

## Appendix 8. Illustrated core and cuttings description, Mackenzie River #4 (E-27).

**UWID:** 300/E-27-6520-12645/0 [NT]

**STATUS:** Drld & ABD

**LAHEE:** DEV

**SPUD:** 1980/02/04

**DRILLED BY:** Imperial Oil Ltd [J001]

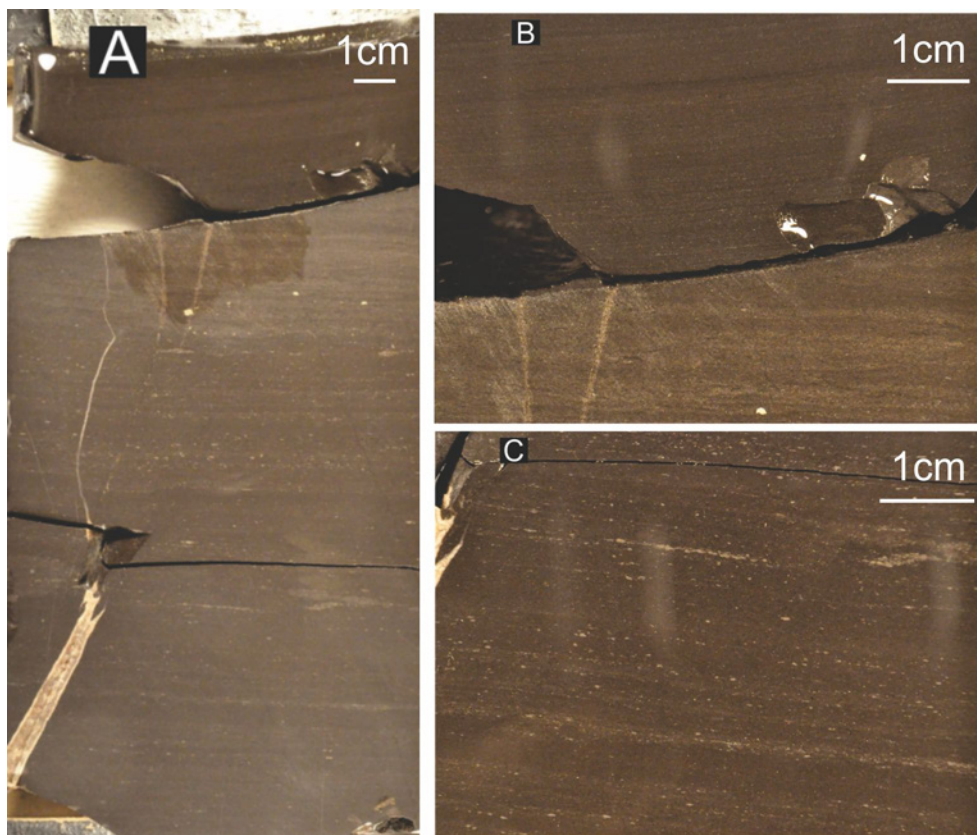
Measurements in meters (original units). Cored interval: 398.0– 542.0m

### CANOL FORMATION

398.0-398.20 Mudrock: hard brownish black laminated pyritic thick-subfissile siliceous shale with minor radiolaria-rich silty laminae (photo). Conchoidal aspect of fissility planes. Lamination is emphasized by pyritic streaks and thin (<0.1 mm) laminae; evenly dispersed “pyrite dust”. Basal 2-3 cm less pyritic and enriched in paler-colored silt that emphasizes lamination. Infrequent pyrobitumen streaks. No sponge spicules. Small black coaly detritus. The basal portion is not preserved.

398.20-398.28 Mudrock: hard brownish black muddy siltstone with faint lamination; admixture of Radiolaria; moderate pyrite content (evenly dispersed “dust” and laminar chains of small nodules near the base). The interval shows coarsening upward (coarse siltstone in base). Small (<0.2 mm) coaly detritus. Conodont specimens present in coarser-grained part near the base.

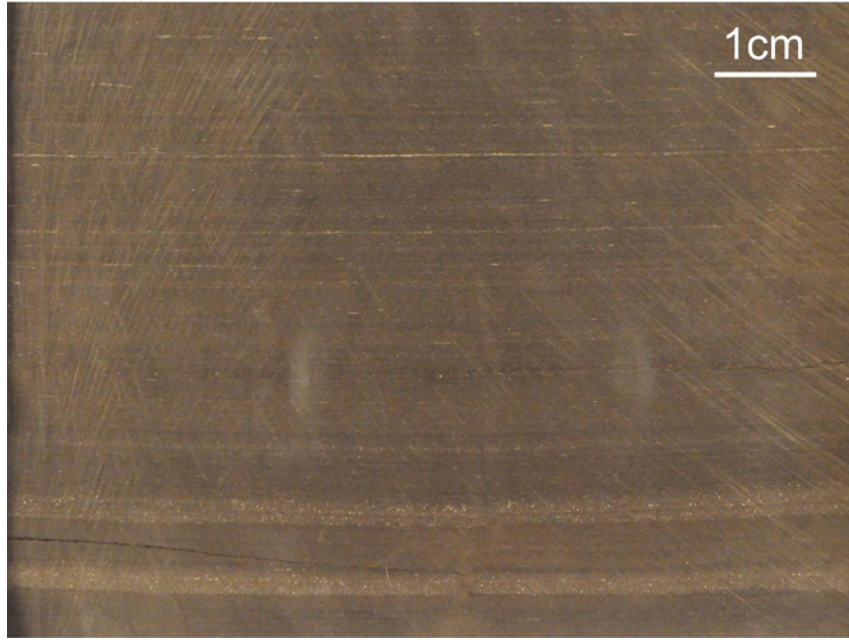
398.28-398.46. Limestone: muddy, dark brownish gray, hard and monolithic, weathers pale brown upon HCl leaching (match to pale calcareous beds and nodules in outcrops). The fabric is vaguely laminar; the matrix is finely silty to pelitomorphic, with laminar chains of white calcite eyes. These eyes are 0.1-1.0 mm in size and have diffused margins. Low pyrite content mostly as “pyrite dust”. An oblique vein of layered hydrothermal calcite. No fossils.



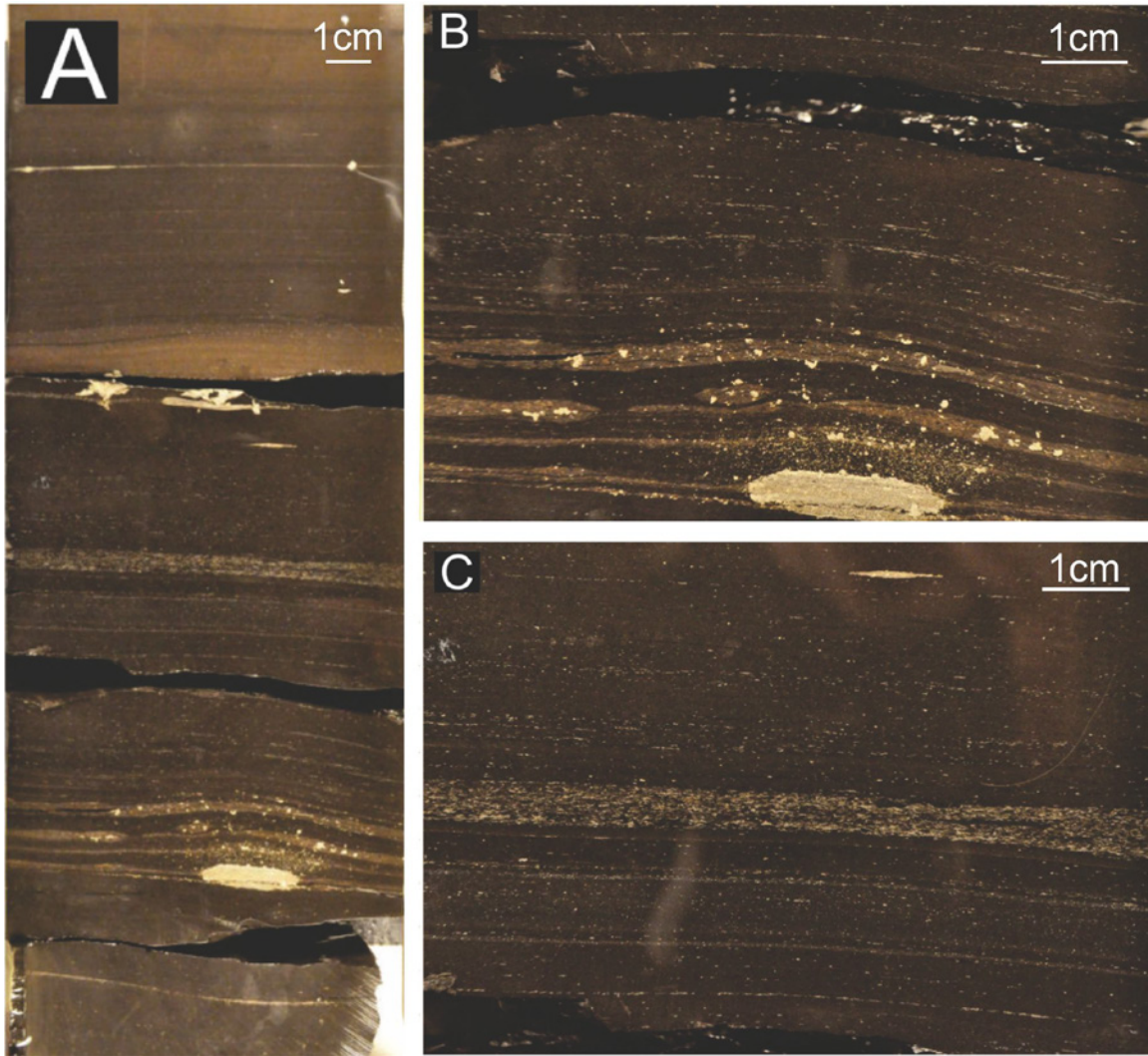
**Figure E-27-1. Diagenetic limestone and overlying pyritic mudrock, 398.28-398.46 m MD**

398.46-398.55 No core (marked F.W.B.)

398.55-400.02 Mudrock: hard back pyritic cherty subfissile laminar shale with 0.1-2.0 cm thick intervals of coarser-grained fabrics. These seams make up about 10% of the interval. Lamination in main mudrock is emphasized by pyritic streaks and laminae. The coarser-grained seams are composed of (1) Radiolaria-rich brownish micaceous siltstones; (2) micaceous siltstones with coaly detritus and no Radiolaria; (3) cherty material impregnated with stellate calcite crystals (the latter only in upper half). Common conchoid fracturing.



**Figure E-27-2. Radiolaria-rich micaceous siltstone laminae (bottom) in pyritic mudrock, 399.45 m MD**



**Figure E-27-3. Calcareous laminar mudrock and brownish silty mudrock above, 399.90-400.17 m MD**

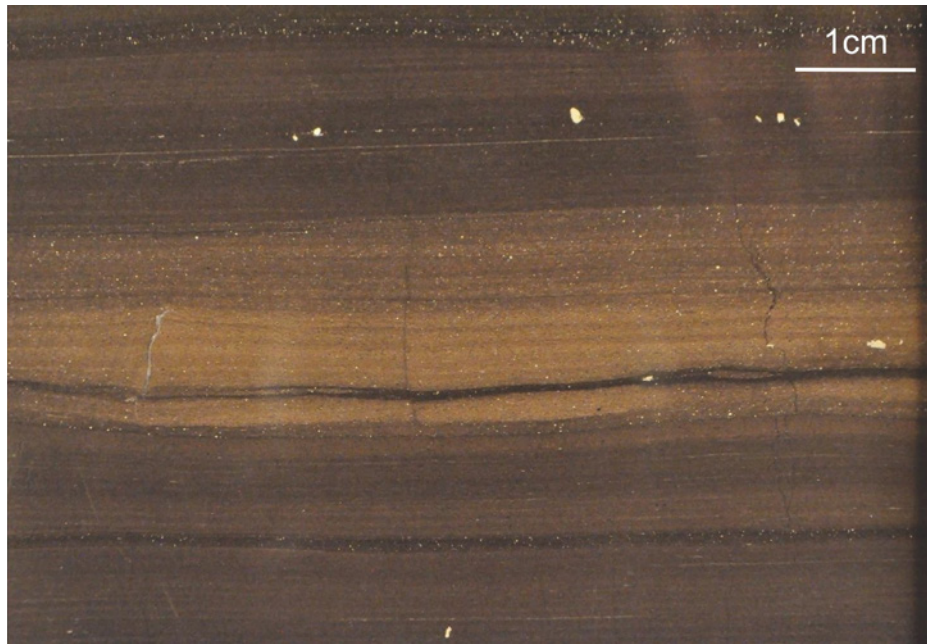
400.02-400.17 Calcareous mudrock: alternation of black pyritic siliceous mudrock and paler colored limestone laminae composed of recrystallized (finely sparitic, 0.1-0.2 mm) material. Matrix of host mudrock is interspersed with stellate calcite aggregates. Abundant very fine (0.1 mm) black (coaly?) detritus, numerous pyrobitumen injections along bedding planes. Some laminae are composed of collapsed pyritized tentaculitids. Pyrite in the form of laminae, streaks, “dust”, and small nodules.

400.17-400.45 Mudrock: black, hard, subfissile to monolithic, laminar, pyritic and cherty; mostly pelitomorphic shale with minor silty shale. Regular pyritic streaks and laminae. No sponge spicules, no calcareous material.

400.45-401.95 Mudrock: hard, laminar, alternation of black laminar pyritic shales (similar to 400.17-400.45 m) and dark brown micaceous Radiolaria-rich siltstones and shales. The latter have higher content of expandable clays and tend to form cm-thick



laminated beds; some of these beds show graded structure. The thickest interval of black pyritic shale at 400.70-400.90 m.

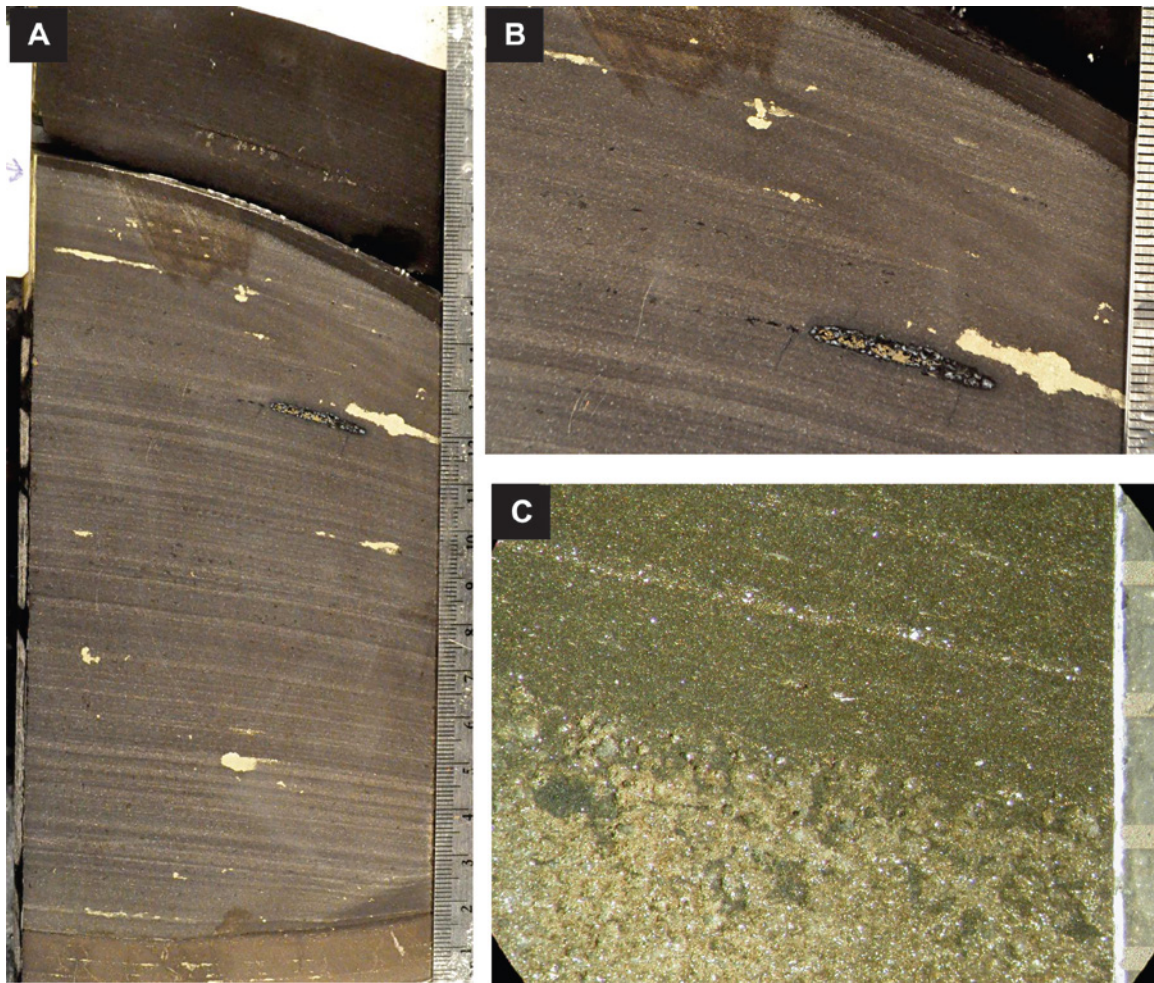


**Figure E-27-4. Alternation of brownish siltstone and black pyritic mudrock; note upright stylolites, 401.85 m MD**

401.95-402.40 Mudrock: hard subfissile dark brownish gray laminated shale intercalated by brownish micaceous Radiolaria-rich siltstones; the latter often showing graded structure. In difference to 400.45-401.95 m, the shale is less pyritic and slightly lighter colored, with sporadic and poorly developed pyritic streaks and laminae. Fine (0.1-0.2 mm) coaly detritus (and/or mafic mineral grains). Radiolaria-rich laminae have higher pyrite content mostly as “pyrite dust”.

402.40-404.20 Mudrock: hard, subfissile, locally monolithic, non-calcareous, similar to 400.45-401.95 m: alternation of pyritic muddy siltstones and silty shales, in the lower half mostly shale; horizontal low-amplitude stylolites, rare upright stylolites. Fracturing in shales producing conchoid surfaces, siltstones split along planar bedding surfaces. The thickest brownish silty shale to siltstone with Radiolaria occurs at 403.90-404.05 m.

404.20-404.40 Limestone: very dark gray, laminated, medium crystalline (0.2-0.3 mm). Oblique and diagenetic top and base and wrapping behavior of overlying pyritic laminae indicate pre-compactional authigenic origin. The crystalline fabric overprints and preserves primary lamination of calcareous laminae with rarely preserved conical outlines (tenaculitids). Laminar chains of pyrite nodules (0.2-2.0 cm), rare bitumen-chalcedony lenticles. Base via overcompacted seam, on core side with an intruding structure (photo).



**Figure E-27-5. Diagenetic limestone nodule, 404.2-404.4 m MD, scale rulers on the right in millimeters; (C) is photomicrograph of the upper contact of nodule and host mudrock.**

404.40-404.72 Mudrock; hard, brownish black, laminated, subfissile (platy), weakly calcareous, with common radiolaria-rich brownish laminae. Calcite resides in laminar chains of “stellate calcite” and occasionally preserved laminae-forming collapsed tentaculitids; no calcite in mudrock matrix. High pyrite content (“pyrite dust” and pyritic laminae). No sponge spicules. Bedding surfaces are planar stylolitized to conchoidal.

## RAMPARTS FORMATION

### *Kee Scarp Member*

The uppermost 15 cm are removed (marked F.W.B.)

404.87-405.15 Limestone: yellow, microporous, massive, oil-impregnated, strongly chalkified; sedimentary texture mostly obliterated; rare poorly preserved *amphiporas* and/or *Thamnopora* corals; strong stylolitization.



405.15-408.0 Limestone: pale yellow moderately chalkified boundstone with large bulbous stromatopores, lamellar favositid corals and stromatoporoids, large brachiopods, and other typical macrofossils. Matrix locally preserves the sedimentary texture of coarse-grained subrounded grainstone.

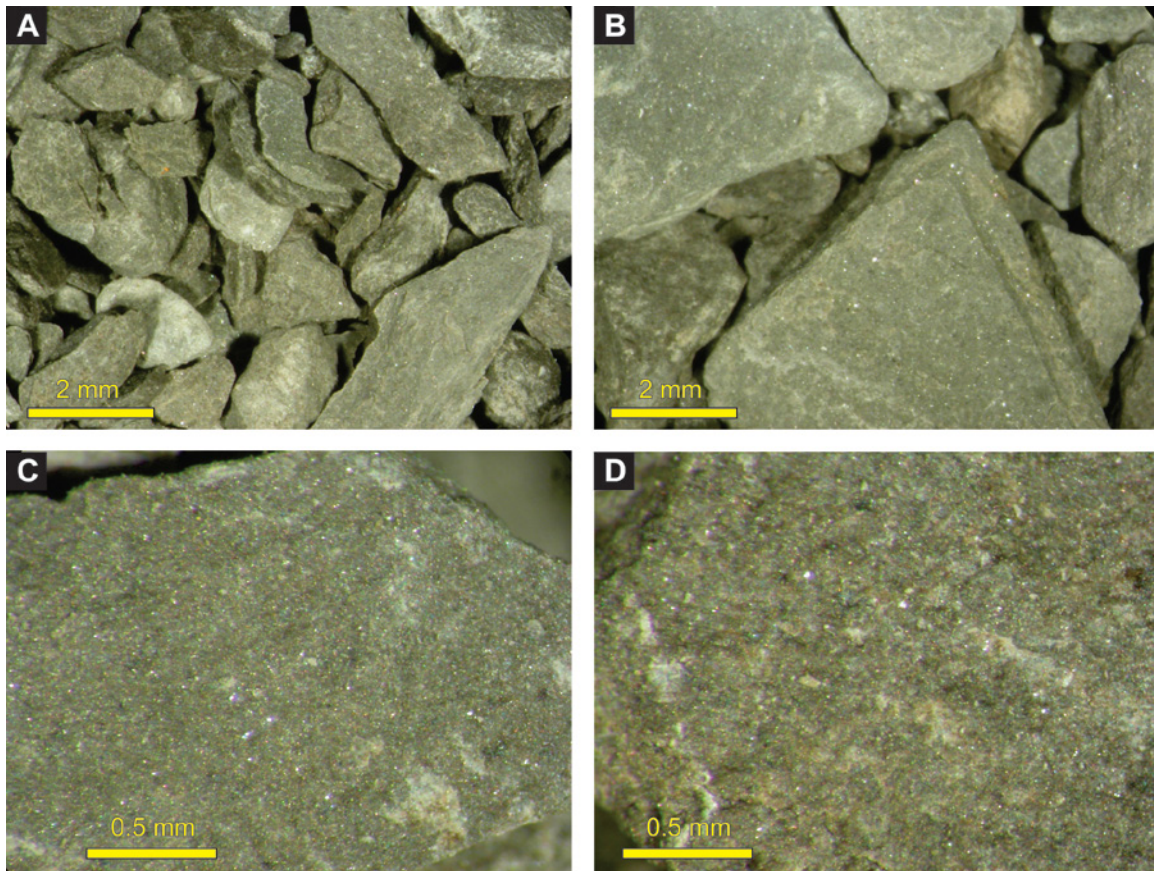
The core below is not described.

#### CUTTINGS CONTROL AT 330-400 m MD

330: Pale gray micaceous shale and fine-grained siltstone; many cuttings are subrounded

340: Pale gray shale and minor siltstone; semi-rounded cuttings; rare very fine-grained sandstone

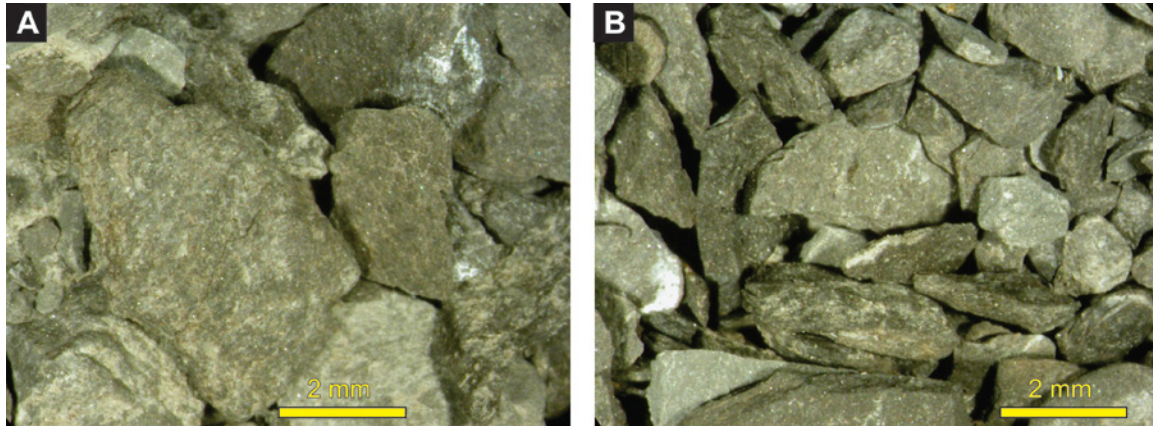
355: Pale gray shale as above 50%; dark brownish gray platy silty shale 40%; siltstones and very fine-grained sandstones 10%



**Figure E-27-6. Cuttings, sample 355 m**

360: Pale gray subrounded shale 50%; brownish gray platy shale and dark brownish gray shale 50%; rare siltstones

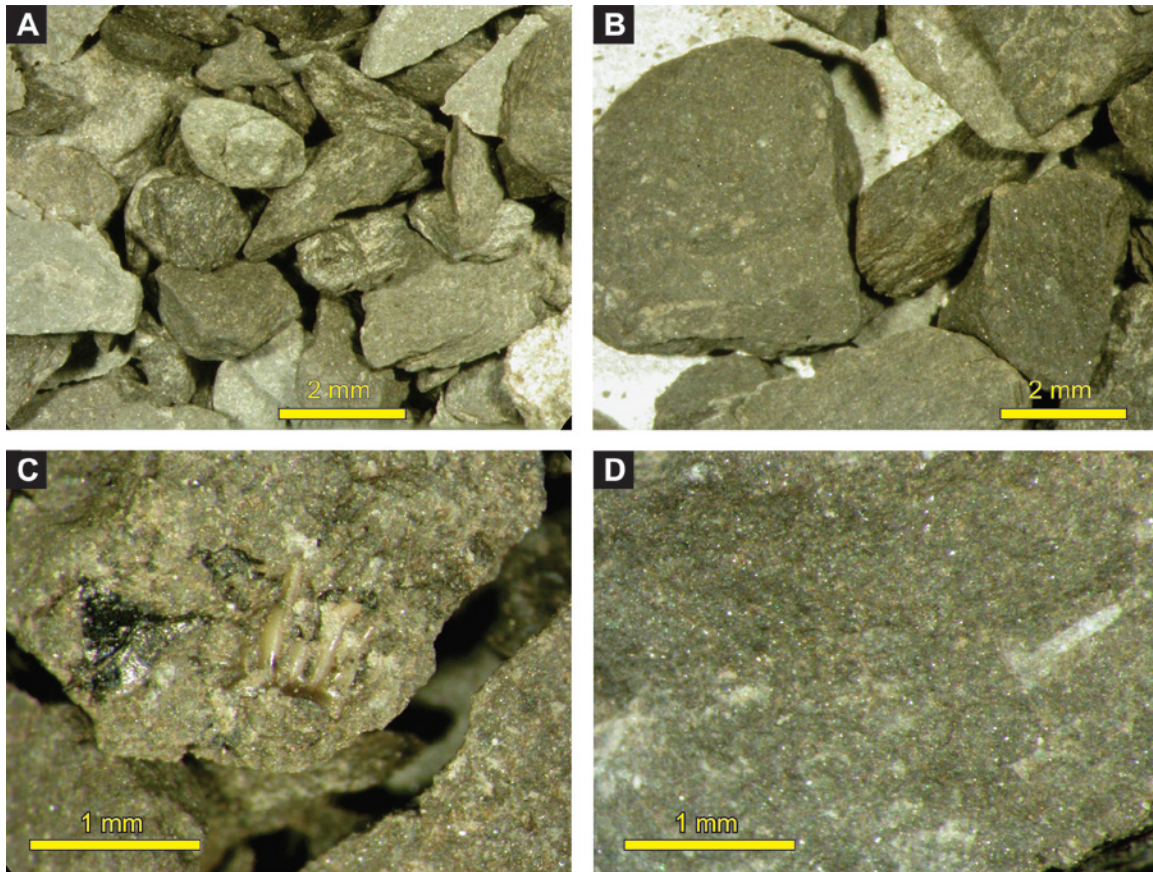
365: Platy brownish gray shale 60-65%; subrounded cuttings of pale gray shale 30%; siltstones 5-10%



**Figure E-27-7. Cuttings, sample 365 m**

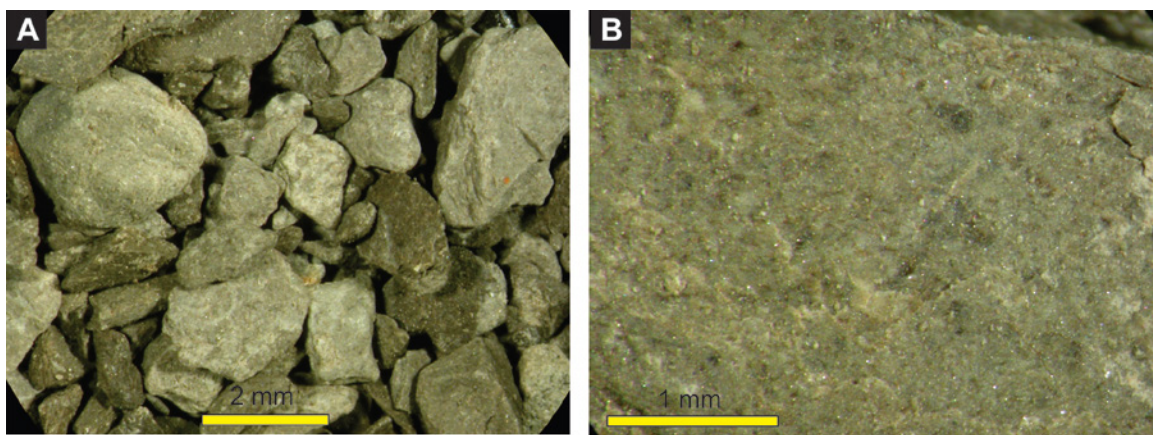
370: Platy brownish gray shale 65-70%; dark platy silty shale 5%; rounded cuttings of pale gray shale 25%





**Figure E-27-8. Cuttings, sample 370 m; note conodonts in a siltstone cutting on (C)**

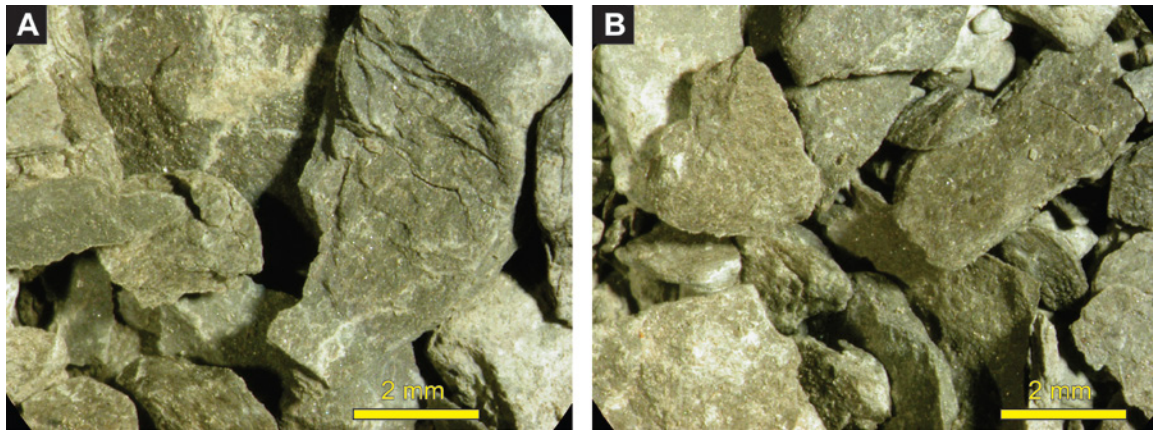
375: Brownish gray platy shale 50%; pale gray shale (rounded cuttings) 10%; pale brownish gray shale with dark ghost impressions (some of them resembling acritarchs) 30-35%



**Figure E-27-9. Cuttings, sample 375 m; note dark ghost impressions on fissility surface on (B)**



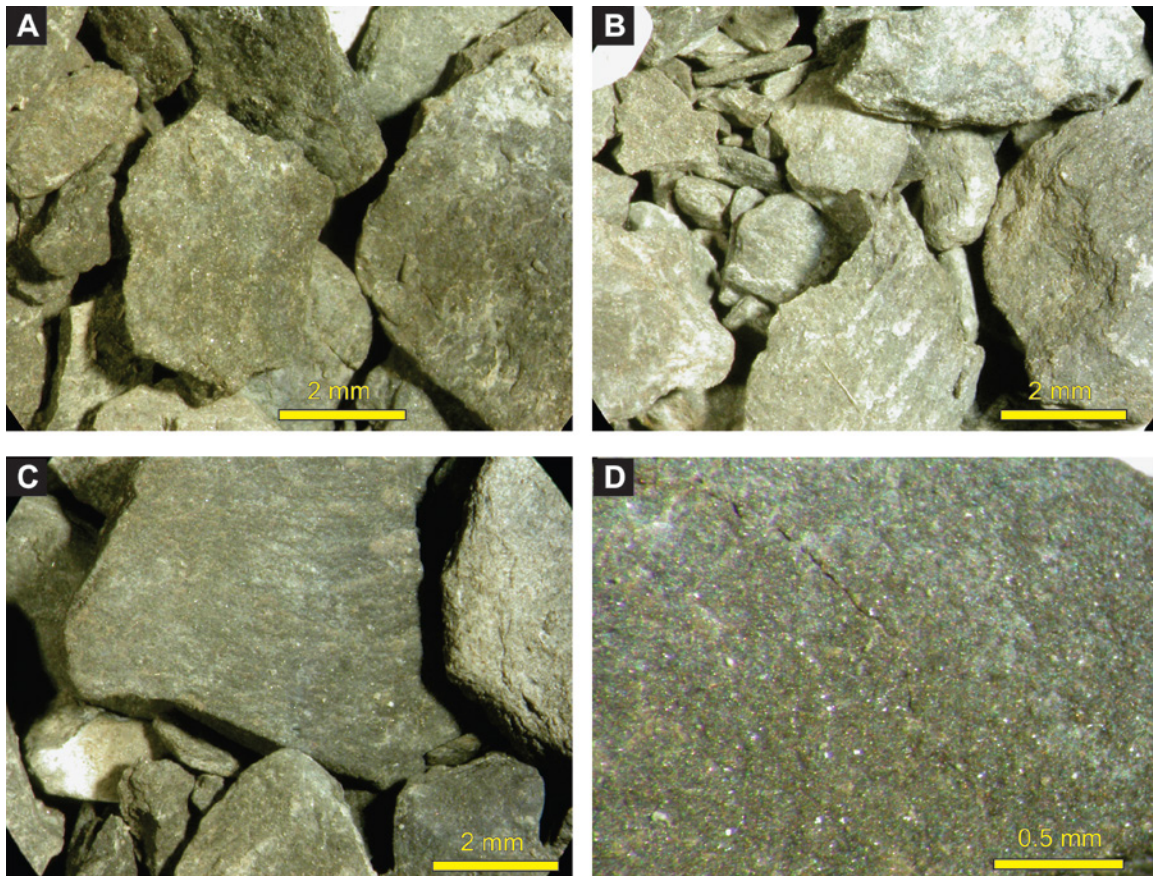
380: Brownish gray platy shales 80%; dark brownish gray shales 10%; pale gray shale (rounded cuttings) 10%; average cutting size larger than above



**Figure E-27-10. Cuttings, sample 380 m.**

385: Brownish gray, partly microcrystalline platy shales 90-95%; pale gray rounded shales 5%

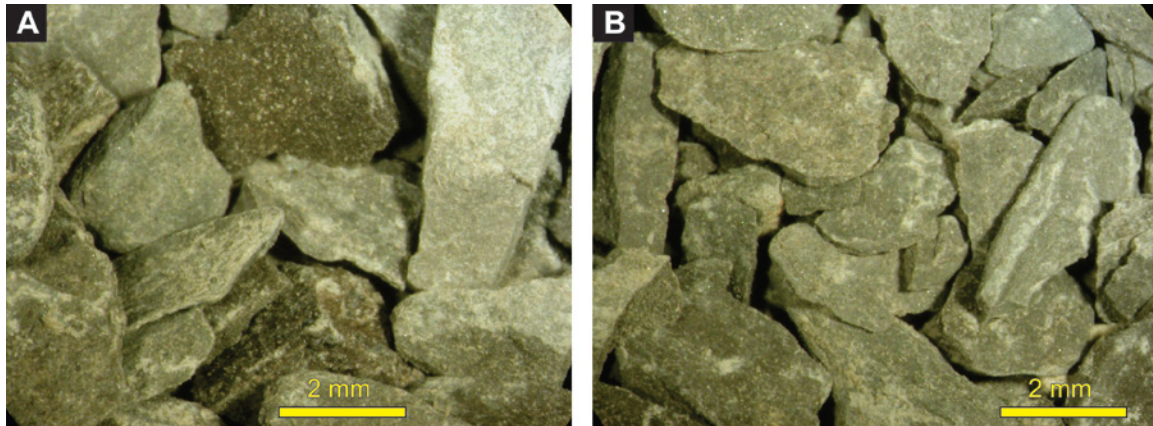
390: Dark gray platy and conchoidal microcrystalline shales 90%; siltstones 5%; average cutting size slightly larger than above



**Figure E-27-11. Cuttings, sample 390 m. Many cuttings have shardy shape with conchoid surfaces.**

395: Same, 85-90%; siltstones 10%; pale gray subrounded shales 5%

400: Platy pale gray microcrystalline shale 80%; rounded gray shale 10%; dark brownish gray platy and conchoidal (shardy) shale 10%; pale gray rounded shales 10%.



**Figure E-27-12. Cuttings, sample 400 m.**