

## **APPENDIX I: LITHOLOGICAL DESCRIPTIONS**

The Mereenie Rig 1 Mudlogging unit was manned by a crew provided by Colin Higgins and Associates. Samples were collected, washed and described at 10 m intervals from 50 m to 930 m and then at 3 m intervals from 930 m to T.D. at 1600 m.

### PARKE SILTSTONE (DEVONIAN)

From 6.0 m to 19.0 m

True Stratigraphic Thickness: 12.4 + m

6.0 - 19.0 m          Sample collection begun at 50 m.

### MEREENIE SANDSTONE (LATE SILURIAN TO DEVONIAN)

From 19.0 m to 541.0 m

True Stratigraphic Thickness: 508.3 m

50 - 80 m            SANDSTONE: red brown, occasionally clear, mostly fine to medium grained, very fine in part, moderately well sorted, subangular to subrounded, poor porosity.

80 - 150 m          SANDSTONE: light orange brown, fine to medium grained, moderately sorted, subrounded to rounded, loose, moderate to good inferred porosity.

150 - 230 m        SANDSTONE WITH TRACE SILTSTONE.  
SANDSTONE: light orange brown, fine to medium grained, moderately sorted, subangular to subrounded, occasional firm aggregates with calcareous cement, generally loose and clean, fair to good inferred porosity.  
SILTSTONE: light orange brown, micromicaceous, firm, subblocky.

230 - 300 m        SANDSTONE WITH TRACE SILTSTONE.  
SANDSTONE: orange to red brown, commonly clear, fine to very fine grained, moderately well sorted, subangular to angular, occasionally subrounded, siliceous cement, sparse silty matrix, firm to moderately hard, poor porosity.  
SILTSTONE: red brown, micromicaceous, firm, subblocky.

300 - 350 m        SANDSTONE: (1) orange brown, fine to medium, moderately well sorted, subangular to subrounded, moderate siliceous cement, rare argillaceous matrix, firm to hard, fair porosity. (2) clear, translucent and light orange, fine to medium grained, well sorted, subangular to subrounded, loose, good porosity.

350 - 400 m        SANDSTONE: light orange pink, fine to medium grained, moderately well sorted, subangular to subrounded, generally loose, occasional weak siliceous cement, fair porosity.

400 - 443 m        SANDSTONE: white, clear, translucent, occasional orange tint, medium to very coarse grained, poorly to moderately sorted, subrounded to rounded and spherical coarse grains, angular to subrounded medium grains, moderately strong siliceous cement, friable to hard, poor porosity.

- 443 - 506 m      SANDSTONE WITH TRACE SILTSTONE.  
SANDSTONE: white, clear, translucent, occasional orange tint, mostly medium to occasionally coarse grained, moderately sorted, subrounded to rounded and spherical coarse grains, angular to subrounded medium grains, moderately strong siliceous cement, trace brown argillaceous matrix, poor porosity.  
SILTSTONE: brown red, purplish red, arenaceous and grading to very fine sandstone, firm.
- 506 - 541 m      SANDSTONE WITH TRACE SILTSTONE.  
SANDSTONE: white, clear, translucent, occasional orange tint, fine to medium, occasionally coarse grained, moderately sorted, subrounded to rounded and spherical coarse grains, angular to subrounded medium grains, moderately strong siliceous cement in part, trace brown argillaceous matrix, commonly loose, poor porosity.  
SILTSTONE: brown red, purplish red, arenaceous and grading to very fine sandstone, firm.

#### CARMICHAEL SANDSTONE (LATE ORDOVICIAN)

From 541.0 m to 614.2 m  
True Stratigraphic Thickness: 71.3 m

- 541 - 614.2 m      SANDSTONE WITH MINOR SILTSTONE.  
SANDSTONE: orange, clear and white, fine to medium grained, moderately sorted, angular to subrounded, siliceous cement, sparse argillaceous matrix, hard to friable and commonly loose, poor porosity.  
SILTSTONE: orange brown, arenaceous, micaceous, firm, subblocky to fissile.

#### UPPER STOKES FORMATION (MID TO LATE ORDOVICIAN)

From 614.2.0 m to 857.3 m  
True Stratigraphic Thickness: 237.7 m

- 614.2 - 760 m      SILTSTONE WITH TRACE SANDSTONE.  
SILTSTONE: red brown, minor grey green, argillaceous where red brown, grey green is siliceous and grades in part to very fine sandstone, moderately hard, subfissile to fissile.  
SANDSTONE: light grey, off white, clear, silty to fine grained, moderately well sorted, subangular to subrounded, siliceous cement in part, commonly loose, poor porosity.
- 760m - 857.3 m      SILTSTONE WITH TRACE SANDSTONE AND TRACE DOLOMITE.  
SILTSTONE: (1) reddish brown, weakly dolomitic, slightly arenaceous, trace micromicaceous, subfissile to subblocky, hard.  
(2) 10-50%, greenish grey, light green, siliceous, arenaceous and grading to very fine sandstone in part, micromicaceous, moderately dolomitic, hard, subblocky- blocky.  
SANDSTONE: off white, light grey green, grey brown, very fine to fine grained, moderately sorted, subangular to rounded, weak to moderate siliceous and dolomitic cement, occasional red brown clay matrix, tight porosity.  
DOLOMITE: light grey, cream, microcrystalline, hard.

## LOWER STOKES FORMATION (MID ORDOVICIAN)

From 857.3 m to 934.8 m

True Stratigraphic Thickness: 76.8 m

857.3 - 890 m      **SILTSTONE WITH DOLOMITE**  
SILTSTONE: red brown, argillaceous to occasionally arenaceous, trace mica, hard, subfissile.  
DOLOMITE: pinkish red, white, crystalline, brittle to very hard, blocky to angular.

NOTE: abrupt colour change in siltstone, red brown to grey at 890m

890 - 934.8 m      **SILTSTONE WITH DOLOMITE AND LIMESTONE.**  
SILTSTONE: medium to dark grey, argillaceous, dolomitic in part, hard, subblocky.  
LIMESTONE: light grey, silty, grades to sandstone, dolomitic in part, hard, dull yellow mineral fluorescence.

## UPPER STAIRWAY SANDSTONE (MID ORDOVICIAN)

From 934.8 m to 999 m

True Stratigraphic Thickness: 62.2 m

934.8 - 950 m      **SANDSTONE AND SILTSTONE.**  
SANDSTONE: white, buff, occasionally translucent, very fine to fine grained, well sorted, angular to subangular, strong dolomitic cement, hard, very poor to tight porosity.  
SILTSTONE: as above.

950 - 999 m      **SANDSTONE WITH TRACE SILTSTONE AND TRACE DOLOMITE**  
SANDSTONE: white, buff, occasionally translucent, very fine to fine grained, well sorted, angular to subangular, strong siliceous cement, hard, very poor to tight porosity.  
SILTSTONE: greenish grey, grey, common very fine quartz grains, firm to hard, subblocky to subfissile in part.  
DOLOMITE: off white, light brown, microcrystalline, hard.

## MIDDLE STAIRWAY SANDSTONE (MID ORDOVICIAN)

From 999 m to 1115.8 m

True Stratigraphic Thickness: 108.8 m

999 - 1020 m      **SANDSTONE WITH MINOR SILTSTONE**  
SANDSTONE: translucent, off white, fine to very fine grained, moderately well sorted, subangular, strong siliceous cement, trace pyrite, sparse silty matrix, very poor visual porosity.  
SILTSTONE: as above.

- 1020 - 1050m      SILTSTONE WITH MINOR SANDSTONE  
SILTSTONE: dark grey, grey, arenaceous and grading to silty sandstone, trace pyrite, firm to hard, subblocky to subfissile.  
SANDSTONE: generally as above with trace to common pyrite and silty matrix, very poor porosity.
- 1050 - 1115.8m      SILTSTONE WITH MINOR SANDSTONE  
SILTSTONE: dark grey, medium grey, arenaceous and grading to silty sandstone, trace pyrite, firm to hard, subblocky to subfissile.  
SANDSTONE: light grey, off white, very fine to fine grained, well sorted, subangular to angular, strong siliceous cement, trace to common pyrite, sparse silty matrix, hard to occasionally friable, very poor porosity.

#### LOWER STAIRWAY SANDSTONE (2) (MID ORDOVICIAN)

From 1115.8 m to 1174.3 m

True Stratigraphic Thickness: 54.3 m

- 1115.8- 1134m      INTERBEDDED SILTSTONE AND SANDSTONE.  
SILTSTONE: medium to dark grey, arenaceous in part, trace pyrite, firm to hard, subblocky to subfissile.  
SANDSTONE: off white, mostly very fine to fine grained aggregates, well sorted, subangular, strong siliceous cement, trace to common pyrite, occasional silty matrix, firm to hard, very poor porosity. Also occasional clear, medium and coarse, subrounded to rounded, loose grains.
- 1134- 1174.3m      SANDSTONE WITH MINOR SILTSTONE.  
SANDSTONE: very fine to fine to occasionally medium grained aggregates as above plus common loose, medium and coarse grains, subrounded to rounded. Sample has poor overall sorting to moderate bimodal sorting.  
SILTSTONE: as above.

#### LOWER STAIRWAY SANDSTONE (1) (MID ORDOVICIAN)

From 1174.3 m to 1203.4 m

True Stratigraphic Thickness: 27.2 m

- 1174.3 -1203.4 m      SANDSTONE WITH MINOR SILTSTONE.  
SANDSTONE; light brown, light grey, very fine to fine grained, with occasional medium and coarse, loose grains, well sorted, subangular to angular aggregates, strong siliceous cement, sparse white argillaceous matrix, firm to hard, poor porosity.  
SILTSTONE: medium to dark grey, arenaceous, trace mica, firm, fissile to subblocky.

## HORN VALLEY SILTSTONE (EARLY ORDOVICIAN)

From 1203.4 m to 1278.6 m

True Stratigraphic Thickness: 70.9 m

- 1203.4 - 1245 m     **SILTSTONE WITH MINOR SANDSTONE AND LIMESTONE.**  
SILTSTONE: medium grey, argillaceous to arenaceous, micaceous, pyritic, firm to hard, subblocky to fissile.  
SANDSTONE: off white, light brown, very fine to occasionally fine grained, well sorted, moderately strong siliceous and dolomitic cement, common light brown silty argillaceous matrix, poor porosity.  
LIMESTONE: light grey, light brown, microcrystalline, arenaceous in part, hard.
- 1245 - 1278.6m     **SILTSTONE WITH 10% LIMESTONE AND TRACE SANDSTONE.**  
SILTSTONE: light to medium grey, light brown grey, trace pyrite, trace mica, arenaceous in part, subblocky.  
SANDSTONE: off white, light grey, light brown grey, rarely clear, very fine to occasionally fine grained, , well sorted, subangular, moderately strong siliceous and dolomitic cement, sparse silty matrix, firm to occasionally loose, poor porosity.  
LIMESTONE: light grey, light brown, arenaceous in part, microcrystalline, hard.

## PACOOTA SANDSTONE - P1 UNIT (EARLY ORDOVICIAN)

From 1278.6 m to 1295.8 m

True Stratigraphic Thickness: 106.5 m

- 1278.6 -1300 m     **SILTSTONE WITH MINOR SANDSTONE AND DOLOMITE/LIMESTONE.**  
SILTSTONE: medium grey, dark grey, argillaceous, micromicaceous, moderately dolomitic /calcareous, trace pyrite, hard, subfissile.  
SANDSTONE: clear, white, fine to occasionally coarse grained, dominantly medium, poorly to moderately sorted, angular to subangular, strong siliceous and carbonate cement in part, sparse argillaceous matrix, hard, poor porosity.  
DOLOMITE/LIMESTONE: off white, light grey, silty, generally associated with siltstone, occasional loose, blocky to angular pieces, hard.
- 1300 - 1366 m     **SANDSTONE WITH MINOR SILTSTONE.**  
SANDSTONE: clear, translucent, white, fine to medium grained, moderately sorted, subangular to occasionally angular, weak siliceous cement, sparse silty/argillaceous matrix, trace glauconite, commonly loose, poor porosity.  
SILTSTONE: medium grey, brown grey, arenaceous where brown grey, micromicaceous, common disseminated and occasional nodular pyrite, firm to hard, subfissile to fissile.
- 1366 - 1370 m     **SANDSTONE: clear, translucent, medium to occasionally coarse grained,**  
P1 - 280     **moderately well sorted, subangular to subrounded, rare siliceous cement and trace silty matrix, generally loose and clean, fair inferred porosity, no fluorescence.**

1370 - 1391.4 m SANDSTONE WITH TRACE-10% SILTSTONE.

SANDSTONE: clear, translucent, frosted and pitted grains, medium to occasionally coarse grained, moderately to well sorted, angular to subrounded, trace siliceous cement, trace silty matrix, mostly loose, fair inferred porosity.

#### PACOOTA SANDSTONE- P2 UNIT (EARLY ORDOVICIAN)

From 1391.4 m to 1462.7 m

True Stratigraphic Thickness: 67.3 m

1391.4 -1425 m SANDSTONE WITH VERY MINOR SILTSTONE.

SANDSTONE: clear, translucent, occasionally white, medium to occasionally coarse grained, well sorted, subangular to subrounded, trace pyrite, commonly loose, fair porosity.

SILTSTONE: dark grey, grey brown, arenaceous in part, micromicaceous, common pyrite, hard, subblocky to occasionally fissile.

1425 - 1462.7m SANDSTONE WITH MINOR SILTSTONE.

SANDSTONE: clear, white, mostly fine to medium grained, occasionally very fine to fine (1425 - 1435 m), well sorted, angular to subrounded, loose, common pyrite and common glauconite below 1435 m, fair inferred porosity.

SILTSTONE: medium to dark grey, arenaceous in part, trace pyrite, subblocky to fissile.

#### PACOOTA SANDSTONE - P3 UNIT (EARLY ORDOVICIAN)

From 1462.7 m to 1550.5 m

True Stratigraphic Thickness: 84.1 m

1462.7-1483.5m SANDSTONE: clear, translucent, medium to coarse grained, moderately sorted, angular to subangular, occasional weak siliceous cement, mostly loose, no visible matrix, fair to poor porosity. Fluorescence: 30% dull, patchy bluish white fluorescence with occasional brighter pinpoints, very weak crush cut to no cut, trace residue.  
P3- 10

1483.5-1498.2m SANDSTONE WITH TRACE SILTSTONE

SANDSTONE: clear, translucent, greenish grey, fine to medium grained, commonly coarse, moderately to poorly sorted, subangular, occasional weak to strong siliceous cement, occasional silty matrix, glauconitic and micromicaceous commonly loose, poor porosity. Fluorescence: as above.

SILTSTONE: dark grey, argillaceous, hard, subblocky to fissile and splintery.

- 1498.2-1514.5m SANDSTONE: clear, translucent, medium to coarse grained, moderately well sorted, angular to subangular, mostly loose, occasional weak siliceous cement trace silty siliceous matrix, poor to fair porosity. Fluorescence: 30% dull, patchy, bluish white, with occasional bright pinpoints, very weak crush cut to no cut, trace residue.  
P3 - 120/130
- 1514.5- 1525.4m SANDSTONE: clear, very light reddish brown, medium to coarse grained, moderately sorted, subangular to angular, strong siliceous cement in aggregates, occasional loose coarse grains, hard, poor porosity. Fluorescence: as above.
- 1525.4- 1536 m SANDSTONE: clear, very light reddish brown tinge in part, mostly medium grained, occasionally coarse, moderately well sorted, subangular, coarse grains are rounded unless broken, weak to moderate siliceous cement, loose in part, fair to poor porosity. Fluorescence: 50% dull, patchy, bluish white with occasional moderately bright, yellowish white pinpoints, no cut to very weak crush cut, trace residue.  
P3 - 190
- 1536 - 1550.5 m SANDSTONE: as above. Fluorescence: as above.  
P3 - 230/250

#### PACOOTTA SANDSTONE P4 (EARLY ORDOVICIAN)

From 1550.5 m to 1600 m (Total Depth)

True Stratigraphic Thickness: 47.7+ m

- 1550.5 - 1600 m SANDSTONE: clear, translucent, light reddish brown, dominantly medium grained, occasionally to commonly coarse grained, moderately sorted, angular to subangular where medium, subrounded to rounded where coarse, weak to moderate siliceous cement, firm to loose in part, poor to occasionally fair porosity. Fluorescence: 25% decreasing to trace, as above except no cut, no residue.