested Petrographic analysis in relation to suitability for use as concrete sand and asphalt.

Methods Account taken of ASTM C 295 Standard Guide for *Petrographic Assessment of Aggregates for Concrete*, the AS2758.1 – 2014 *Aggregates and rock for engineering purposes part 1; Concrete aggregates (Appendix B)*, the AS1141 Standard Guide for the *Method for sampling and testing aggregates*, of the content of the 2015 joint publication of the Cement and Concrete Association of Australia and Standards Australia, (HB 79-2015) entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*

Identification medium to coarse quartz sand

Description

The sample consisted of about 0.5 kg of free flowing, damp, pale yellowish orange (Munsell Rock-Colour chart 2009 10YR 8/6), clean sand, composed of water-worn, sub-rounded and sub-angular quartz grains and minor lithic fragments.



Figure 1: Digital image of sub-sample from supplied sample 257662

GEOCHEMPET SERVICES, BRISBANE

In a crude, dry sieving test of small subsample these results were tabulated:

Sieve Size	Wt % of sample
Coarse (>1.18mm)	31.0%
Medium (>0.3mm)	47.2%
Fine (>0.075mm)	21.2%
Silt (<0.075mm)	0.6%

The coarse fraction consists of quartz grains and minor lithic fragments of variably ferruginized sandstone clasts which are difficult to break by hand. There are no apparent deleterious grain coatings; benign secondary iron oxide occurs as minor grain coatings and within surficial indents.

When a subsample was swirled in water, a very reddish turbidity was noted with some argillized scum, which cleared rapidly suggesting minor silt and clay within the sample.



Figure 2: Digital image of sieve fractions as recorded above.

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Figure 3: Digital image of coarse sieve fraction as recorded above. Note the ferricrete fragment.

A thin section was prepared for microscopic examination in transmitted polarized light. A count of 100 widely spaced points falling within sectioned clasts gave the following composition:

- 66% quartz as single, free, unstrained to mildly strained grains (55%) or as simple composite crystalline aggregates of quartz grains (11%)
- 22% quartz as moderately strained single or more commonly crystalline composite grains
- 5% quartzite (moderately strained)
- 1% vein quartz (heavily strained)

- <1% feldspar grains (orthoclase)
- 1% heavy mineral grains (including epidote, zircon, haematite/goethite (1%), hornblende and opaque oxide)

- 1% lithic clasts of acid volcanics (<1% microcrystalline quartz)
- 1% lithic clasts of intermediate volcanics
- 1% lithic clasts of sandstone (1% quartz)

- 1% lithic clasts of ferricrete
- 1% secondary iron coatings

The free silica content (or total quartz plus chert content) of the sand is 95% comprised of 88% free quartz grains or simple crystalline composite grains, and 7% quartz locked within lithic

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fragments of quartzite and vein quartz, and sandstone fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

In thin section, the sand is seen to consist very largely of quartz, comprising 55% quartz as single, free, unstrained to mildly strained grains, 11% quartz as simple composite crystalline aggregates of quartz grains, and 22% quartz as moderately strained single or crystalline composite grains. The grains carry minor iron trapped in surface indents, but the amount is very small (1%). Siliceous fragments of quartzite amounts to about 5% and 1% vein quartz.

Variable weathered sericitized and kaolinized feldspar grains amount to less than 1%. Small heavy mineral grains are conspicuous and amount to about 1%, comprising epidote, zircon, haematite/goethite (1%), hornblende and opaque oxide.

Lithic clasts amount to 4% of the sample and consist of 1% each of acid volcanic/tuffaceous fragments (<1% finely crystalline quartz in groundmass), intermediate volcanics, sandstone (consisting of quartz and subordinate feldspars suspended in a ferruginous matrix) and ferricrete.

Comments and Interpretations

The supplied coarse sand sample (labelled 257662) from the Maroota Quarry is considered to be fairly clean quartz sand which may be described broadly for engineering purposes as medium to coarse sand however there is significant fine fraction.

The **free silica content** of the sand is **about 95%** comprised of 88% free quartz grains or simple crystalline composite grains, and 7% quartz locked within lithic fragments of quartzite and vein quartz, and sandstone fragments and <1% microcrystalline quartz locked within acid volcanic/tuffaceous clasts.

Being composed largely of sub-rounded and sub-angular grains of quartz, the sand is interpreted to be **physically suitable for use as concrete sand**.

The sand as a whole is predicted to have **potential for mild or slow deleterious alkali-silica reactivity in concrete**. It carries about 27% of moderately stained quartz (as free grains or simple composite grains, and in quartzite), and 1% heavily strained quartz within vein material and a further <1% microcrystalline quartz in lithic clasts of acid volcanic/tuffaceous rock.

Guidance can be obtained from the 2015 joint publication of the *Cement and Concrete Association of Australia* and *Standards Australia*, entitled *Alkali Aggregate Reaction - Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia*.

This supplied sand sample is more than adequate hard, strength and durability for use as a component in asphalt.

Free Silica Content

The free silica content is about 95%.

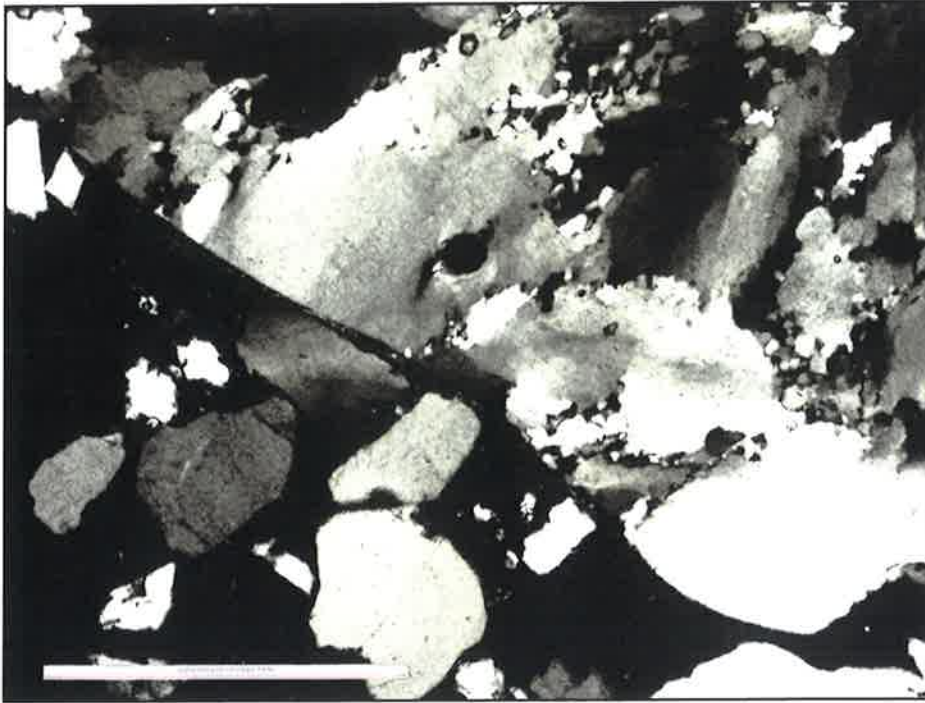


Figure 4: Micrograph of supplied sand sample, taken at low magnification under transmitted cross polarised light. Image shows a typical view of the sample, dominated by sub-angular to sub-rounded quartz showing a range of straining extinctions, along with lithic clasts of quartzite.

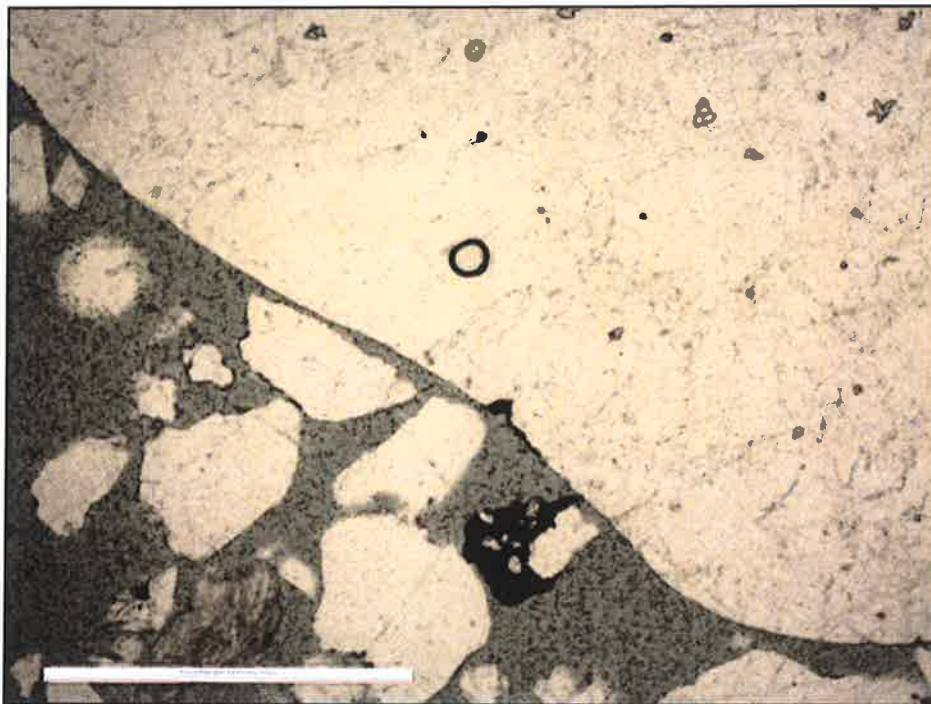


Figure 4: Same Micrograph as above , taken at low magnification under transmitted plane polarised light, showing ferricrete fragment and thin incomplete secondary iron coatings on the grains.