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PETROLOGY OF SAMPLES FROM KOROIT WEST-1, OTWAY BASIN, PEP 152

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A report to:

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C O N T E N T S

1. INTRODUCTION

A petrological study was carried out on two samples from 432.0mKB (#25) and 566.9mKB (#15) in Koroit West-1, Otway Basin (PEP 152) to determine lithology, mineralogy, diagenetic effects and porosity characteristics.

2. ANALYTICAL PROGRAM

Thin-sections were cut in kerosene, impregnated with blue-dyed epoxy resin to aid porosity recognition, and stained with sodium cobaltinitrite to aid feldspar identification. Mineral composition and visible porosity were determined by a count of 400 points, and mean grain size and sorting were estimated in thin-section with the aid of an eyepiece graticule. Photomicrographs were taken to illustrate texture, composition, clay distribution, diagenetic effects and porosity.

3. THIN-SECTION ANALYSES

Lithology, texture and composition are given in Table 1, and the QFR ratio for #15 is plotted in Figure 1. Annotated photomicrographs are presented in Appendix 1.

3.1. #25; 432.0M (CLIFTON FORMATION) (PLATES 1, 2)

This **biomicrite limestone** contains scattered, poorly sorted, fine to coarse (up to at least 3.6mm long) calcareous fossil allochems (shell fragments, echinoderm plates, forams) and angular to subangular, very fine to fine sand-sized detrital quartz grains that are supported by iron oxide/hydroxide-stained calcareous micrite matrix. The limestone also includes rare argillaceous siltstone intraclasts. Shell fragments are unabraded or slightly abraded. Clots of iron oxide/hydroxide replace allochems and micrite and fill intragranular cavities. Fine (0.05-0.10mm), authigenic dolomite rhombs are disseminated throughout the micrite matrix. Ignoring artifact porosity resulting from thin-section preparation, the limestone contains little (<0.3%) macroporosity and thus would have negligible permeability.

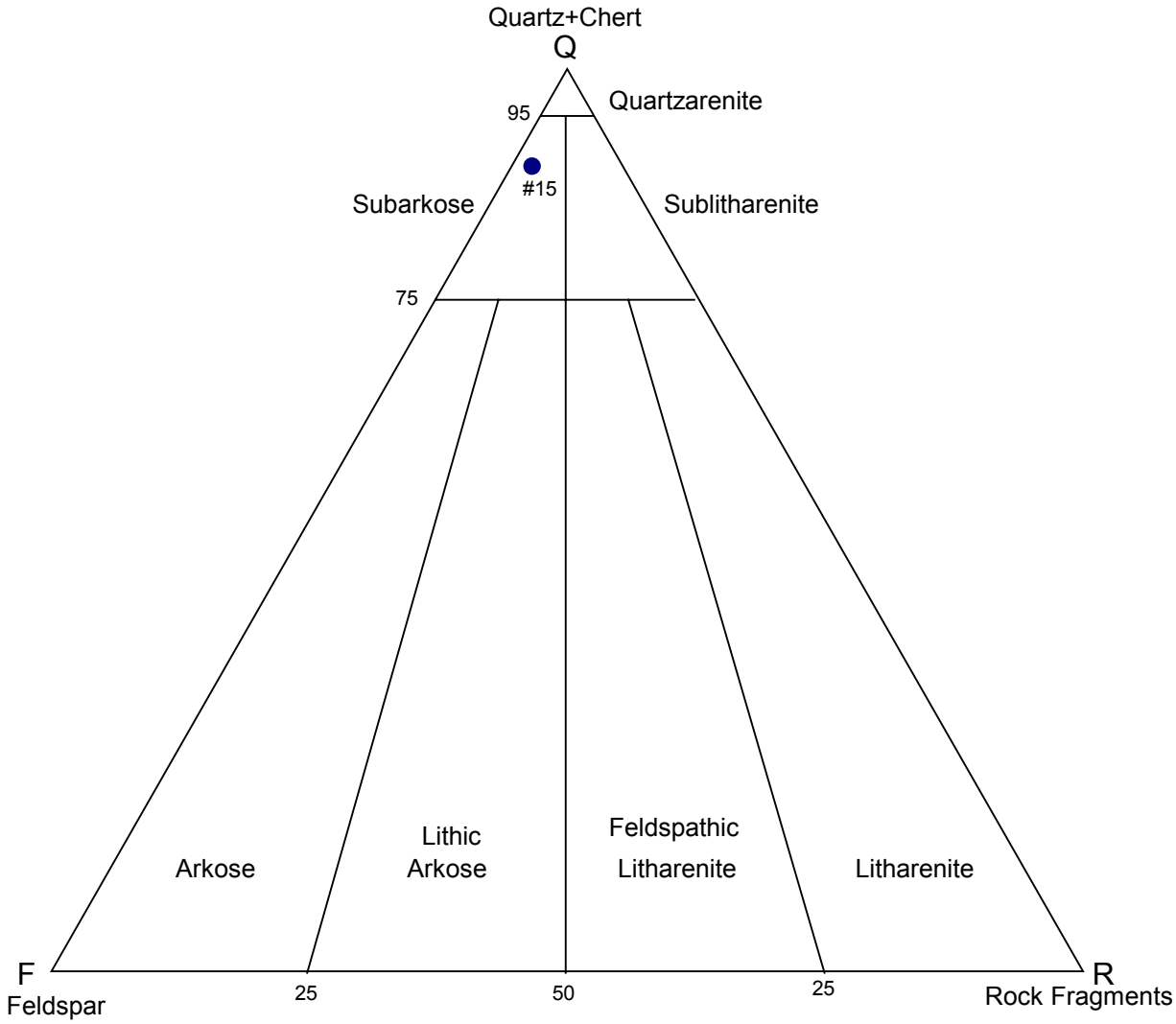
3.2. #15; 566.9M (PEMBER MUDSTONE) (PLATES 3, 4)

Framework grains in this grain/matrix-supported, moderately-well sorted, **fine grained, argillaceous subarkose** are mainly quartz and also include K-feldspar (fresh to slightly altered granitic orthoclase and microcline), plagioclase, chert, micaceous metamorphic rock fragments, felsic volcanic rock fragments, altered biotite, muscovite, organics, and accessory heavy minerals (tourmaline, monazite, zircon, opaques). Quartz grains are mainly angular to subangular. Detrital clay forms widely dispersed matrix and is also concentrated along irregular, very fine laminae, the distribution of which has been influenced by bioturbation. Clay also includes minor authigenic chlorite, kaolinite and illite that have formed by mica alteration. Zeolite forms rare poikilotopic cement patches. Fine pyrite framboids are associated with detrital clay and organic fragments. Little (2.0%) primary intergranular porosity is preserved due to extensive pore filling by detrital clay, authigenic clay, compacted micaceous grains, and compacted organic fragments. Primary intergranular porosity is mainly confined to localised areas that are relatively clean, but, with intervening areas being almost totally microporous due to pore filling by clay, would not be conducive to permeability.

TABLE 1. THIN-SECTION ANALYSES

Sample #	25	15
Depth (mKB)	432.0	566.9
Unit	Clifton Fm	Pember Mst
Lithology	limestone	argill. sst
Quartz	2.1	55.1
Chert	-	0.7
K-feldspar	-	4.7
Plagioclase	-	0.5
Volcanic rock fragments	-	0.3
Metamorphic rock fragments	-	0.7
Sedimentary rock fragments	0.3	-
Mica	-	0.7
Organics	-	1.8
Calcareous fossil	12.6	-
Iron oxide	37.9	-
Pyrite	-	1.8
Calcareous micrite	44.7	-
Dolomite	2.4	-
Authigenic kaolin	-	0.3
Authigenic illitic clay	-	0.3
Detrital clay	-	31.1
Primary porosity	-	2.0
Secondary porosity	-	-
Q (quartz + chert)	-	90.0
F (feldspar)	-	8.4
R (rock fragments)	-	1.6
Mean grain size (mm)	-	0.15
Grain size class	-	fine
Sorting class	-	mod-well

FIGURE 1. QFR COMPOSITION



4. SUMMARY AND CONCLUSIONS

- Samples #25 (432.0mKB) and #15 (566.9mKB) from Koroit West-1 are an iron oxide/hydroxide-stained biomicrite limestone and a bioturbated, fine grained, argillaceous subarkosic sandstone, respectively.

- The biomicrite limestone (#25) contains little macroporosity and would have negligible permeability.

- In the argillaceous subarkose (#15), most intergranular spaces are filled by detrital clay, authigenic clay, compacted micaceous grains, and compacted organic fragments. Minor primary intergranular porosity is confined to localised areas that are relatively clean, but, with intervening areas being almost totally microporous due to pore filling by clay, permeability would be low.

- Compacted, pyritic, detrital carbonaceous fragments in #15 account for all observed organics. Residual bitumen in absent.

APPENDIX 1.

PHOTOMICROGRAPHS

PLATE 1: #25 432.0m Clifton Formation

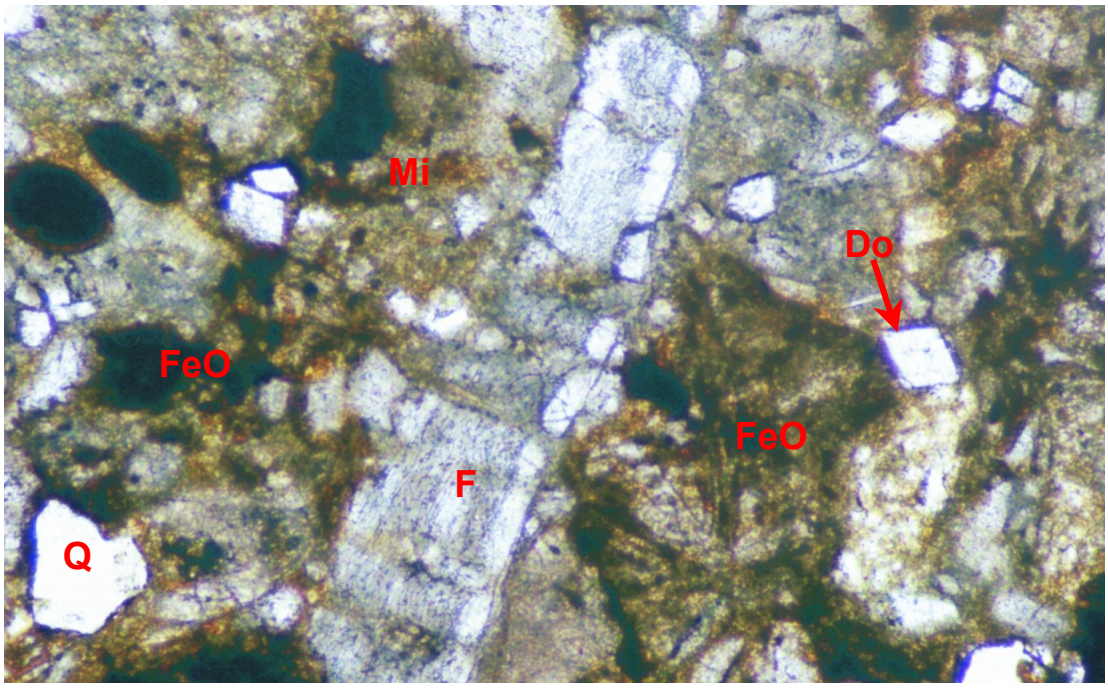
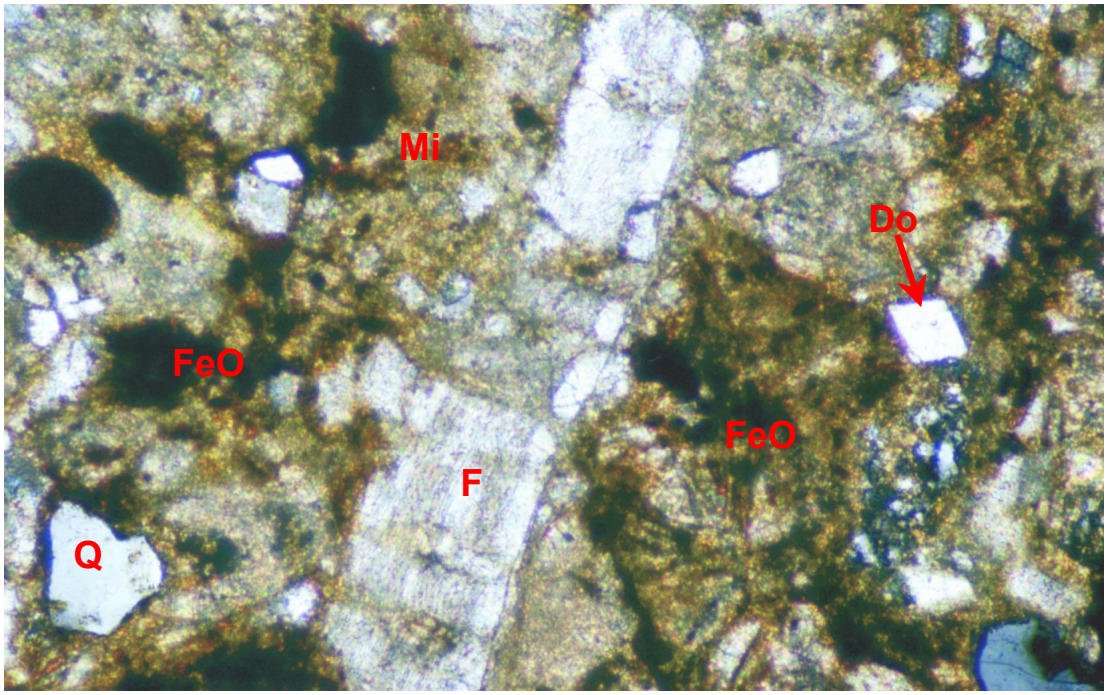


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.2mm



Biomicrite limestone in which calcareous shell fragments (F) and detrital quartz grains (Q) are supported by iron-oxide/hydroxide (FeO)-stained micrite matrix (Mi) in which fine dolomite rhombs (Do) have precipitated.

PLATE 2: #25 432.0m Clifton Formation (cont.)

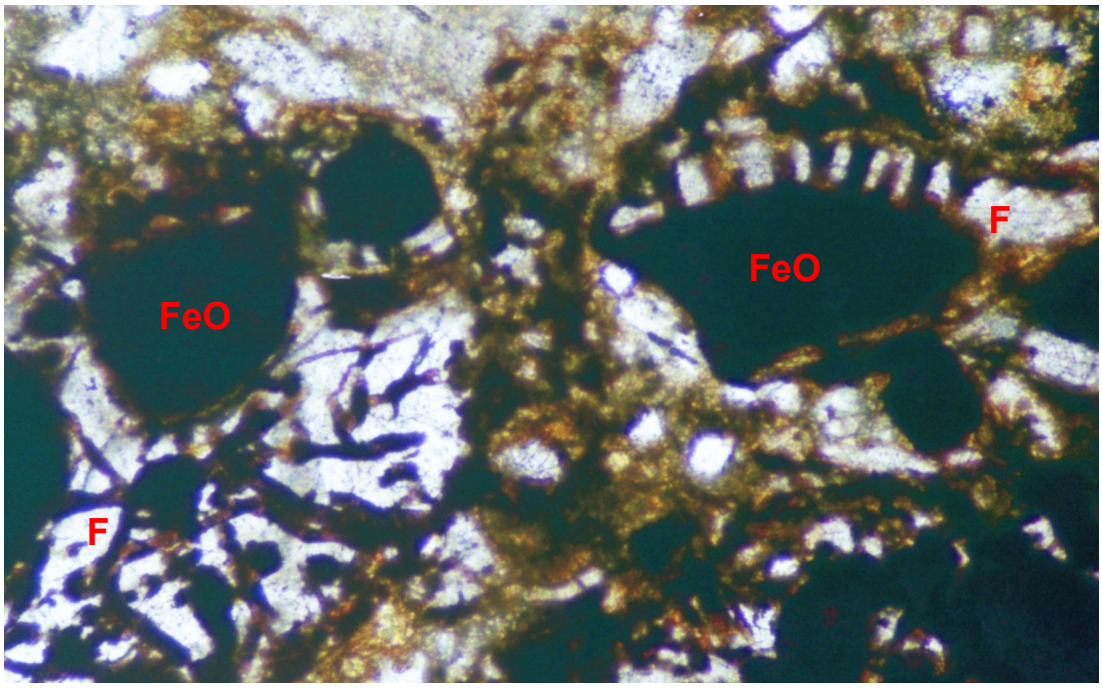
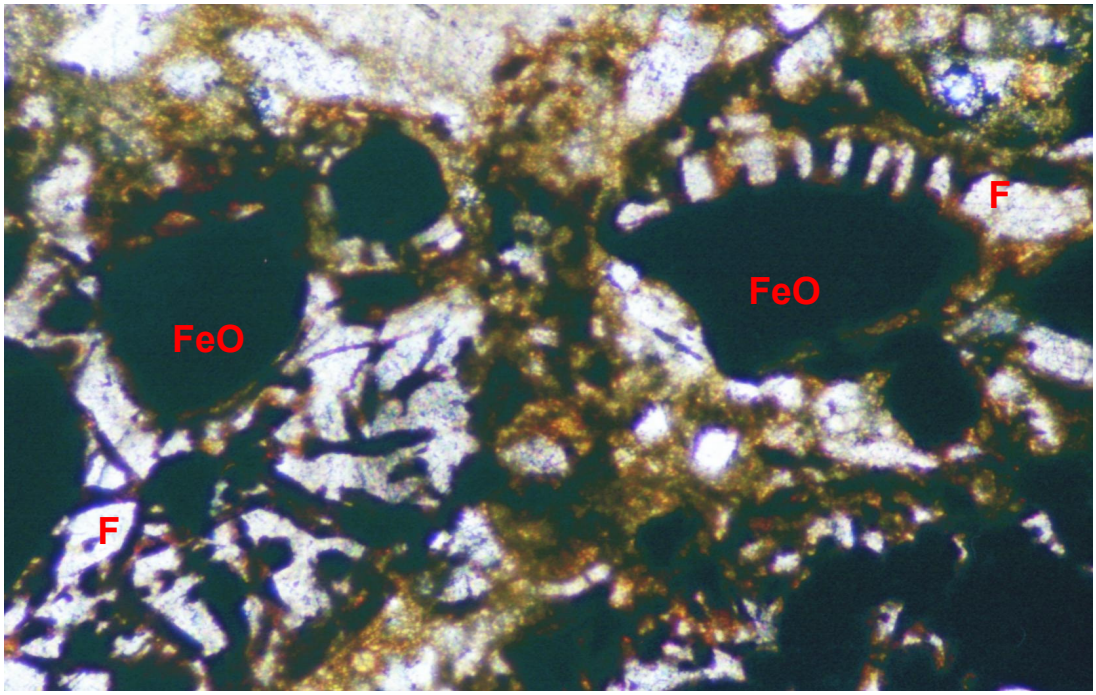


FIGURE 1 Plane polarised light

FIGURE 2 Crossed polarisers

0.2mm



Clots of iron oxide/hydroxide (FeO) replace calcareous fossils (F) and fill intragranular cavities. The limestone is strongly stained by iron oxide/hydroxide.

PLATE 3: #15 566.9m Pember Mudstone

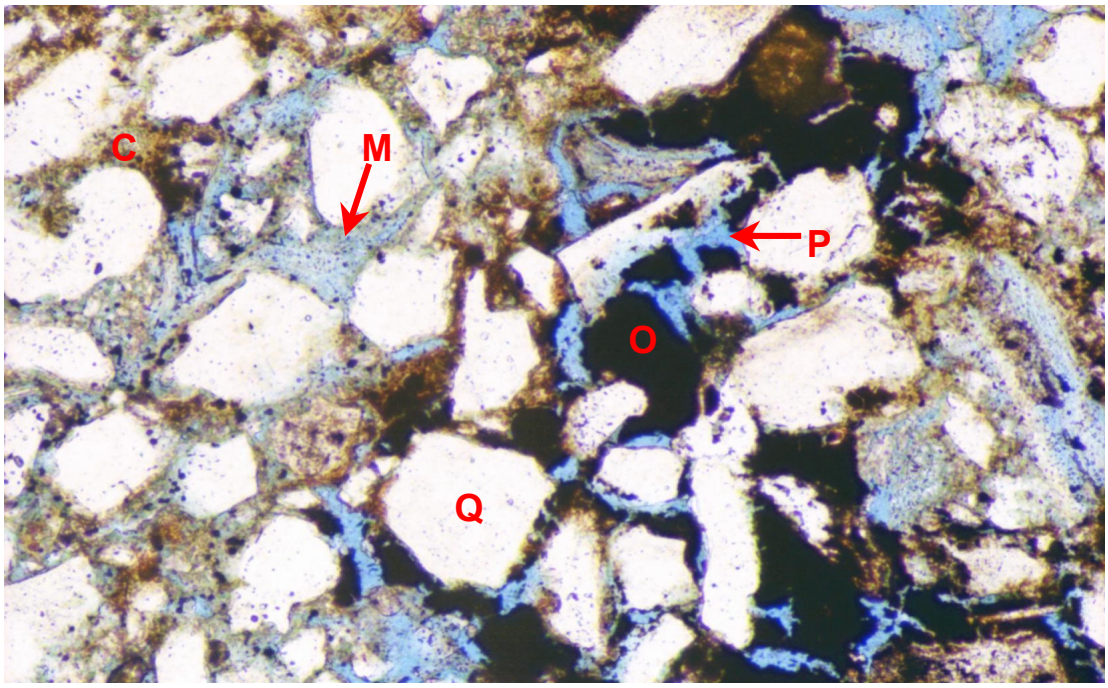
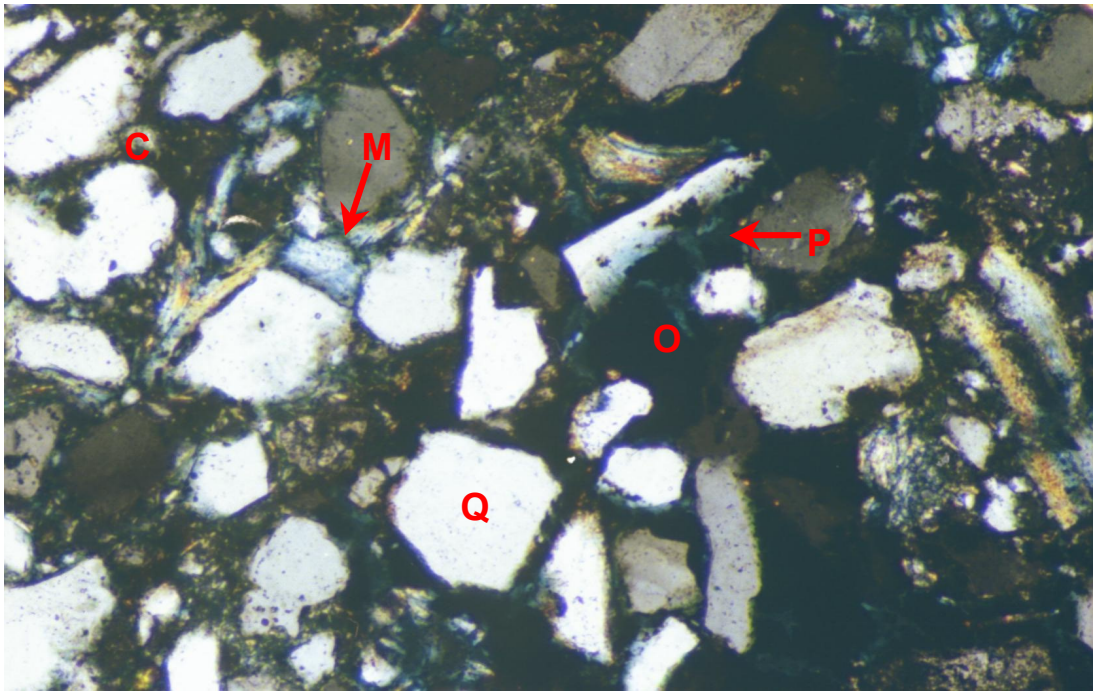


FIGURE 1 Plane polarised light

FIGURE 2 Crossed polarisers

0.2mm



Fine grained, argillaceous subarkose in which intergranular spaces between quartz framework grains (Q) are largely filled by compacted organic fragments (O), altered/compacted mica (M), and dispersed detrital clay matrix (C). Intergranular macroporosity (P) is localised and thus would not be conducive to permeability.

PLATE 4: #15 566.9m Pember Mudstone (cont.)

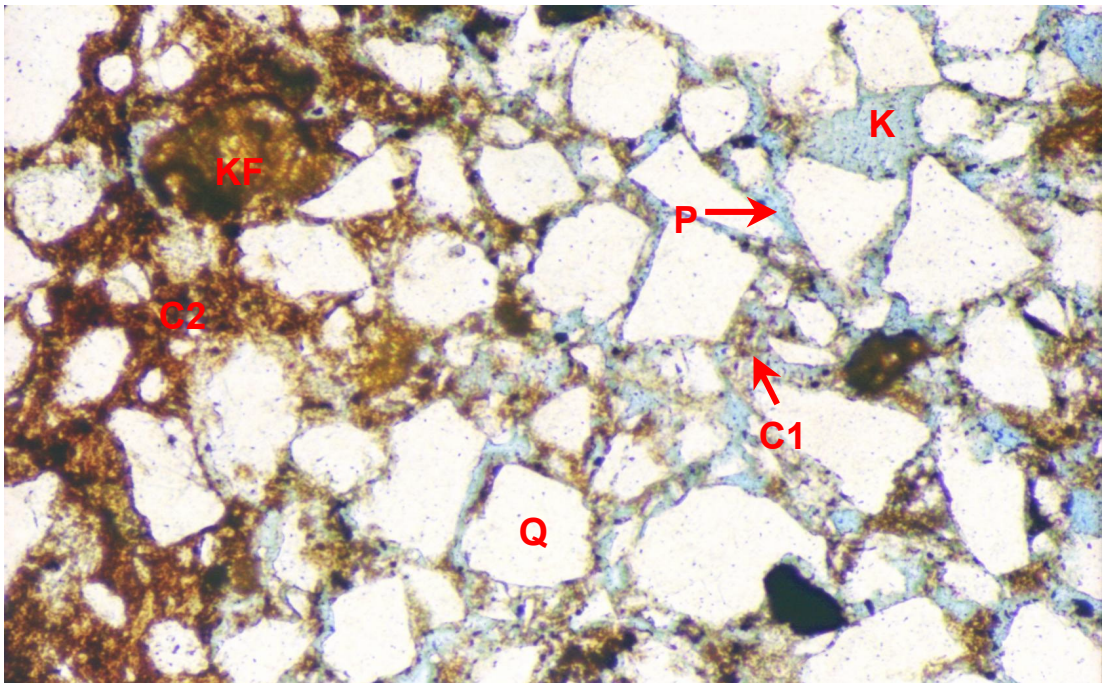


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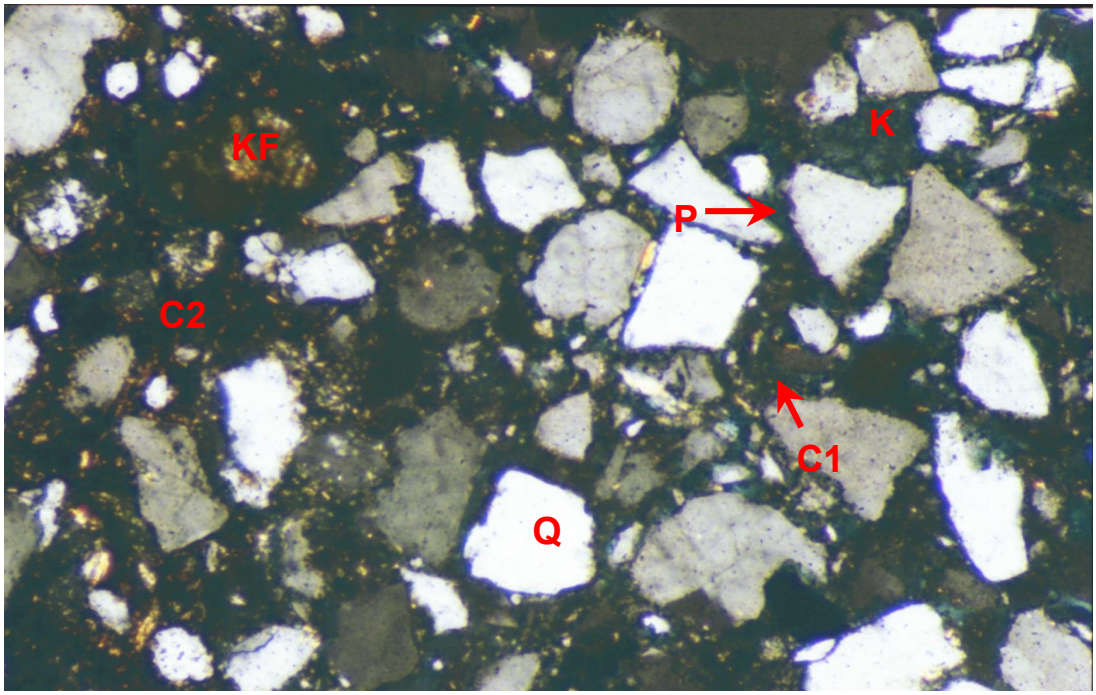
FIGURE 2 Crossed polarisers

0.2mm



Macroporosity (P) is confined to localised, relatively clean areas, but even here intergranular spaces are partly filled by authigenic kaolinite (K) and thinly dispersed detrital clay (C1). Elsewhere, intergranular spaces are completely filled by detrital clay matrix (C2). Framework grains are mainly quartz (Q) and K-feldspar (KF) (stained brown).