ERCB/AGS Open File Report 2008-12

# Rock Eval™, Total Organic Carbon, Adsorption Isotherms and Organic Petrography of the Banff and Exshaw Formations: Shale Gas Data Release

Energy Resources Conservation Board

Alberta Geological Survey

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# Rock Eval™, Total Organic Carbon, Adsorption Isotherms and Organic Petrography of the Banff and Exshaw Formations: Shale Gas Data Release

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## Abstract

This report is a data release of adsorption isotherms, Rock Eval™, total organic carbon and organic petrography for selected samples of the Banff and Exshaw Formations generated for the ERCB/AGS project on shale gas resources in Alberta. This data release complements other reports and data from the same project, as listed in this report.

# 1 Introduction

ERCB/AGS initiated a project in 2007 to evaluate shale gas in Alberta, to determine the quantity and spatial extent of these resources. The first two formations chosen for evaluation are the Colorado Group and the Banff and Exshaw formations. Alberta Geological Survey is releasing a series of reports to disseminate data and knowledge from the project.

This report disseminates results from adsorption isotherms, Rock Eval™ and total organic carbon (TOC) analysis, and organic petrography associated with the Banff and Exshaw formations. In addition to the analyses listed above, AGS ran a series of analyses on core and outcrop samples (Table 1). The data generated from the project will be combined with additional data to map and estimate shale gas resources in the province.

**Table 1. Analyses performed on core and outcrop samples, and the organization that performed the analyses as part of the shale gas resource evaluation project.**

| Type of Analysis | Company/ Analyst | References |
|---|---|---|
| Adsorption isotherms | Schlumberger/TerraTek; CBM Solutions | Beaton et al. (2009), this report |
| Mercury porosimetry, envelope and helium pycnometry. | Department of Physics, University of Alberta (D. Schmitt) | Pawlowicz et al. (2009a, b) |
| Permeametry | Department of Earth and Atmospheric Sciences, University of Alberta (M. Gingras) | Pawlowicz et al. (2009a, b) |
| Rock Eval™/TOC | Geological Survey of Canada; Schlumberger; CBM Solutions | Beaton et al. (2009), this report |
| Organic petrography | Geological Survey of Canada (J. Reyes) | Beaton et al. (2009), this report |
| Petrographic analysis (thin section) | Vancouver Petrographics; CBM Solutions | Work in preparation |
| Scanning electron microscope (SEM) with energy-dispersive X-ray (EDX) | Department of Earth and Atmospheric Sciences, University of Alberta (G. Braybrook) | Pawlowicz et al. (2009a, b) |
| Environmental scanning electron microscope (ESEM) | Department of Biology, University of Alberta (R. Bhatnagar) | Pawlowicz et al. (2009a, b) |
| X-ray diffraction (bulk and clay mineral) | SGS Minerals Services Ltd. (H. Zhou); CBM Solutions | Pawlowicz et al. (2009a, b) |

Alberta Geological Survey is also releasing a series of reports to introduce the project and disseminate information related to specific formations (Rokosh et al., 2009a–c).

## 2 Sample Location and Description

The location map (Figure 1) displays all core and outcrop samples sites associated with the Banff and Exshaw formations. Tables 2 and 3, and Appendices 1 and 2 list the precise locations of the sample sites.

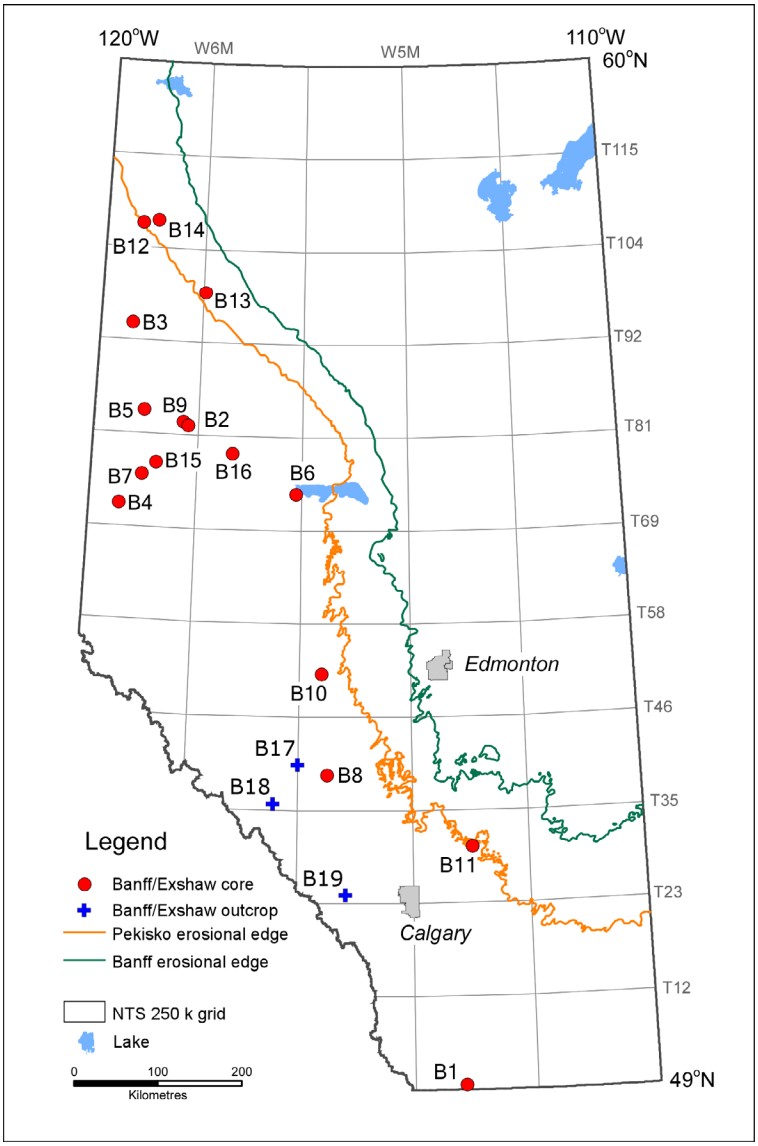


**Figure 1. Core and outcrop sites sampled for the Banff and Exshaw formations. See Appendices 1 to 4 for a list of all sites and the type and results of analyses run on various samples.**

**Table 2. Core sample sites in the Banff and Exshaw formations.**

| Site No. | UWI | Latitude (NAD 83) | Longitude (NAD 83) | Year Drilled | No. of Samples | Formation |
|---|---|---|---|---|---|---|
| B01 | 100/01-20-001-24W4/00 | 49.045566 | -113.165460 | 1981 | 3 | Banff/Exshaw |
| B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1950 | 6 | Banff |
| B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1952 | 6 | Banff |
| B04 | 100/04-23-072-10W6/00 | 55.245950 | -119.431068 | 1972 | 4 | Banff/Exshaw |
| B05 | 100/06-04-084-07W6/00 | 56.252096 | -119.047260 | 1974 | 2 | Banff |
| B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1949 | 8 | Banff/Exshaw |
| B07 | 100/08-08-076-07W6/00 | 55.568451 | -119.040018 | 2002 | 2 | Banff |
| B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 1955 | 14 | Banff |
| B09 | 100/08-30-082-02W6/00 | 56.135519 | -118.293350 | 1985 | 3 | Banff/Exshaw |
| B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 1954 | 8 | Banff/Exshaw |
| B11 | 100/12-36-030-22W4/00 | 51.614422 | -112.978894 | 1950 | 4 | Banff/Exshaw |
| B12 | 100/15-05-107-08W6/00 | 58.264601 | -119.290939 | 2001 | 4 | Banff |
| B13 | 100/15-27-098-25W5/00 | 57.539368 | -117.965423 | 2002 | 1 | Banff |
| B14 | 100/16-18-107-06W6/00 | 58.296137 | -118.982929 | 1954 | 2 | Banff |
| B15 | 100/16-24-077-06W6/00 | 55.693279 | -118.777249 | 1986 | 3 | Banff |
| B16 | 102/06-02-079-22W5/00 | 55.817907 | -117.332954 | 1984 | 2 | Banff |

**Table 3. Outcrop sample sites in the Banff and Exshaw formations.**

| Site No. | Datum | UTM (NAD 83) | | | Site Location Name | No. of Samples | Formation |
|---|---|---|---|---|---|---|---|
| | | Zone | Easting | Northing | | | |
| B17 | NAD83 | 11 | 567642 | 5816426 | Nordegg (railroad) section | 30 | Banff, Exshaw |
| B18 | NAD83 | 11 | 539339 | 5769916 | Kootenay Plains (mountain section) | 1 | Banff |
| B19 | NAD83 | 11 | 628902 | 5661581 | Jura Creek | 28 | Banff, Exshaw |

# 3 Analytical Methods and Results

A total of 59 outcrop and 72 core samples was selected for analysis. The analyses itemized in Table 1 were performed on selected samples, as indicated in Appendices 3 and 4.

## 3.1 Isotherms, Rock-Eval™/TOC

Schlumberger/TerraTek and CBM Solutions (isotherms) performed adsorption isotherms, Rock Eval 6 and total organic carbon (TOC) analyses on outcrop and core. The Geological Survey of Canada performed Rock Eval and TOC. References for the methodology are, for isotherms, CBM Solutions (2002) and Mavor and Nelson (1997), and for Rock Eval and TOC, Lafargue et al. (1996).

Data are tabulated in Appendices 5 and 6. Adsorption isotherms indicate the gas storage capacity of the organic matter within a sample. Rock Eval indicates the current amount of hydrocarbon in a sample and the potential for *in situ* kerogen to generate hydrocarbon. Total organic carbon indicates total organic matter (suggestive of hydrocarbon potential); this dataset is useful in determining hydrocarbon potential of a sample.

## 3.2 Organic Petrography

Petrographic analysis of organic components (e.g., Taylor et al., 1998) of shale samples was performed to identify organic constituents conducive to hydrocarbon potential, texture and inorganic composition, and thermal maturity of the sample. Geological Survey of Canada conducted the analyses (http://gsc.nrcan.gc.ca/labs/petrology_e.php [January 2009]). Data are tabulated in Appendix 7 and photomicrographs of organic constituents are presented in Appendix 8.

Organic petrography is typically performed in both white and UV reflected light, to observe dispersed organic matter and hydrocarbon in a sample. Organic petrography will help identify the type and amount of organic matter present (algae, bitumen, etc.) and is useful in determining hydrocarbon potential and modelling organic facies to assist in source rock exploration and evaluation. Vitrinite reflectance (and reflectance on bitumen) is used to determine thermal maturation of a sample, which is correlated to its hydrocarbon-generation history and potential.

# 4 References


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# Appendices

## Appendix 1. Banff/Exshaw Formations Core Sample Location, Depth and Lithology

### Legend

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Site No. | Site location number |
| UWI | Well location - unique well identifier |
| Latitude (NAD 83) | Well location - degrees latitude (North American Datum 1983) |
| Longitude (NAD 83) | Well location - degrees longitude (North American Datum 1983) |
| Sample Depth (metres) | Depth of sample from core in metres (measured from core) |
| Lithology | Brief lithological description of sample |
| Formation Division | Subdivision of formation sampled |
| Year Sampled | Year sample collected |

| Sample No. | Site No. | Location | | | Sample Depth (metres) | Lithology | Formation Division | Year Sampled |
|---|---|---|---|---|---|---|---|---|
| | | UWI | Latitude (NAD 83) | Longitude (NAD 83) | | | | |
| **6931** | B01 | 100/01-20-001-24W4/00 | 49.045566 | -113.165460 | 2783.3 | Grey dolomitic mudstone | Lower Banff | 2007 |
| **6932** | B01 | 100/01-20-001-24W4/00 | 49.045566 | -113.165460 | 2789.5 | Black coal | Exshaw? | 2007 |
| **6933** | B01 | 100/01-20-001-24W4/00 | 49.045566 | -113.165460 | 2795.3 | Black shale | Exshaw | 2007 |
| **8047** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1975.1-1983.9 | Combined samples: 8684, 85 | Lower Banff | 2008 |
| **8681** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1958.0 | Grey calcareous mudstone | Lower Banff | 2008 |
| **8682** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1962.9 | Dark grey calcareous shale | Lower Banff | 2008 |
| **8683** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1968.6 | Dark grey shale | Lower Banff | 2008 |
| **8684** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1975.1 | Medium grey calcareous mudstone, see sample 8047 | Lower Banff | 2008 |
| **8685** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1983.9 | Grey calcareous. mudstone, see sample 8047 | Lower Banff | 2008 |
| **8686** | B02 | 100/02-14-082-02W6/00 | 56.103477 | -118.193028 | 1987.3 | Dark grey shale | Lower Banff | 2008 |
| **8017** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1576.3 | Dark grey calcareous mudstone | Lower Banff | 2008 |
| **8696** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1329.5 | Laminated lime mudstone & siltst with organic debris | Upper Banff | 2008 |
| **8697** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1364.0 | Grey calcareous. mudstone with organic debris | Upper Banff | 2008 |
| **8698** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1455.4 | Dark grey calcareous mudstone | Middle Banff | 2008 |
| **8699** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1498.1 | Dark grey calcareous mudstone | Lower Banff | 2008 |
| **8700** | B03 | 100/02-28-094-09W6/00 | 57.179218 | -119.376578 | 1539.2 | Interbedded calcareous mudstone & siltstone | Lower Banff | 2008 |
| **6934** | B04 | 100/04-23-072-10W6/00 | 55.245950 | -119.431068 | 3549.7 | Black shale | Lower Banff | 2007 |
| **6935** | B04 | 100/04-23-072-10W6/00 | 55.245950 | -119.431068 | 3556.4 | Black shale | Lower Banff | 2007 |
| **6936** | B04 | 100/04-23-072-10W6/00 | 55.245950 | -119.431068 | 3565.2 | Black shale, finely laminated | Lower Banff | 2007 |
| **6937** | B04 | 100/04-23-072-10W6/00 | 55.245950 | -119.431068 | 3569.4 | Massive black shale | Exshaw?/Lower Banff? | 2007 |
| **8687** | B05 | 100/06-04-084-07W6/00 | 56.252096 | -119.047260 | 2234.2 | Dark grey shale | Lower Banff | 2008 |
| **8688** | B05 | 100/06-04-084-07W6/00 | 56.252096 | -119.047260 | 2247.3 | Dark grey shale | Lower Banff | 2008 |
| **6938** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1040.4 | Light green grey calcareous mudstone | Banff | 2007 |
| **6939** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1082.0 | Light green grey calcareous shale | Banff | 2007 |
| **6940** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1118.9 | Light green grey calcareous mudstone | Banff | 2007 |
| **6941** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1159.2 | Light green grey calcareous mudstone | Banff | 2007 |
| **6942** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1204.0 | Medium grey calcareous shale | Banff | 2007 |
| **6943** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1235.4 | Medium grey calcareous mudstone | Banff | 2007 |
| **6944** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1258.8 | Dark grey calcareous shale | Banff | 2007 |
| **6945** | B06 | 100/07-08-074-14W5/00 | 55.394566 | -116.113837 | 1273.8 | Black shale | Exshaw? | 2007 |
| **8694** | B07 | 100/08-08-076-07W6/00 | 55.568451 | -119.040018 | 2904.0 | Dark grey calcareous mudstone | Middle Banff | 2008 |
| **8695** | B07 | 100/08-08-076-07W6/00 | 55.568451 | -119.040018 | 2911.8 | Dark grey calcareous mudstone with silt laminea | Middle Banff | 2008 |
| **6917** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3611.7 | Shale | Upper Banff | 2007 |
| **6918** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3626.6 | Lime mudstone | Upper Banff | 2007 |
| **6919** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3657.6 | Shale | Upper Banff | 2007 |
| **6920** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3665.8 | Shale | Upper Banff | 2007 |
| **6921** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3673.6 | Shale | Upper Banff | 2007 |
| **6922** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3706.4 | Lime mudstone | Middle Banff | 2007 |
| **6923** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3732.3 | Lime mudstone | Middle Banff | 2007 |
| **6924** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3779.2 | Laminated silt/carbonate? | Middle Banff | 2007 |
| **6925** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3792.0 | Laminated silt, high gamma | Lower -Middle Banff | 2007 |

| Sample No. | Site No. | Location | | | Sample Depth (metres) | Lithology | Formation Division | Year Sampled |
|---|---|---|---|---|---|---|---|---|
| | | UWI | Latitude (NAD 83) | Longitude (NAD 83) | | | | |
| **6926** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3790.2 | Laminated silt | Lower -Middle Banff | 2007 |
| **6927** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3796.4 | Laminated silt | Lower -Middle Banff | 2007 |
| **6928** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3800.2 | Laminated carbonate silt | Lower Banff | 2007 |
| **6929** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3807.3 | Black mudstone | Lower Banff | 2007 |
| **6930** | B08 | 100/08-27-039-11W5/00 | 52.383168 | -115.491096 | 3814.0 | Light grey mudstone | 11' below Wabamun Contact | 2007 |
| **8046** | B09 | 100/08-30-082-02W6/00 | 56.135519 | -118.293350 | 1994.5-1998.6 | Combined samples: 8678, 79 | Lower Banff | 2008 |
| **8678** | B09 | 100/08-30-082-02W6/00 | 56.135519 | -118.293350 | 1994.5 | Dark grey shale | Lower Banff | 2008 |
| **8679** | B09 | 100/08-30-082-02W6/00 | 56.135519 | -118.293350 | 1998.6 | Dark grey shale | Lower Banff | 2008 |
| **8680** | B09 | 100/08-30-082-02W6/00 | 56.135519 | -118.293350 | 2004.5 | Dark grey shale | Exshaw/Lower Banff? | 2008 |
| **6946** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2282.6 | Shale | Upper Banff | 2007 |
| **6947** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2287.5 | Shale | Upper Banff | 2007 |
| **6948** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2295.4 | Shale | Upper Banff | 2007 |
| **8003** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2297.3 | Grey dolostone | Upper Banff | 2007 |
| **8004** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2439.6 | Grey dolomitic mudstone | Lower Banff | 2007 |
| **8005** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2442.7 | Calcareous mudstone | Lower Banff | 2007 |
| **8006** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2446.0 | Black shale | Exshaw? | 2007 |
| **8007** | B10 | 100/09-06-052-11W5/00 | 53.463004 | -115.601615 | 2446.3 | Grey limestone | Wabaman | 2007 |
| **8008** | B11 | 100/12-36-030-22W4/00 | 51.614422 | -112.978894 | 1633.9 | Lime mudstone | Lower Banff | 2007 |
| **8009** | B11 | 100/12-36-030-22W4/00 | 51.614422 | -112.978894 | 1638.3 | Lime mudstone with thin black shale | Lower Banff | 2007 |
| **8010** | B11 | 100/12-36-030-22W4/00 | 51.614422 | -112.978894 | 1638.9 | Black shale | Exshaw | 2007 |
| **8011** | B11 | 100/12-36-030-22W4/00 | 51.614422 | -112.978894 | 1639.5 | Limestone | Wabaman | 2007 |
| **8019** | B12 | 100/15-05-107-08W6/00 | 58.264601 | -119.290939 | 505.6 | Grey calcareous shale | Upper Banff | 2008 |
| **8020** | B12 | 100/15-05-107-08W6/00 | 58.264601 | -119.290939 | 512.4 | Oilstained calcareous grainstone | Upper Banff | 2008 |
| **8021** | B12 | 100/15-05-107-08W6/00 | 58.264601 | -119.290939 | 518.0 | Green mudstone | Upper Banff | 2008 |
| **8022** | B12 | 100/15-05-107-08W6/00 | 58.264601 | -119.290939 | 522.0 | Reddish mudstone | Upper Banff | 2008 |
| **8018** | B13 | 100/15-27-098-25W5/00 | 57.539368 | -117.965423 | 879.8 | Grainstone | Middle Banff ? | 2008 |
| **8689** | B14 | 100/16-18-107-06W6/00 | 58.296137 | -118.982929 | 544.7 | Grey mudstone | Upper Banff | 2008 |
| **8690** | B14 | 100/16-18-107-06W6/00 | 58.296137 | -118.982929 | 621.2 | Grey mudstone | Lower Banff | 2008 |
| **8691** | B15 | 100/16-24-077-06W6/00 | 55.693279 | -118.777249 | 2612.8 | Dark grey shaley mudstone | Lower Banff | 2008 |
| **8692** | B15 | 100/16-24-077-06W6/00 | 55.693279 | -118.777249 | 2619.5 | Black shale with silt beds | Lower Banff | 2008 |
| **8693** | B15 | 100/16-24-077-06W6/00 | 55.693279 | -118.777249 | 2610.0 | Dark grey mudstone | Lower Banff | 2008 |
| **8038** | B16 | 102/06-02-079-22W5/00 | 55.817907 | -117.332954 | 1712.9-1715 | Dark blue-grey mudstone | Lower Banff | 2008 |
| **8039** | B16 | 102/06-02-079-22W5/00 | 55.817907 | -117.332954 | 1709.0 | Dark blue-grey mudstone | Lower Banff | 2008 |
| **8012** | Duplicate | Duplicate of 6921 | 52.383168 | -115.491096 | | Shale | Upper Banff | 2007 |
| **8013** | Duplicate | Duplicate of 6947 | 53.463004 | -115.601615 | | Shale | Upper Banff | 2007 |
| **8014** | Duplicate | Duplicate of 6935 | 55.245950 | -119.431068 | | Black shale | Lower Banff | 2007 |
| **8015** | Duplicate | Duplicate of 8699 | 57.179218 | -119.376578 | | Dark grey calcareous mudstone | Lower Banff | 2008 |

## Appendix 2. Banff/Exshaw Formations Outcrop Sample Location, Depth and Lithology

### Legend

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Site No. | Site location number |
| Site Location | Description of outcrop site |
| Zone | Site location - UTM Zone (North American Datum 1983) |
| Easting | Site location - UTM easting |
| Northing | Site location - UTM northing |
| Elevation (metres) | Elevation of sampled site in metres |
| Lithology<br>Formation Division | Brief lithological description of sample<br>Subdivision of formation sampled |
| Sample Depth and Description | Sample location on section |

| Sample No. | Site No. | Site Location | Year Sampled | UTM (NAD 83) | | | Elevation (metres) | Lithology | Formation Division | Sample Depth and Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Zone | Easting | Northing | | | | |
| **6506** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Exshaw | Duplicate of 6540 |
| **6533** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816441 | 1309 | Shale | Lower Banff | 1.0 m interval, Lower Banff |
| **6534** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816441 | 1309 | Shale | Exshaw | 0-2.4 m above Palliser contact |
| **6535** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816441 | 1309 | Bentonite | Exshaw | 2.1 m above Palliser contact (1 cm) |
| **6536** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Limestone | Palliser | .6 m below Exshaw contact |
| **6537** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Exshaw | .05 m above Palliser contact |
| **6538** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Exshaw | 1.0 m above Palliser contact |
| **6539** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Exshaw | 1.7-1.8 m above Palliser contact |
| **6540** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Exshaw | 2.3-2.4 m above Palliser contact |
| **6541** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Silt dolostone | Exshaw dolostone | 3.7 m above Palliser contact |
| **6542** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Lower Banff | 6.4 m above Palliser contact |
| **6543** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Lower Banff | 7.4 m above Palliser contact |
| **6545** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Siltstone | Lower Banff | 11.2 m above Palliser contact |
| **6546** | B17 | Nordegg - railway section | 2007 | 11 | 567642 | 5816426 | 1327 | Shale | Lower Banff | 13.2 m above Palliser contact |
| **6547** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816454 | 1307 | Lime mudstone | Banff | 17.4 m above Palliser contact |
| **6548** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816454 | 1307 | Lime mudstone | Banff | 21.4 m above Palliser contact |
| **6549** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816454 | 1307 | Lime mudstone | Banff | 29.4 m above Palliser contact |
| **6550** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816454 | 1307 | Lime mudstone | Banff | 37.4 m above Palliser contact |
| **7301** | B17 | Nordegg - railway section | 2007 | 11 | 567651 | 5816454 | 1307 | Lime mudstone | Banff | 45.4 m above Palliser contact |
| **7302** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime shale | Banff | 53.4 m above Palliser contact |
| **7303** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime mudstone | Banff | 53.5 m above Palliser contact |
| **7304** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime shale | Banff | 61.4 m above Palliser contact |
| **7305** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime mudstone | Banff | 61.5 m above Palliser contact |
| **7307** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime shale | Banff | 71.4 m above Palliser contact |
| **7308** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime mudstone | Banff | 71.5 m above Palliser contact |
| **7309** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime shale | Banff | 83.4m above Palliser contact |
| **7310** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime mudstone | Banff | 83.5 m above Palliser contact |
| **7311** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime shale | Banff | 103.4 m above Palliser contact |
| **7312** | B17 | Nordegg - railway section | 2007 | 11 | 587663 | 5816478 | 1315 | Lime mudstone | Banff | 103.5 m above Palliser contact |
| **7313** | B17 | Nordegg - railway section | 2007 | 11 | 567698 | 5816526 | 1316 | Lime mudstone | Banff | 120 m above Palliser contact |
| **7314** | B18 | Kootenay Plains - mountain section | 2007 | 11 | 539339 | 5769916 | 1512 | Shale | Banff | ~100 m above Palliser contact (2 m shale) |
| **6507** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Sandstone | Exshaw | 0-.04 m above Palliser contact |
| **6508** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | .04-.09 m above Palliser contact |
| **6509** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | .09-.36 m above Palliser contact |
| **6510** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | .36-.76 m above Palliser contact |
| **6511** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | .76-1.01 m above Palliser contact |
| **6512** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 1.01-1.26 m above Palliser contact |
| **6513** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 1.26-1.29 m above Palliser contact |

| Sample No. | Site No. | Site Location | Year Sampled | UTM (NAD 83) | | | Elevation (metres) | Lithology | Formation Division | Sample Depth and Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Zone | Easting | Northing | | | | |
| **6514** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 1.29-1.57 m above Palliser contact |
| **6515** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Bentonite | Exshaw | 1.57-1.61 m above Palliser contact |
| **6516** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 1.57-1.61 m above Palliser contact |
| **6517** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale - shear | Exshaw | 2.01-2.51 m above Palliser contact |
| **6518** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 2.33-2.41 m above Palliser contact |
| **6519** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 2.51-2.89 m above Palliser contact |
| **6520** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 2.89-3.04 m above Palliser contact |
| **6521** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 3.04-3.54 m above Palliser contact |
| **6522** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 3.54-4.04 m above Palliser contact |
| **6523** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 4.04-4.54 m above Palliser contact |
| **6524** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 4.54-5.04 m above Palliser contact |
| **6525** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 5.04-5.54 m above Palliser contact |
| **6526** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 5.54-6.04 m above Palliser contact |
| **6527** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 6.04-6.54 m above Palliser contact |
| **6528** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 6.54-7.04 m above Palliser contact |
| **6529** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 7.04-7.54 m above Palliser contact |
| **6530** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | 7.54-8.04 m above Palliser contact |
| **6531** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Limestone | Palliser | 0- -.05 m above Palliser contact |
| **6907** | B19 | Jura Creek | 2007 | 11 | 628902 | 5661581 | 1509 | Shale | Exshaw | Duplicate of 6521 |
| **7287** | B19 | Jura Creek | 2007 | 11 | 628873 | 5661532 | 1523 | Shale | Lower Banff | +1.3 m above Exshaw dolostone |
| **7288** | B19 | Jura Creek | 2007 | 11 | 628873 | 5661532 | 1523 | Shale | Lower Banff | +3.0 m above Exshaw dolostone |
| **6544** | AGS standard | AGS standard | 2007 | AGS standard | AGS standard | AGS standard | AGS standard | Rock powder | AGS standard | AGS standard |
| **6914** | AGS standard | AGS standard | 2007 | AGS standard | AGS standard | AGS standard | AGS standard | Rock powder | AGS standard | AGS standard |
| **7253** | AGS standard | AGS standard | 2007 | AGS standard | AGS standard | AGS standard | AGS standard | Rock powder | AGS standard | AGS standard |
| **7279** | AGS standard | AGS standard | 2007 | AGS standard | AGS standard | AGS standard | AGS standard | Rock powder | AGS standard | AGS standard |
| **7349** | AGS standard | AGS standard | 2007 | AGS standard | AGS standard | AGS standard | AGS standard | Rock powder | AGS standard | AGS standard |

## Appendix 3. Banff/Exshaw Formations Core Samples Analyzed

### Legend

Y = Sample data presented in this report

x = Sample data presented in other Alberta Geological Survey reports (see Table 1 for details)

Analyses presented in this report

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Site No. | Site location number |
| Rock Eval™ | Analysis to test for organic maturity and total organic carbon (TOC) |
| X-ray Diff-Bulk | X-Ray diffraction analysis of whole-rock mineralogy |
| X-ray Diff-Clay | X-Ray diffraction analysis of clay mineralogy |
| Organic Pet. | Organic petrology examines organic macerals |
| Thin Section | Thin section of sample |
| Thin Section Photo | Photograph of thin section |
| Adsorption Isotherm | Gas adsorption analysis to determine gas-holding capacity of sample |
| SEM | Scanning Electron Microscope |
| ESEM | Environmental Scanning Electron Microscope |
| Mini-perm | Analysis to determine permeability |
| Porosimetry | Analysis to determine porosity |

| Sample No. | Site No. | Rock Eval™ | X-Ray Diff-Bulk | X-Ray Diff-Clay | Organic Pet. | Thin Section | Thin Section Photo | Adsorption Isotherm | SEM | ESEM | Mini-perm | Porosity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6931** | B01 | Y | x | | | x | x | | | | | x |
| **6932** | B01 | Y | | | | | | | | | | |
| **6933** | B01 | Y | | | | x | | | | | x | |
| **8047** | B02 | Y | | | | | | Y | | | | |
| **8681** | B02 | Y | | | | | | | | | | |
| **8682** | B02 | Y | | | | x | | | | | x | |
| **8683** | B02 | Y | x | x | | | | | | | | |
| **8684** | B02 | Y | x | | | | | | x | | | x |
| **8685** | B02 | Y | | | | | | | | | | |
| **8686** | B02 | Y | | | | | | | | | | |
| **8017** | B03 | Y | x | | | | | | | | | |
| **8696** | B03 | Y | | | | | | | | | | |
| **8697** | B03 | Y | | | | | | | | | | |
| **8698** | B03 | Y | | | | | | | | | | x |
| **8699** | B03 | Y | | | | | | | | | | |
| **8700** | B03 | Y | | | | x | | | | | | x |
| **6934** | B04 | Y | x | x | | x | | | | | | |
| **6935** | B04 | Y | | | | | | | | | x | |
| **6936** | B04 | Y | | | | x | | | x | x | | x |
| **6937** | B04 | Y | | | | x | | | | | x | |
| **8687** | B05 | Y | | | | | | | | | | |
| **8688** | B05 | Y | x | x | | x | x | | x | | x | x |
| **6938** | B06 | Y | | | | | | | | | | |
| **6939** | B06 | Y | | | | x | | | | | | |
| **6940** | B06 | Y | | | | | | | | | | |
| **6941** | B06 | Y | | | | | | | | | x | |
| **6942** | B06 | Y | | | | x | | | | | | |
| **6943** | B06 | Y | x | | | | | | | | | |
| **6944** | B06 | Y | | | | | | | | | | |
| **6945** | B06 | Y | | | | | | | | | | |
| **8694** | B07 | Y | | | | | | | | | | |
| **8695** | B07 | Y | | | | x | | | | x | | x |
| **6917** | B08 | Y | | | | | | | | | | |
| **6918** | B08 | Y | | | | | | | | | | |
| **6919** | B08 | Y | | | | | | | | | x | |
| **6920** | B08 | Y | | | | | | | | | | |
| **6921** | B08 | Y | | | | | | | | | | |
| **6922** | B08 | Y | | | | x | x | | | | | |
| **6923** | B08 | Y | | | | | | | | | x | |
| **6924** | B08 | Y | | | | x | x | | | | x | |
| **6925** | B08 | Y | | | | | | | | | x | |
| **6926** | B08 | Y | x | | | x | | | | | | |
| **6927** | B08 | Y | | | | | | | | | | |
| **6928** | B08 | Y | | | | | | | | | x | |
| **6929** | B08 | Y | | | | | | | | | | |
| **6930** | B08 | Y | | | | | | | | | | |
| **8046** | B09 | Y | | | | | | Y | | | | |
| **8678** | B09 | Y | | | | | | | | | | |
| **8679** | B09 | Y | | | | x | | | | | | x |
| **8680** | B09 | Y | x | | | | | | | | | |
| **6946** | B10 | Y | | | | | | | | | | |
| **6947** | B10 | Y | x | | | | | | | | | |
| **6948** | B10 | Y | | | | | | | | | | |
| **8003** | B10 | Y | | | | | | | | | | |
| **8004** | B10 | Y | | | | | | | | | | |
| **8005** | B10 | Y | | | | x | | | | | | |
| **8006** | B10 | Y | | | | x | | | | x | | x |
| **8007** | B10 | Y | | | | | | | | | | |
| **8008** | B11 | Y | | | | | | | | | | |
| **8009** | B11 | Y | | | | | | | | | | |
| **8010** | B11 | Y | | | | | | | | | | |
| **8011** | B11 | Y | | | | | | | | | | |
| **8019** | B12 | Y | | | | | | | | | | |
| **8020** | B12 | | | | | | | | | | | |
| **8021** | B12 | Y | x | | | x | | | | | | |
| **8022** | B12 | Y | | | | x | | | | | | |
| **8018** | B13 | | | | | x | | | | | | |
| **8689** | B14 | Y | | | | x | | | | | | |
| **8690** | B14 | Y | | | | x | | | x | | | x |
| **8691** | B15 | Y | | | | | | | | | x | |
| **8692** | B15 | Y | x | | | x | | | x | | | x |
| **8693** | B15 | Y | | | | | | | | | x | |
| **8038** | B16 | Y | x | | | x | | | | | | |
| **8039** | B16 | Y | | | | | | | | | | |
| **8012** | Duplicate | Y | | | | | | | | | | |
| **8013** | Duplicate | Y | | | | | | | | | | |
| **8014** | Duplicate | Y | | | | | | | | | | |
| **8015** | Duplicate | Y | | | | | | | | | | |

## Appendix 4. Banff/Exshaw Formations Outcrop Samples Analyzed

### Legend

Y = Sample data presented in this report

x = Sample data presented in other Alberta Geological Survey reports (see Table 1 for details)

xx = Clay separated

Analyses presented in this report

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Site No. | Site location number |
| Geochem | Inorganic geochemical analysis |
| Rock Eval™ | Analysis for organic maturity and total organic carbon (TOC) |
| X-ray Diff-Bulk | X-Ray diffraction analysis of whole-rock mineralogy |
| X-ray Diff-Clay | X-Ray diffraction analysis of clay mineralogy |
| Organic Pet. | Organic petrology examines organic macerals |
| Thin Section | Thin section of sample |
| Thin Section Photo | Photograph of thin section |
| Adsorption Isotherm | Gas adsorption analysis to determine gas-bearing capacity |

| Sample No. | Site No. | Geochem | Rock Eval™ | X-Ray Diff-Bulk | X-Ray Diff-Clay | Organic Pet. | Thin Section | Thin Section Photo | Adsorption Isotherm |
|---|---|---|---|---|---|---|---|---|---|
| **6506** | B17 | x | Y | | | | | | |
| **6533** | B17 | x | Y | x | x | | | | |
| **6534** | B17 | x | Y | x | xx | | | | Y |
| **6535** | B17 | x | | | | | | | |
| **6536** | B17 | x | Y | x | | | | | |
| **6537** | B17 | x | Y | x | x | | | | |
| **6538** | B17 | x | Y | x | x | | | | |
| **6539** | B17 | x | Y | x | x | Y | | | |
| **6540** | B17 | x | Y | x | x | | | | |
| **6541** | B17 | x | Y | x | x | | x | x | |
| **6542** | B17 | x | Y | x | x | Y | | | |
| **6543** | B17 | x | Y | x | xx | | | | Y |
| **6545** | B17 | x | Y | x | x | | | | |
| **6546** | B17 | x | Y | x | x | | | | |
| **6547** | B17 | x | Y | x | | | | | |
| **6548** | B17 | x | Y | x | xx | Y | x | x | Y |
| **6549** | B17 | x | Y | x | | | x | x | |
| **6550** | B17 | x | Y | x | | | x | x | |
| **7301** | B17 | x | Y | x | | | x | x | |
| **7302** | B17 | x | Y | x | x | | | | |
| **7303** | B17 | x | Y | x | x | | x | x | |
| **7304** | B17 | x | Y | x | xx | | x | x | Y |
| **7305** | B17 | x | Y | x | x | | x | x | |
| **7307** | B17 | x | Y | x | x | | x | x | |
| **7308** | B17 | x | Y | x | x | | x | x | |
| **7309** | B17 | x | Y | x | xx | | x | x | |
| **7310** | B17 | x | Y | x | x | | x | x | |
| **7311** | B17 | x | Y | x | x | Y | x | x | |
| **7312** | B17 | x | Y | x | | | x | x | |
| **7313** | B17 | x | Y | x | | | x | x | |
| **7314** | B18 | x | Y | x | x | | | | |
| **6507** | B19 | x | Y | x | x | | x | x | |
| **6508** | B19 | x | Y | x | x | | | | |
| **6509** | B19 | x | Y | x | x | | x | x | |
| **6510** | B19 | x | Y | x | x | Y | | | |
| **6511** | B19 | x | Y | x | x | | | | |
| **6512** | B19 | x | Y | x | x | | | | |
| **6513** | B19 | x | Y | x | x | | | | |
| **6514** | B19 | x | Y | x | x | Y | x | x | |
| **6515** | B19 | x | Y | | | | | | |
| **6516** | B19 | x | Y | x | x | | | | |
| **6517** | B19 | x | Y | x | xx | | | | Y |
| **6518** | B19 | x | Y | x | x | | | | |
| **6519** | B19 | x | Y | x | x | | | | |
| **6520** | B19 | x | Y | x | x | | | | |
| **6521** | B19 | x | Y | x | x | Y | | | |
| **6522** | B19 | x | Y | x | x | | | | |
| **6523** | B19 | x | Y | x | x | | | | |
| **6524** | B19 | x | Y | x | x | | | | |
| **6525** | B19 | x | Y | x | xx | Y | | | Y |
| **6526** | B19 | x | Y | x | x | | | | |
| **6527** | B19 | x | Y | x | x | | | | |
| **6528** | B19 | x | Y | x | x | | | | |
| **6529** | B19 | x | Y | x | x | | | | |
| **6530** | B19 | x | Y | x | x | | | | |
| **6531** | B19 | x | Y | x | | Y | x | x | |
| **6907** | B19 | x | Y | | | | | | |
| **7287** | B19 | x | Y | x | xx | | | | |
| **7288** | B19 | x | Y | x | x | | | | |
| **6544** | AGS standard | x | | | | | | | |
| **6914** | AGS standard | x | | | | | | | |
| **7253** | AGS standard | x | | | | | | | |
| **7279** | AGS standard | x | | | | | | | |
| **7349** | AGS standard | x | | | | | | | |

## Appendix 5. Banff/Exshaw Formations Adsorption Isotherm Data

### *Appendix 5a. Adsorption Isotherm and Summary and Point Data*

**Legend**

poor data

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Depth (metres) | Sample depth in metres (measured from core) |
| TOC (%) | Total organic carbon in weight per cent |
| Analysis Temperature (°C) | Temperature in degrees Celsius |
| As Received Moisture (%) | Sample moisture content in weight per cent |
| Langmuir Pressure | Pressure - Langmuir pressure |
| Langmuir Volume | Volume - Langmuir volume |
| MPa | MegaPascal |
| scc/g | Standard cubic centimetres per gram |
| Point No. | Individual measurement |

| Sample No. | Depth (metres) | TOC (%) | Analysis Temperature (°C) | As Received Moisture (%) | Langmuir Pressure Raw Basis (Mpa) | Langmuir Volume Raw Basis (scc/g) |
|---|---|---|---|---|---|---|
| **6517** | outcrop | 4.48 | 38 | 0.77 | 5.20 | 0.86 |
| **6525** | outcrop | 0 | 38 | 1.87 | 12.20 | 1.07 |
| **6534** | outcrop | 3.25 | 38 | 1.47 | 17.17 | 1.13 |
| **6543** | outcrop | 0.75 | 38 | 0.59 | 15.27 | 0.66 |
| **6548** | outcrop | 0.09 | 38 | 1.51 | 24.57 | 1.14 |
| **7304** | outcrop | 0.38 | 38 | 1.87 | n/a | n/a |
| **8046** | 1994.45 | 1.66 | 50 | 1.42 | 9.42 | 0.97 |
| **8047** | 1975 | 0.44 | 50 | 0.66 | 8.29 | 0.30 |

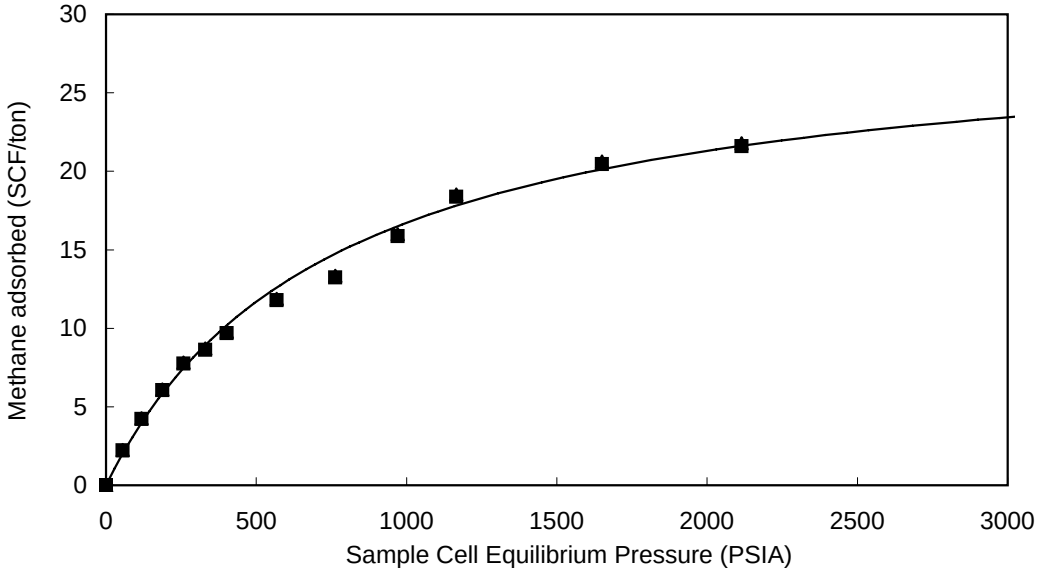
**Adsorption Isotherm Point Data**

| Sample No. | Point No. | Pressure Raw Basis (Mpa) | Gas Content Raw Basis (scc/g) |
|---|---|---|---|
| **6517** | 1 | 0.38 | 0.07 |
| | 2 | 0.82 | 0.12 |
| | 3 | 1.29 | 0.18 |
| | 4 | 1.78 | 0.23 |
| | 5 | 2.28 | 0.25 |
| | 6 | 2.77 | 0.28 |
| | 7 | 3.91 | 0.35 |
| | 8 | 5.26 | 0.39 |
| | 9 | 6.69 | 0.47 |
| | 10 | 8.03 | 0.54 |
| | 11 | 11.38 | 0.60 |
| | 12 | 14.58 | 0.63 |
| **6525** | 1 | 0.31 | 0.01 |
| | 2 | 0.71 | 0.07 |
| | 3 | 1.15 | 0.11 |
| | 4 | 1.62 | 0.15 |
| | 5 | 2.10 | 0.18 |
| | 6 | 2.59 | 0.20 |
| | 7 | 3.21 | 0.25 |
| | 8 | 3.93 | 0.30 |
| | 9 | 6.53 | 0.41 |
| | 10 | 8.83 | 0.46 |
| | 11 | 12.98 | 0.54 |
| | 12 | 15.97 | 0.57 |
| **6534** | 1 | 0.28 | 0.02 |
| | 2 | 0.67 | 0.04 |
| | 3 | 1.12 | 0.07 |
| | 4 | 1.60 | 0.10 |
| | 5 | 2.08 | 0.12 |
| | 6 | 2.57 | 0.16 |
| | 7 | 3.70 | 0.21 |
| | 8 | 5.04 | 0.26 |
| | 9 | 6.47 | 0.30 |
| | 10 | 7.92 | 0.35 |
| | 11 | 9.04 | 0.39 |
| | 12 | 11.83 | 0.46 |
| | 13 | 15.52 | 0.54 |
| **6543** | 1 | 0.41 | 0.02 |
| | 2 | 0.84 | 0.03 |
| | 3 | 1.29 | 0.04 |
| | 4 | 1.74 | 0.06 |
| | 5 | 2.21 | 0.09 |
| | 6 | 2.69 | 0.11 |
| | 7 | 3.30 | 0.12 |
| | 8 | 4.05 | 0.13 |
| | 9 | 5.23 | 0.15 |
| | 10 | 6.58 | 0.19 |
| | 11 | 7.56 | 0.23 |
| | 12 | 11.57 | 0.27 |
| | 13 | 15.53 | 0.35 |
| **6548** | 1 | 0.41 | 0.02 |

| Sample No. | Point No. | Pressure Raw Basis (Mpa) | Gas Content Raw Basis (scc/g) |
|---|---|---|---|
| | 2 | 0.80 | 0.04 |
| | 3 | 1.24 | 0.05 |
| | 4 | 1.73 | 0.07 |
| | 5 | 2.21 | 0.08 |
| | 6 | 2.69 | 0.10 |
| | 7 | 3.33 | 0.13 |
| | 8 | 4.02 | 0.20 |
| | 9 | 5.18 | 0.24 |
| | 10 | 6.52 | 0.28 |
| | 11 | 8.99 | 0.32 |
| | 12 | 12.55 | 0.38 |
| | 13 | 15.54 | 0.41 |
| **7304** | 1 | 0.27 | 0.00 |
| | 2 | 0.67 | 0.01 |
| | 3 | 1.11 | 0.02 |
| | 4 | 1.59 | 0.03 |
| | 5 | 2.06 | 0.07 |
| | 6 | 2.55 | 0.07 |
| | 7 | 3.16 | 0.09 |
| | 8 | 3.89 | 0.12 |
| | 9 | 5.07 | 0.13 |
| | 10 | 6.43 | 0.19 |
| | 11 | 7.86 | 0.20 |
| | 12 | 9.01 | 0.22 |
| | 13 | 12.28 | 0.27 |
| **8046** | 1 | 0.44 | 0.05 |
| | 2 | 0.93 | 0.08 |
| | 3 | 1.46 | 0.12 |
| | 4 | 2.83 | 0.22 |
| | 5 | 5.72 | 0.37 |
| | 6 | 8.60 | 0.48 |
| | 7 | 11.40 | 0.54 |
| | 8 | 15.47 | 0.61 |
| | 9 | 20.24 | 0.64 |
| **8047** | 1 | 0.46 | 0.02 |
| | 2 | 0.92 | 0.03 |
| | 3 | 1.49 | 0.05 |
| | 4 | 2.90 | 0.08 |
| | 5 | 5.85 | 0.13 |
| | 6 | 8.80 | 0.15 |
| | 7 | 11.59 | 0.18 |
| | 8 | 15.62 | 0.20 |
| | 9 | 20.42 | 0.21 |

## *Appendix 5b. Adsorption Isotherm Graphs*

## *AGS 6517*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 56 | 2.2 |
| 118 | 4.2 |
| 187 | 6.1 |
| 258 | 7.8 |
| 330 | 8.6 |
| 402 | 9.7 |
| 567 | 11.8 |
| 763 | 13.2 |
| 970 | 15.9 |
| 1165 | 18.4 |
| 1651 | 20.5 |
| 2114 | 21.6 |

**Langmuir Parameters**

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | 29.1 |
| Pressure (PSIA) | 754.5 |

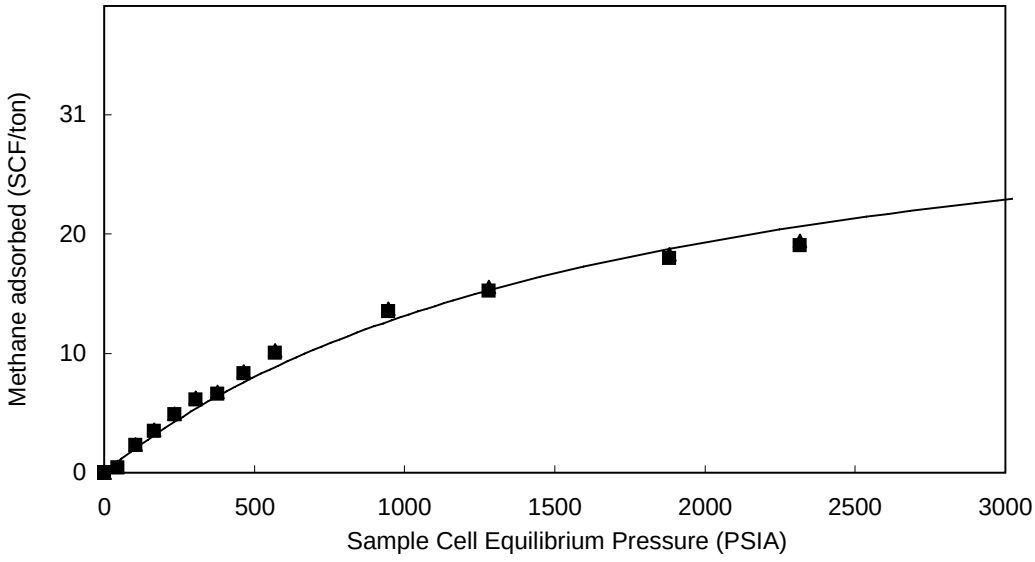
## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 ºF**

**Goodness of fit of Langmuir regression:** **0.99**

**% Moisture=** **0.77** **Density g/cc** **2.558**

## *AGS 6525*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 44 | 0.5 |
| 103 | 2.4 |
| 167 | 3.6 |
| 235 | 5.0 |
| 305 | 6.3 |
| 376 | 6.8 |
| 465 | 8.5 |
| 569 | 10.3 |
| 947 | 13.8 |
| 1280 | 15.6 |
| 1882 | 18.4 |
| 2316 | 19.5 |

### Langmuir Parameters

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | 36.5 |
| Pressure (PSIA) | 1768.9 |

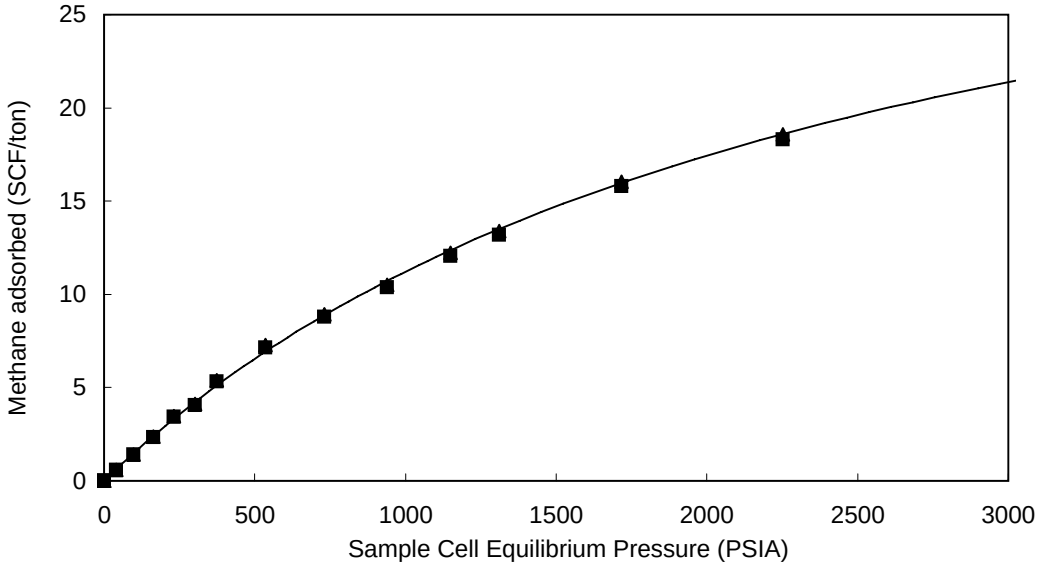
## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 ºF**

**Goodness of fit of Langmuir regression:** **0.63**

**% Moisture=** **1.87** **Density g/cc** **2.583**

## *AGS 6534*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 40 | 0.6 |
| 97 | 1.4 |
| 163 | 2.3 |
| 232 | 3.4 |
| 302 | 4.1 |
| 373 | 5.3 |
| 536 | 7.2 |
| 732 | 8.8 |
| 938 | 10.4 |
| 1148 | 12.0 |
| 1312 | 13.2 |
| 1716 | 15.8 |
| 2251 | 18.3 |

### Langmuir Parameters

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | 38.6 |
| Pressure (PSIA) | 2490.8 |

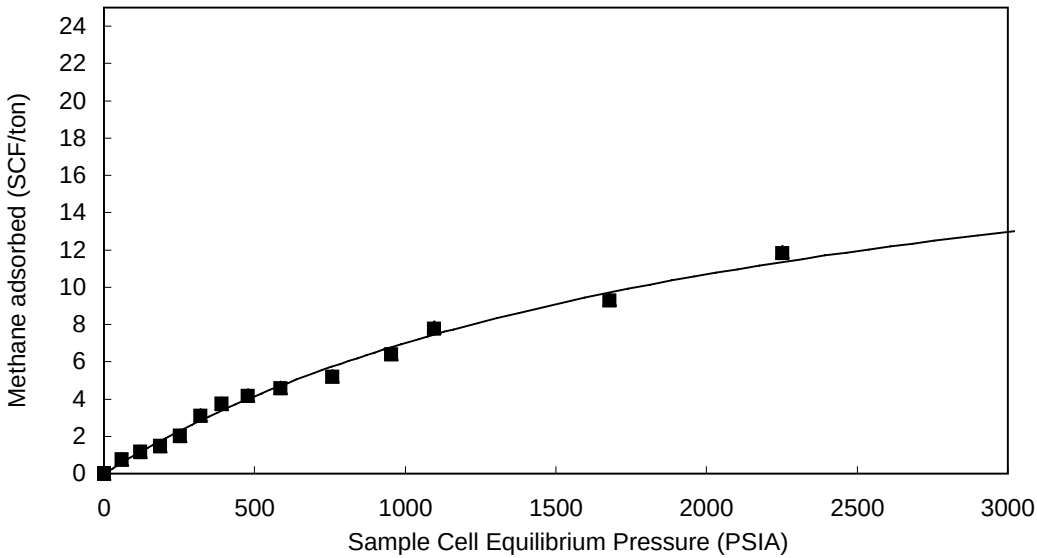
## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 °F**

**Goodness of fit of Langmuir regression:** **0.99**

**% Moisture=** **1.47** **Density g/cc** **2.589**

## *AGS 6543*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 59 | 0.8 |
| 122 | 1.2 |
| 187 | 1.5 |
| 252 | 2.0 |
| 321 | 3.1 |
| 391 | 3.7 |
| 479 | 4.2 |
| 587 | 4.6 |
| 758 | 5.2 |
| 954 | 6.4 |
| 1096 | 7.8 |
| 1678 | 9.3 |
| 2252 | 11.8 |

### Langmuir Parameters

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | 22.4 |
| Pressure (PSIA) | 2214.2 |

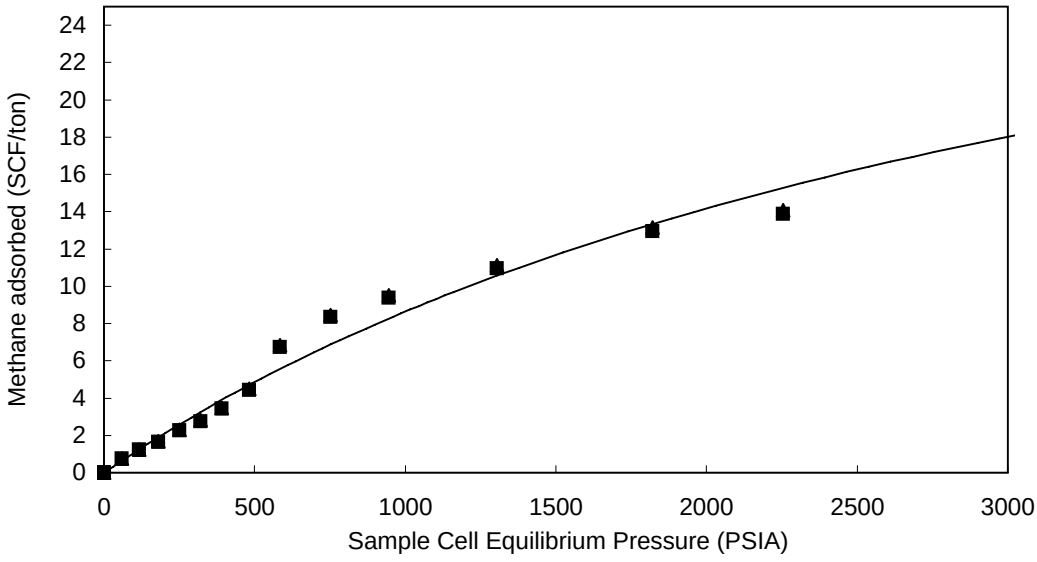
## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 ºF**

**Goodness of fit of Langmuir regression:** **0.84**

**% Moisture=** **0.59** **Density g/cc** **2.352**

## *AGS 6548*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 60 | 0.7 |
| 116 | 1.2 |
| 180 | 1.7 |
| 250 | 2.2 |
| 321 | 2.8 |
| 391 | 3.4 |
| 482 | 4.4 |
| 583 | 6.7 |
| 751 | 8.3 |
| 945 | 9.4 |
| 1304 | 10.9 |
| 1820 | 12.9 |
| 2254 | 13.9 |

**Langmuir Parameters**

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | 38.8 |
| Pressure (PSIA) | 3563.2 |

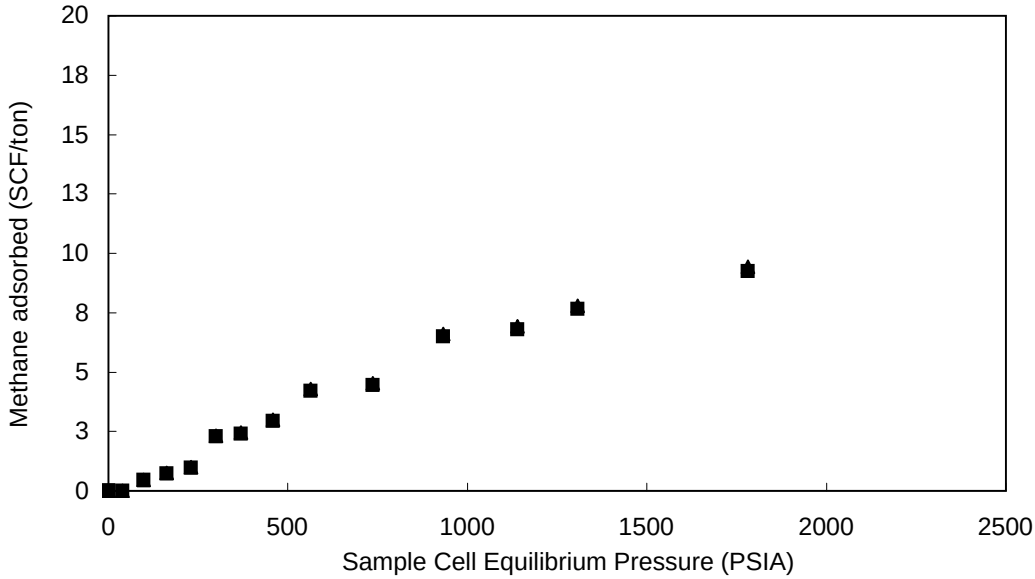
## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 °F**

**Goodness of fit of Langmuir regression:** **0.63**

**% Moisture=** **1.51** **Density g/cc** **2.608**

## *AGS 7304*




| Pressure (PSIA) | Adsorbed gas ($ft^3$ /ton) In-Situ |
|---|---|
| 39 | 0.0 |
| 97 | 0.5 |
| 162 | 0.7 |
| 230 | 1.0 |
| 299 | 2.3 |
| 370 | 2.4 |
| 459 | 2.9 |
| 564 | 4.2 |
| 736 | 4.4 |
| 933 | 6.5 |
| 1140 | 6.8 |
| 1307 | 7.6 |
| 1781 | 9.2 |

### Langmuir Parameters

| | In-Situ |
|---|---|
| Vol. ($ft^3$ /ton) | n/a |
| Pressure (PSIA) | n/a |

## *SUMMARY OF ADSORPTION ANALYSES IMP. UNITS*

**Isotherm Temperature:** **100.4 ºF**

**Goodness of fit of Langmuir regression:**

**% Moisture=** **1.87** **Density g/cc** **2.658**

# Methane Adsorption Isotherm

**Alberta Geological Survey** **Well: 100/08-30-082-02W6/00**
**Sample: 8046** **Depth: 1994.45 m**
**Raw Basis** **TOC = 1.66%**

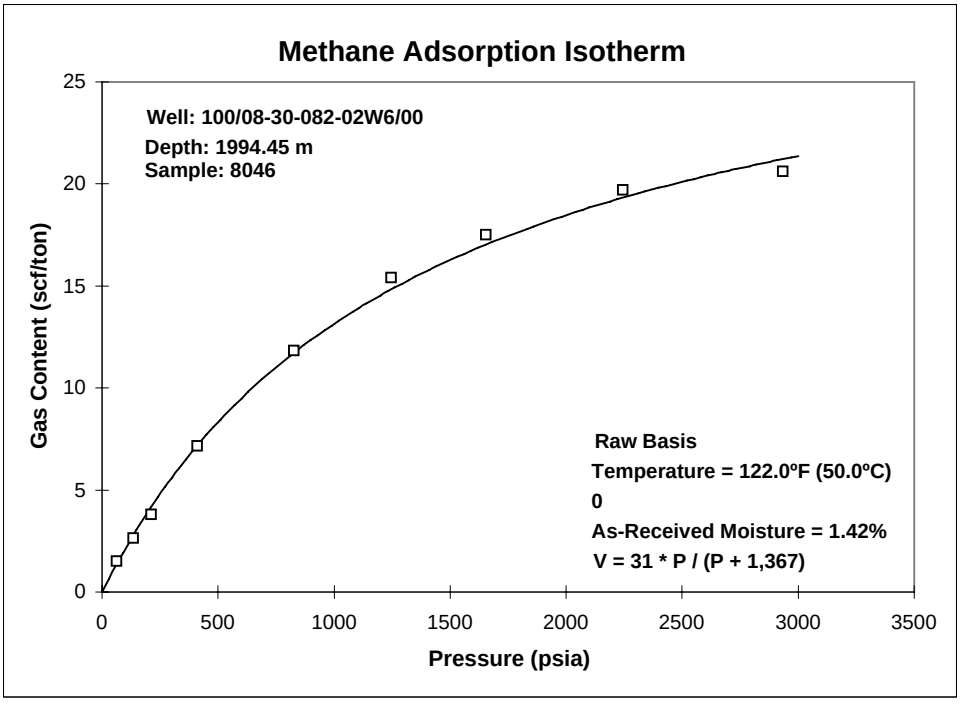
| | |
|---|---|
| Sample Weight = 233.36 g | |
| Particle Size = < 12 Mesh | As-Received Moisture = 1.42% |
| Temperature = 122.0ºF (50.0ºC) | |

**Methane Adsorption**

| Pressure | | Gas Content (Raw Basis) | |
|---|---|---|---|
| (psia) | (MPa) | (scf/ton) | (scc/gm) |
| 64 | 0.44 | 1.5 | 0.05 |
| 135 | 0.93 | 2.7 | 0.08 |
| 212 | 1.46 | 3.8 | 0.12 |
| 411 | 2.83 | 7.2 | 0.22 |
| 829 | 5.72 | 11.8 | 0.37 |
| 1,247 | 8.60 | 15.4 | 0.48 |
| 1,654 | 11.40 | 17.4 | 0.54 |
| 2,244 | 15.47 | 19.7 | 0.61 |
| 2,936 | 20.24 | 20.6 | 0.64 |

**Langmuir Coefficients** **V = 31.1 * P / (P + 1,366.7)**

| PL | | VL (Raw Basis) | |
|---|---|---|---|
| (psia) | (MPa) | (scf/ton) | (scc/gm) |
| 1,366.7 | 9.42 | 31.1 | 1.0 |

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# Methane Adsorption Isotherm

**Alberta Geological Survey** **Well: 100/08-30-082-02W6/00**
**Sample: 8047** **Depth: 1975 m**
**Raw Basis** **TOC = 0.44%**

Sample Weight = 239.03 g
Particle Size = < 12 Mesh
Temperature = 122.0ºF (50.0ºC)

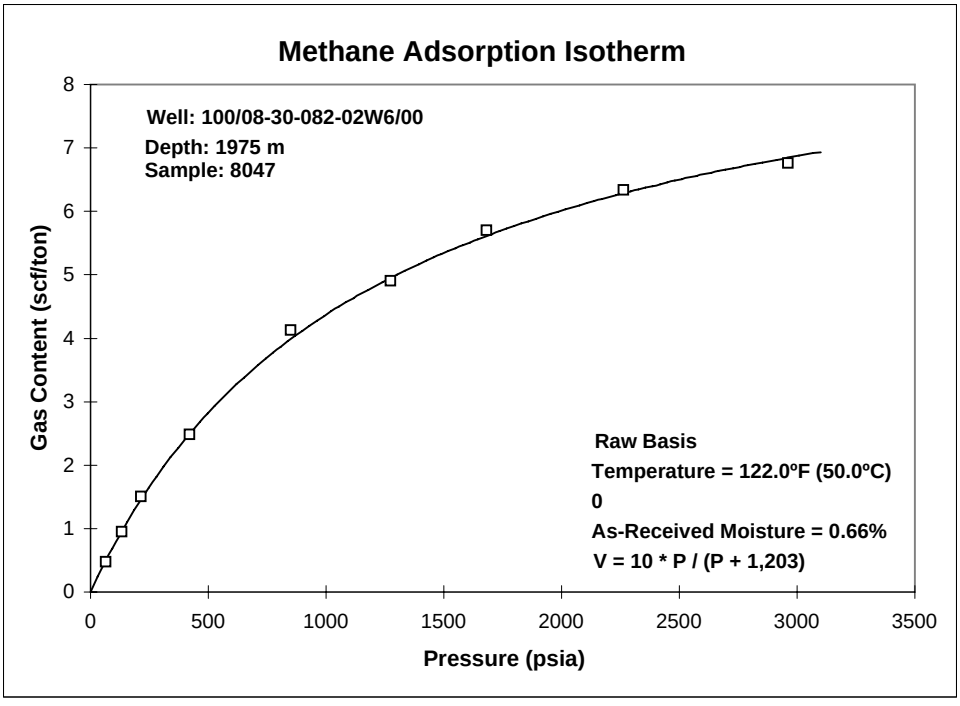
As-Received Moisture = 0.66%

**Methane Adsorption**

| Pressure | | Gas Content (Raw Basis) | |
|---|---|---|---|
| (psia) | (MPa) | (scf/ton) | (scc/gm) |
| 66 | 0.46 | 0.5 | 0.02 |
| 134 | 0.92 | 1.0 | 0.03 |
| 216 | 1.49 | 1.5 | 0.05 |
| 421 | 2.90 | 2.5 | 0.08 |
| 849 | 5.85 | 4.2 | 0.13 |
| 1,276 | 8.80 | 4.9 | 0.15 |
| 1,681 | 11.59 | 5.7 | 0.18 |
| 2,265 | 15.62 | 6.4 | 0.20 |
| 2,961 | 20.42 | 6.8 | 0.21 |

**Langmuir Coefficients** **V = 9.6 * P / (P + 1,202.8)**

| PL | | VL (Raw Basis) | |
|---|---|---|---|
| (psia) | (MPa) | (scf/ton) | (scc/gm) |
| 1,202.8 | 8.29 | 9.6 | 0.3 |

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Appendix 6. Banff/Exshaw Formations Rock Eval™ and TOC

## Legend

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Sample Type | Outcrop or core sample |
| Site No. | Site location number |
| Qty (g) | Sample weight in grams |
| S1* | Amount of free hydrocarbons (in milligrams of hydrocarbon per gram of rock) |
| S2* | Amount of hydrocarbons generated through thermal cracking |
| PI* | Production index, S1/(S1+S2) |
| S3 | Milligrams $CO_2$ per gram of rock |
| Max T (°C) | Rock Eval II - adjusted temperature of maximum hydrocarbon generation calculated from Peak T |
| Peak T (°C) | Temperature of maximum hydrocarbon generation from Rock Eval VI |
| TOC (wt %) | Total organic carbon in weight percent |
| HI | Hydrogen index - (100 * S2)/TOC |
| OI | Oxygen index - (100 * S3)/TOC |
| MINC (%) | Mineral carbon in weight per cent |

* Output rounded to two decimal places.

| Sample No. | Sample Type | Site No. | Qty (g) | S1 | S2 | PI | S3 | Max T (°C) | Peak T (°C) | TOC (wt %) | HI | OI | MINC (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6506** | outcrop | B17 | 70.6 | 0.01 | 0.03 | 0.20 | 0.49 | 458 | 495 | 0.17 | 18 | 288 | 5.0 |
| **6507** | outcrop | B19 | 70.4 | 0.03 | 0.01 | 0.64 | 0.21 | 410 | 447 | 0.68 | 1 | 31 | 2.6 |
| **6508** | outcrop | B19 | 70.4 | 0.03 | 0.12 | 0.19 | 0.19 | 609 | 646 | 3.64 | 3 | 5 | 4.6 |
| **6509** | outcrop | B19 | 50.6 | 0.03 | 0.19 | 0.14 | 0.12 | 607 | 644 | 4.93 | 4 | 2 | 0.8 |
| **6510** | outcrop | B19 | 50.6 | 0.03 | 0.12 | 0.18 | 0.16 | 608 | 645 | 5.01 | 2 | 3 | 0.2 |
| **6511** | outcrop | B19 | 50.3 | 0.03 | 0.14 | 0.15 | 0.14 | 608 | 645 | 4.72 | 3 | 3 | 0.2 |
| **6512** | outcrop | B19 | 50.7 | 0.01 | 0.04 | 0.24 | 0.38 | 610 | 647 | 4.25 | 1 | 9 | 0.1 |
| **6513** | outcrop | B19 | 70.2 | 0.02 | 0.02 | 0.53 | 0.55 | 333 | 370 | 1.29 | 2 | 43 | 2.5 |
| **6514** | outcrop | B19 | 50.0 | 0.02 | 0.08 | 0.17 | 0.28 | 610 | 647 | 5.26 | 2 | 5 | 0.1 |
| **6516** | outcrop | B19 | 50.0 | 0.02 | 0.04 | 0.27 | 0.25 | 610 | 647 | 3.59 | 1 | 7 | 0.1 |
| **6517** | outcrop | B19 | 50.8 | 0.02 | 0.04 | 0.34 | 0.30 | 609 | 646 | 3.31 | 1 | 9 | 0.1 |
| **6518** | outcrop | B19 | 50.4 | 0.02 | 0.06 | 0.25 | 0.42 | 610 | 647 | 4.81 | 1 | 9 | 0.1 |
| **6519** | outcrop | B19 | 50.3 | 0.02 | 0.06 | 0.20 | 0.13 | 611 | 648 | 4.12 | 1 | 3 | 0.1 |
| **6520** | outcrop | B19 | 50.5 | 0.02 | 0.06 | 0.27 | 0.45 | 610 | 647 | 2.91 | 2 | 15 | 1.5 |
| **6521** | outcrop | B19 | 50.0 | 0.02 | 0.05 | 0.26 | 0.27 | 611 | 648 | 4.94 | 1 | 5 | 0.1 |
| **6522** | outcrop | B19 | 50.4 | 0.02 | 0.08 | 0.15 | 0.44 | 610 | 647 | 4.33 | 2 | 10 | 0.2 |
| **6523** | outcrop | B19 | 51.0 | 0.02 | 0.09 | 0.17 | 0.23 | 610 | 647 | 3.95 | 2 | 6 | 0.7 |
| **6524** | outcrop | B19 | 49.9 | 0.02 | 0.07 | 0.21 | 0.69 | 610 | 647 | 4.00 | 2 | 17 | 0.9 |
| **6525** | outcrop | B19 | 50.9 | 0.01 | 0.06 | 0.11 | 0.81 | 611 | 648 | 4.57 | 1 | 18 | 0.1 |
| **6526** | outcrop | B19 | 50.3 | 0.01 | 0.04 | 0.21 | 0.46 | 610 | 647 | 2.71 | 1 | 17 | 3.7 |
| **6527** | outcrop | B19 | 50.5 | 0.01 | 0.05 | 0.18 | 0.91 | 611 | 648 | 1.92 | 3 | 47 | 1.4 |
| **6528** | outcrop | B19 | 50.1 | 0.01 | 0.04 | 0.19 | 0.39 | 611 | 648 | 1.81 | 2 | 22 | 2.8 |
| **6529** | outcrop | B19 | 50.4 | 0.01 | 0.05 | 0.23 | 0.31 | 611 | 648 | 1.96 | 3 | 16 | 5.0 |
| **6530** | outcrop | B19 | 50.0 | 0.02 | 0.03 | 0.37 | 0.25 | 611 | 648 | 1.60 | 2 | 16 | 2.1 |
| **6531** | outcrop | B19 | 50.2 | 0.03 | 0.03 | 0.44 | 0.14 | 303 | 340 | 0.16 | 19 | 88 | 9.8 |
| **6533** | outcrop | B17 | 70.3 | 0.01 | 0.08 | 0.09 | 1.21 | 513 | 550 | 1.14 | 7 | 106 | 3.6 |
| **6534** | outcrop | B17 | 70.8 | 0.02 | 0.25 | 0.08 | 2.74 | 520 | 557 | 2.26 | 11 | 121 | 0.3 |
| **6536** | outcrop | B17 | 70.3 | 0.01 | 0.01 | 0.53 | 0.18 | 479 | 516 | 0.11 | 9 | 164 | 13.2 |
| **6537** | outcrop | B17 | 51.0 | 0.02 | 0.24 | 0.07 | 4.51 | 521 | 558 | 2.83 | 8 | 159 | 0.4 |
| **6538** | outcrop | B17 | 50.5 | 0.02 | 0.27 | 0.08 | 3.26 | 526 | 563 | 3.03 | 9 | 108 | 0.3 |
| **6539** | outcrop | B17 | 50.4 | 0.08 | 0.35 | 0.19 | 1.64 | 583 | 620 | 4.21 | 8 | 39 | 0.2 |
| **6540** | outcrop | B17 | 70.6 | 0.00 | 0.02 | 0.20 | 0.47 | 455 | 492 | 0.17 | 12 | 276 | 5.2 |
| **6541** | outcrop | B17 | 70.7 | 0.05 | 0.07 | 0.39 | 0.27 | 444 | 481 | 0.34 | 21 | 79 | 7.7 |
| **6542** | outcrop | B17 | 70.5 | 0.01 | 0.06 | 0.08 | 1.26 | 522 | 559 | 0.86 | 7 | 147 | 4.1 |
| **6543** | outcrop | B17 | 70.7 | 0.01 | 0.07 | 0.17 | 0.78 | 518 | 555 | 0.68 | 10 | 115 | 5.4 |
| **6545** | outcrop | B17 | 70.2 | 0.07 | 0.08 | 0.47 | 0.28 | 451 | 488 | 0.34 | 24 | 82 | 7.7 |
| **6546** | outcrop | B17 | 70.6 | 0.02 | 0.14 | 0.12 | 1.03 | 448 | 485 | 0.47 | 30 | 219 | 8.3 |
| **6547** | outcrop | B17 | 70.9 | 0.09 | 0.09 | 0.49 | 0.22 | 460 | 497 | 0.30 | 30 | 73 | 11.6 |
| **6548** | outcrop | B17 | 70.6 | 0.07 | 0.17 | 0.27 | 0.52 | 430 | 467 | 0.34 | 50 | 153 | 10.5 |
| **6549** | outcrop | B17 | 70.1 | 0.09 | 0.10 | 0.46 | 0.17 | 501 | 538 | 0.23 | 43 | 74 | 3.5 |
| **6550** | outcrop | B17 | 70.8 | 0.05 | 0.11 | 0.29 | 0.67 | 420 | 457 | 0.35 | 31 | 191 | 10.7 |
| **6907** | outcrop | B19 | 50.6 | 0.02 | 0.08 | 0.19 | 1.44 | 610 | 647 | 4.16 | 2 | 35 | 0.7 |
| **6917** | core | B08 | 70.9 | 0.01 | 0.05 | 0.17 | 0.05 | 459 | 499 | 0.09 | 56 | 56 | 0.7 |
| **6918** | core | B08 | 70.3 | 0.04 | 0.06 | 0.36 | 0.17 | 311 | 351 | 0.22 | 27 | 77 | 10.1 |
| **6919** | core | B08 | 70.5 | 0.01 | 0.07 | 0.16 | 0.13 | 437 | 477 | 0.22 | 32 | 59 | 1.6 |

| Sample No. | Sample Type | Site No. | Qty (g) | S1 | S2 | PI | S3 | Max T (°C) | Peak T (°C) | TOC (wt %) | HI | OI | MINC (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6920** | core | B08 | 70.2 | 0.05 | 0.11 | 0.32 | 0.11 | 311 | 351 | 0.31 | 35 | 35 | 0.5 |
| **6921** | core | B08 | 70.5 | 0.05 | 0.08 | 0.38 | 0.21 | 307 | 347 | 0.35 | 23 | 60 | 2.6 |
| **6922** | core | B08 | 70.3 | 0.07 | 0.07 | 0.49 | 0.11 | 414 | 454 | 0.12 | 58 | 92 | 11.7 |
| **6923** | core | B08 | 70.3 | 0.55 | 0.64 | 0.46 | 0.24 | 320 | 360 | 0.44 | 145 | 55 | 6.1 |
| **6924** | core | B08 | 70.6 | 0.45 | 0.30 | 0.60 | 0.20 | 302 | 342 | 0.77 | 39 | 26 | 8.4 |
| **6925** | core | B08 | 70.0 | 0.42 | 0.36 | 0.54 | 0.17 | 303 | 343 | 0.81 | 44 | 21 | 8.6 |
| **6926** | core | B08 | 70.8 | 0.44 | 0.38 | 0.54 | 0.19 | 453 | 493 | 1.09 | 35 | 17 | 8.6 |
| **6927** | core | B08 | 70.3 | 0.79 | 0.41 | 0.65 | 0.16 | 296 | 336 | 1.12 | 37 | 14 | 9.8 |
| **6928** | core | B08 | 70.8 | 0.39 | 0.23 | 0.63 | 0.16 | 289 | 329 | 0.96 | 24 | 17 | 9.5 |
| **6929** | core | B08 | 70.6 | 0.03 | 0.08 | 0.29 | 0.20 | 420 | 460 | 0.13 | 62 | 154 | 11.6 |
| **6930** | core | B08 | 70.6 | 0.01 | 0.02 | 0.25 | 0.27 | 406 | 446 | 0.05 | 40 | 540 | 11.9 |
| **6931** | core | B01 | 70.8 | 0.04 | 0.07 | 0.36 | 0.11 | 333 | 373 | 0.19 | 37 | 58 | 4.5 |
| **6932** | core | B01 | 10.8 | 1.29 | 2.21 | 0.37 | 0.23 | 471 | 511 | 6.79 | 33 | 3 | 2.1 |
| **6933** | core | B01 | 50.7 | 1.30 | 2.11 | 0.38 | 0.11 | 463 | 503 | 5.46 | 39 | 2 | 0.4 |
| **6934** | core | B04 | 70.3 | 0.16 | 0.28 | 0.36 | 0.26 | 426 | 466 | 0.85 | 33 | 31 | 5.4 |
| **6935** | core | B04 | 70.8 | 0.33 | 0.47 | 0.41 | 0.22 | 489 | 529 | 1.55 | 30 | 14 | 3.2 |
| **6936** | core | B04 | 70.6 | 0.32 | 0.59 | 0.35 | 0.12 | 483 | 523 | 2.04 | 29 | 6 | 3.4 |
| **6937** | core | B04 | 70.6 | 0.21 | 0.62 | 0.25 | 0.15 | 480 | 520 | 3.10 | 20 | 5 | 1.3 |
| **6938** | core | B06 | 70.3 | 0.04 | 0.22 | 0.16 | 0.21 | 430 | 470 | 0.10 | 220 | 210 | 10.9 |
| **6939** | core | B06 | 70.6 | 0.17 | 0.18 | 0.48 | 0.58 | 299 | 339 | 0.20 | 90 | 290 | 4.4 |
| **6940** | core | B06 | 70.4 | 0.06 | 0.22 | 0.20 | 0.34 | 425 | 465 | 0.20 | 110 | 170 | 10.7 |
| **6941** | core | B06 | 70.3 | 0.03 | 0.10 | 0.21 | 0.32 | 428 | 468 | 0.14 | 71 | 229 | 9.5 |
| **6942** | core | B06 | 70.9 | 0.27 | 0.97 | 0.22 | 0.75 | 429 | 469 | 0.51 | 190 | 147 | 4.5 |
| **6943** | core | B06 | 70.5 | 0.04 | 0.10 | 0.30 | 0.43 | 420 | 460 | 0.23 | 43 | 187 | 7.7 |
| **6944** | core | B06 | 70.9 | 0.19 | 1.66 | 0.10 | 0.86 | 434 | 474 | 0.79 | 210 | 109 | 5.9 |
| **6945** | core | B06 | 70.3 | 4.21 | 89.12 | 0.05 | 3.83 | 413 | 453 | 16.44 | 542 | 23 | 1.1 |
| **6946** | core | B10 | 70.1 | 0.01 | 0.07 | 0.13 | 0.18 | 423 | 463 | 0.19 | 37 | 95 | 2.1 |
| **6947** | core | B10 | 69.7 | 0.06 | 0.87 | 0.06 | 0.11 | 437 | 477 | 0.26 | 335 | 42 | 0.2 |
| **6948** | core | B10 | 70.6 | 0.11 | 1.78 | 0.06 | 0.15 | 440 | 480 | 0.76 | 234 | 20 | 1.7 |
| **7287** | outcrop | B19 | 70.9 | 0.02 | 0.05 | 0.30 | 0.67 | 440 | 477 | 0.31 | 16 | 216 | 5.4 |
| **7288** | outcrop | B19 | 70.6 | 0.03 | 0.09 | 0.23 | 0.89 | 339 | 376 | 0.28 | 32 | 318 | 5.5 |
| **7301** | outcrop | B17 | 70.5 | 0.01 | 0.07 | 0.14 | 0.77 | 445 | 482 | 0.31 | 23 | 248 | 11.5 |
| **7302** | outcrop | B17 | 70.7 | 0.01 | 0.06 | 0.12 | 0.90 | 507 | 544 | 0.39 | 15 | 231 | 6.9 |
| **7303** | outcrop | B17 | 70.5 | 0.01 | 0.03 | 0.27 | 0.61 | 496 | 533 | 0.29 | 10 | 210 | 7.5 |
| **7304** | outcrop | B17 | 70.4 | 0.01 | 0.05 | 0.14 | 0.82 | 496 | 533 | 0.31 | 16 | 265 | 7.9 |
| **7305** | outcrop | B17 | 70.3 | 0.02 | 0.05 | 0.22 | 0.70 | 496 | 533 | 0.32 | 16 | 219 | 8.3 |
| **7307** | outcrop | B17 | 70.7 | 0.02 | 0.09 | 0.19 | 0.80 | 493 | 530 | 0.30 | 30 | 267 | 7.2 |
| **7308** | outcrop | B17 | 70.3 | 0.05 | 0.46 | 0.09 | 1.40 | 422 | 459 | 0.51 | 90 | 275 | 8.1 |
| **7309** | outcrop | B17 | 70.5 | 0.01 | 0.05 | 0.15 | 0.93 | 489 | 526 | 0.30 | 17 | 310 | 8.5 |
| **7310** | outcrop | B17 | 70.5 | 0.01 | 0.02 | 0.28 | 0.61 | 489 | 526 | 0.20 | 10 | 305 | 10.2 |
| **7311** | outcrop | B17 | 70.5 | 0.00 | 0.03 | 0.12 | 0.95 | 495 | 532 | 0.26 | 12 | 365 | 7.7 |
| **7312** | outcrop | B17 | 70.8 | 0.01 | 0.04 | 0.17 | 0.75 | 485 | 522 | 0.20 | 20 | 375 | 8.8 |
| **7313** | outcrop | B17 | 70.7 | 0.02 | 0.07 | 0.18 | 0.52 | 437 | 474 | 0.23 | 30 | 226 | 11.7 |
| **7314** | outcrop | B18 | 70.7 | 0.01 | 0.03 | 0.24 | 0.25 | 560 | 597 | 0.15 | 20 | 167 | 9.9 |
| **8003** | core | B10 | 70.3 | 0.01 | 0.03 | 0.15 | 0.25 | 416 | 456 | 0.12 | 25 | 208 | 12.7 |

| Sample No. | Sample Type | Site No. | Qty (g) | S1 | S2 | PI | S3 | Max T (°C) | Peak T (°C) | TOC (wt %) | HI | OI | MINC (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8004** | core | B10 | 70.1 | 0.21 | 0.14 | 0.60 | 0.25 | 430 | 470 | 0.25 | 56 | 100 | 7.8 |
| **8005** | core | B10 | 70.9 | 0.27 | 0.21 | 0.56 | 0.22 | 423 | 463 | 0.23 | 91 | 96 | 7.9 |
| **8006** | core | B10 | 70.0 | 1.30 | 16.71 | 0.07 | 0.23 | 441 | 481 | 5.57 | 300 | 4 | 6.7 |
| **8007** | core | B10 | 70.3 | 0.09 | 0.18 | 0.33 | 0.15 | 434 | 474 | 0.14 | 129 | 107 | 10.2 |
| **8008** | core | B11 | 70.5 | 0.07 | 0.76 | 0.09 | 0.16 | 435 | 475 | 0.39 | 195 | 41 | 5.7 |
| **8009** | core | B11 | 70.2 | 0.05 | 0.61 | 0.07 | 0.19 | 429 | 469 | 0.32 | 191 | 59 | 5.6 |
| **8010** | core | B11 | 70.7 | 4.58 | 70.72 | 0.06 | 2.14 | 424 | 464 | 13.19 | 536 | 16 | 0.5 |
| **8011** | core | B11 | 70.6 | 0.08 | 0.36 | 0.18 | 0.23 | 427 | 467 | 0.14 | 257 | 164 | 9.2 |
| **8012** | core | Duplicate | 70.3 | 0.06 | 0.10 | 0.40 | 0.26 | 419 | 459 | 0.35 | 29 | 74 | 2.6 |
| **8013** | core | Duplicate | 70.6 | 0.07 | 0.83 | 0.08 | 0.07 | 437 | 477 | 0.33 | 252 | 21 | 0.3 |
| **8014** | core | Duplicate | 70.9 | 0.28 | 0.39 | 0.42 | 0.22 | 487 | 527 | 1.49 | 26 | 15 | 3.3 |
| **8015** | core | Duplicate | 70.1 | 0.05 | 0.23 | 0.17 | 0.48 | 433 | 473 | 0.62 | 37 | 77 | 0.6 |
| **8017** | core | B03 | 70.9 | 1.21 | 10.96 | 0.10 | 0.58 | 435 | 475 | 2.21 | 496 | 26 | 3.2 |
| **8019** | core | B12 | 70.3 | 0.19 | 0.49 | 0.28 | 0.32 | 420 | 460 | 0.65 | 75 | 49 | 0.4 |
| **8021** | core | B12 | 70.6 | 0.28 | 0.27 | 0.52 | 0.25 | 298 | 338 | 0.12 | 225 | 208 | 0.1 |
| **8022** | core | B12 | 70.1 | 0.13 | 0.15 | 0.46 | 0.25 | 308 | 348 | 0.17 | 88 | 147 | 2.8 |
| **8038** | core | B16 | 70.8 | 3.33 | 70.40 | 0.05 | 0.79 | 432 | 472 | 11.34 | 621 | 7 | 2.0 |
| **8039** | core | B16 | 70.4 | 0.73 | 8.47 | 0.08 | 0.30 | 433 | 473 | 2.26 | 375 | 13 | 0.4 |
| **8678** | core | B09 | 70.9 | 0.15 | 1.52 | 0.09 | 0.33 | 429 | 469 | 0.90 | 169 | 37 | 0.4 |
| **8679** | core | B09 | 70.4 | 0.13 | 2.14 | 0.06 | 0.32 | 430 | 470 | 0.95 | 225 | 34 | 0.5 |
| **8680** | core | B09 | 70.2 | 0.52 | 8.13 | 0.06 | 0.41 | 427 | 467 | 2.45 | 332 | 17 | 0.5 |
| **8681** | core | B02 | 70.5 | 0.13 | 1.24 | 0.09 | 0.31 | 438 | 478 | 0.31 | 400 | 100 | 6.4 |
| **8682** | core | B02 | 70.5 | 0.53 | 7.02 | 0.07 | 0.40 | 432 | 472 | 1.60 | 439 | 25 | 2.9 |
| **8683** | core | B02 | 70.6 | 0.77 | 13.97 | 0.05 | 0.68 | 428 | 468 | 3.17 | 441 | 21 | 2.1 |
| **8684** | core | B02 | 70.8 | 0.07 | 0.38 | 0.16 | 0.52 | 432 | 472 | 0.36 | 106 | 144 | 4.0 |
| **8685** | core | B02 | 70.7 | 0.28 | 0.28 | 0.50 | 0.47 | 296 | 336 | 0.21 | 133 | 224 | 3.8 |
| **8686** | core | B02 | 70.2 | 0.93 | 15.50 | 0.06 | 0.43 | 430 | 470 | 3.26 | 475 | 13 | 0.9 |
| **8687** | core | B05 | 70.4 | 0.06 | 0.31 | 0.15 | 0.11 | 446 | 486 | 0.39 | 79 | 28 | 0.2 |
| **8688** | core | B05 | 70.3 | 0.49 | 2.15 | 0.19 | 0.13 | 449 | 489 | 0.95 | 226 | 14 | 0.3 |
| **8689** | core | B14 | 70.1 | 0.17 | 0.31 | 0.35 | 0.15 | 427 | 467 | 0.62 | 50 | 24 | 0.3 |
| **8690** | core | B14 | 70.6 | 0.11 | 0.28 | 0.27 | 0.17 | 428 | 468 | 0.30 | 93 | 57 | 2.9 |
| **8691** | core | B15 | 70.0 | 0.36 | 0.73 | 0.33 | 0.19 | 448 | 488 | 0.39 | 187 | 49 | 4.7 |
| **8692** | core | B15 | 70.8 | 1.69 | 3.82 | 0.31 | 0.12 | 451 | 491 | 1.80 | 212 | 7 | 1.8 |
| **8693** | core | B15 | 70.3 | 0.63 | 1.46 | 0.30 | 0.20 | 448 | 488 | 0.72 | 203 | 28 | 3.3 |
| **8694** | core | B07 | 70.3 | 0.02 | 0.08 | 0.16 | 0.33 | 356 | 396 | 0.12 | 67 | 275 | 4.7 |
| **8695** | core | B07 | 70.5 | 0.04 | 0.14 | 0.21 | 0.40 | 337 | 377 | 0.21 | 67 | 190 | 5.1 |
| **8696** | core | B03 | 70.6 | 0.03 | 0.12 | 0.20 | 0.57 | 421 | 461 | 0.15 | 80 | 380 | 4.9 |
| **8697** | core | B03 | 70.2 | 0.04 | 0.19 | 0.17 | 0.45 | 424 | 464 | 0.24 | 79 | 188 | 2.9 |
| **8698** | core | B03 | 70.3 | 0.03 | 0.13 | 0.20 | 0.56 | 428 | 468 | 0.35 | 37 | 160 | 0.7 |
| **8699** | core | B03 | 70.1 | 0.05 | 0.21 | 0.20 | 0.59 | 430 | 470 | 0.56 | 38 | 105 | 0.8 |
| **8700** | core | B03 | 70.0 | 0.04 | 0.25 | 0.15 | 0.43 | 432 | 472 | 0.23 | 109 | 187 | 7.5 |

## Appendix 7. Banff/Exshaw Formations Organic Petrography Description/Maturation

### Description and Reflectance (Maturation)

# Legend

| Column Label | Label Description |
|---|---|
| Sample No. | AGS sample number |
| Photo No. | Photo number of sample |
| Organic Type | Kerogen type (I to IV) |
| Vitrinite Reflectance ($\%_R$) | Per cent random reflectance in oil |
| Standard Deviation | Standard deviation |
| n | Number of individual measurements |
| Comments | Sample observations |

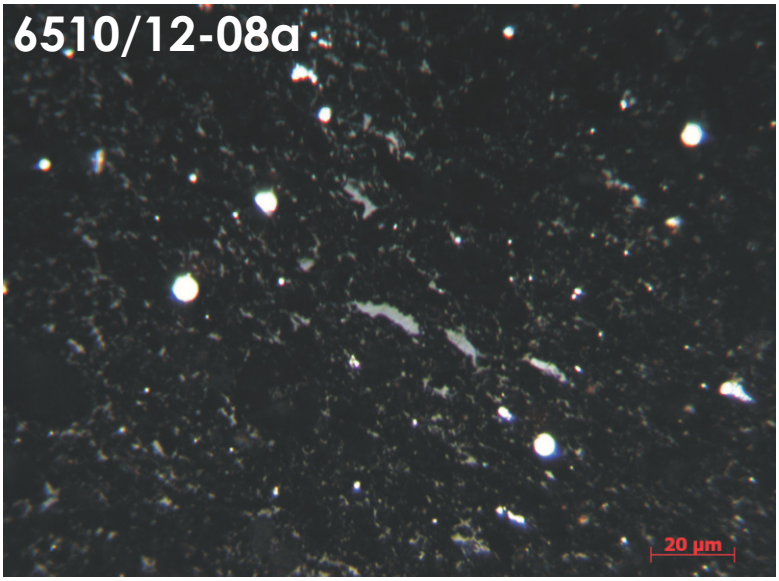
**Organic Type**

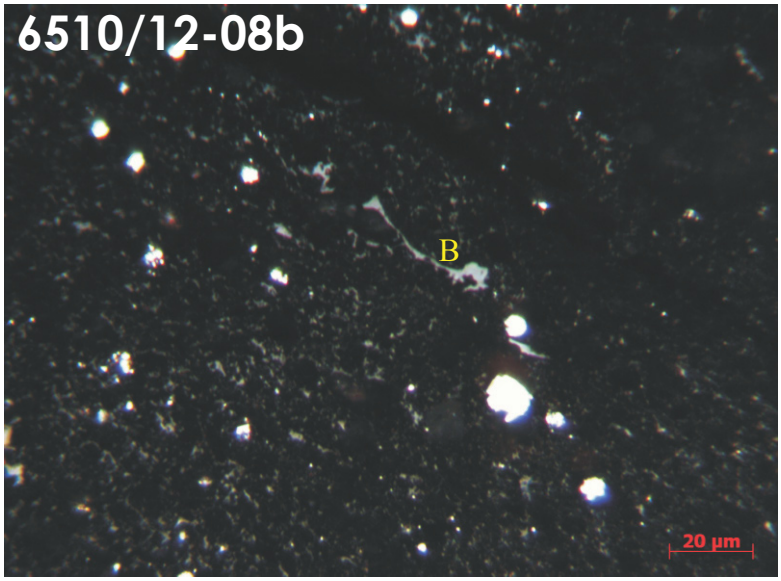
| | |
|---|---|
| 2 | Vitrinite %Ro |
| 2.1,2.2,2.3 | Refers to reworked population |
| 3 | Vitrinite equivalent = 0.618*bitumen %Ro + 0.40 |
| 4 | Bitumen |
| 31 | Isotropic low %Ro secondary bitumen (derived from secondary bitumen) |
| 32 | Isotropic high %Ro secondary bitumen (typically derived from 31) |

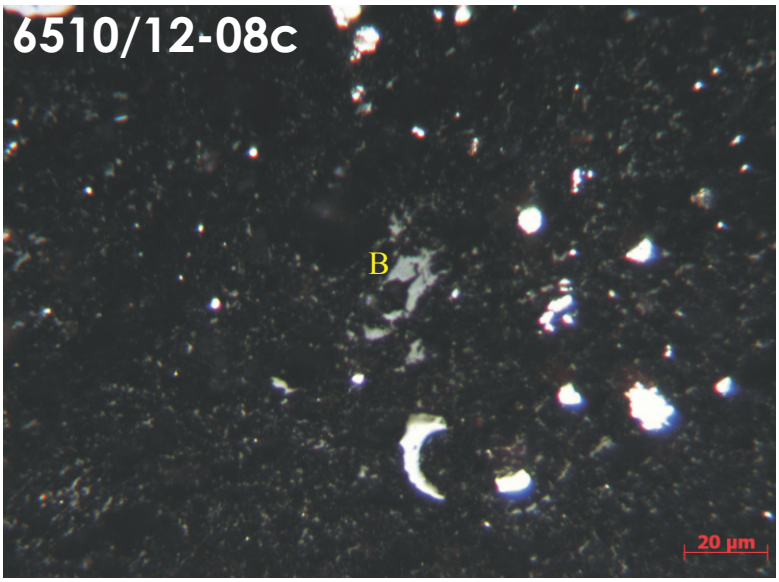
| Sample No. | Photo No. | Organic Type | Vitrinite Reflectance ($\%_R$) | Standard Deviation | n | Comments |
|---|---|---|---|---|---|---|
| **6510** | **12-08** | 2 | 1.432 | 0.149 | 7 | Black shale with mostly non-fluorescing amorphinite and continuous network of amorphous kerogen, possibly from alginite. Also higher reflecting isotropic migrabitumen within carbonate pores. |
| | | 2, 4 | 1.792 | 0.095 | 19 | Mostly migrabitumen but also some oxidized vitrinite lenses. |
| | | 4 | 2.311 | 0.241 | 14 | |
| | | 4 | 3.172 | 0.231 | 9 | |
| **6514** | **13-08** | 4 | 1.675 | 0.029 | 3 | Black shale with calcite cement and bitumen filled siliceous microfossils (S) derived from radiolaria. Mostly thin lenses of isotropic vitrinite derived from alginite within the network amorphinite and amorphous kerogen. Very few can be measured accurately. |
| | | 4 | 1.850 | 0.060 | 2 | |
| | | 4 | 2.489 | 0.219 | 4 | |
| | | 4 | 3.090 | | 1 | |
| **6521** | **14-08** | 2.1 | 0.965 | 0.074 | 4 | Black shale with mostly thin lenses of isotropic alginite derived vitrinite and network of amorphous kerogen. Some evidence calcite cement filled radiolarian like structure. |
| | | 4 | 1.655 | 0.087 | 9 | |
| | | 4 | 1.946 | 0.086 | 12 | |
| | | 4 | 2.272 | 0.132 | 15 | |
| | | 4 | 3.119 | 0.527 | 3 | |
| **6525** | **15-08** | 2 | 1.131 | 0.150 | 2 | Shale with mostly non-fluorescing amorphinite kerogen with very few measureable vitrinite/kerogen particles. |
| | | 4 | 1.670 | | 1 | |
| | | 4 | 2.034 | 0.075 | 7 | |
| | | 4 | 2.318 | 0.051 | 2 | |
| | | 4 | 2.781 | 0.117 | 2 | |
| **6531** | **16-08** | 4? | 1.890 | | 1 | Organically lean carbonate/limestone with very few isotropic migrabitumen. |
| | | 4 | 2.483 | 0.179 | 9 | |
| | | 4 | 3.095 | 0.136 | 5 | |
| **6532** | **17-08** | 4? | 1.217 | 0.153 | 29 | Shale with some brecciated kerogen, some showing signs of oxidation. High reflecting solid bitumen some showing anisotropy. Rare weak yellow fluorescing bitumen with some micrinite inclusions. |
| | | 4 | 1.650 | 0.112 | 19 | |
| | | 4 | 2.008 | 0.060 | 3 | |
| **6539** | **18-08** | 4? | 1.173 | 0.131 | 34 | Shale with high amount of amorphous primary bitumen with isotropic secondary migrabitumen brecciated in between pores. Also rare anisotropic granular bitumen. High iron oxides content found in some shale matrix (possibly due to oxidation). |
| | | 4 | 1.502 | 0.065 | 16 | |
| **6542** | **19-08** | 4? | 1.248 | 0.060 | 2 | Organically lean shale with rare lenses of spent kerogen. |
| | | 4 | 1.571 | 0.034 | 2 | |
| | | 2 | 2.020 | | 1 | |
| **6548** | **20-08** | 4? | 1.273 | 0.139 | 26 | Lime/mudstone with some amorphinite, migrabitumen and reworked anisotropic fine grain mosaic pyrobitumen (possibly reworked). |
| | | 4 | 1.592 | 0.104 | 7 | |
| | | 4 | 2.401 | 0.241 | 5 | |
| | | | 4.680 | | | |
| **6927** | **85--09** | 4 | 1.327 | 0.095 | 17 | Laminated silt with mostly small lenses of amorphous kerogen (am) and migrabitumen (B) within fractures and intergranular pores of carbonates matrix. |
| | | 4 | 0.890 | 0.14 | 2 | Possibly suppressed? |
| | | 4 | 1.642 | 0.107 | 14 | |
| | | 2.2 | 2.112 | 0.096 | 4 | 2.45 |
| **6932** | **84-08** | 2 | 1.324 | 0.131 | 15 | Pyrite rich black shale/calc within the network of dark amorphous kerogen (some still showing staining), grey granular bitumen and a high concentration of yellow fluorescing hcfi (all yellow fluorescing globules) within carbonate matrix. |
| | | 2.2 | 0.892 | 0.117 | 7 | Possibly suppressed? |
| | | 2.2 | 1.792 | 0.095 | 5 | |
| **6945** | **87-08** | 2 | 0.620 | 0.066 | 8 | Organic and pyrite rich shale with mainly continuous network of grey amorphous kerogen with some bright yellow fluorescing alginite (*Tasmanites* and cocoidal *Pila-Botryococcus* like alginite) and weak fluorescing fluoramorphinite, (with dull yellow fluorescing alginite and orange fluorescing bitumen) and hebamorphinite with marl matrix. |
| | | 4 | 0.409 | 0.047 | 10 | |
| | | 4 | 0.208 | 0.024 | 3 | |
| **7311** | **05-08** | 2 | 0.987 | 0.111 | 11 | Lime shale with mostly calcareous non-fossils. Some greenish to yellow fluorescing alginite (Prasinophyites), possibly reworked |
| | | 2.2 | 0.567 | 0.098 | 3 | |
| | | 2.2 | 1.726 | 0.290 | 5 | |
| | | 2.2 | 2.440 | 2.790 | 2 | |
| **8006** | **86-08** | 2 | 0.955 | 0.05 | 15 | Calc/shale source rock with continuous network of dark amorphous kerogen,, grey granular bitumen (some associated with high micrinite inclusion) and migrabitumen between intergranular pores and microfractures. Some dull yellow to orange fluorescing alginite, yellow fluorescing hcfi within quartz matrix (Prasinophyte alginite (P)). |
| | | 4 | 0.727 | 0.061 | 36 | |
| | | 4 | 0.482 | 0.034 | | |

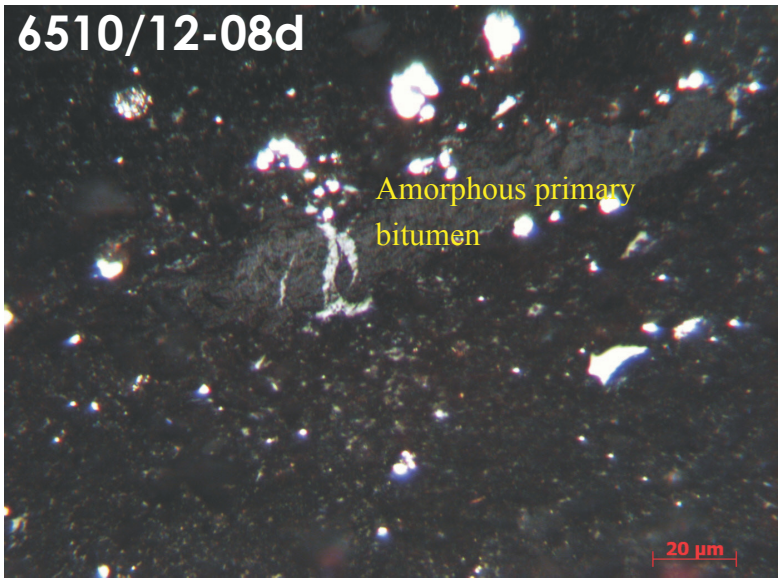
| Sample No. | Photo No. | Organic Type | Vitrinite Reflectance ($\%_R$) | Standard Deviation | n | Comments |
|---|---|---|---|---|---|---|
| **8010** | **88-08** | 2 | 0.557 | 0.110 | 19 | Organic and pyrite rich shale with mainly spent amorphous kerogen, bright yellow fluorescing *Tasmanites* and *Leiosphaeridia* alginite, weak fluorescing fluoramorphinite and bitumenite with dull yellow fluorescing alginite (mostly Prasinophyte (P)). Orange fluorescing bitumen also observed. |
| | | 4 | 0.309 | 0.050 | 7 | |
| **8014** | **89-08** | 2? | 1.156 | 0.084 | 5 | Organic and pyrite rich shale/calc consisting mostly of dark amorphous kerogen and rare bitumen, migrabitumen and reworked intertinite. |
| | | 4 | 0.788 | 0.017 | 3 | |
| | | 2.2 | 2.043 | 0.120 | 8 | |
| | | 2.2 | 2.310 | | 1 | |
| **8019** | **61-08** | 2 | 0.642 | 0.060 | 10 | Calcareous mudstone with rare yellow to orange fluorescing Prasinophyte (P) and *Leiosphaeridia* like alginite (L), orange fluorescing bitumenite (bt) with micrinite inclusion. Some weak orange fluorescing sporinite-like liptinite. Fluorescence and Reflected white light. |
| | | 2.2 | 0.469 | 0.039 | 18 | |
| | | 2.2 | 0.960 | | 1 | |
| | | 2.2 | 1.212 | 0.025 | 2 | |
| **8019** | **62-08** | 2 | 0.445 | 0.070 | 4 | Organically lean calcareous shale with some weak yellow fluorescing alginite, mainly Prasinophyte (P) and thick walled Tasmanites (T). Bitumen (B) with micrinite inclusion. Rare reworked vitrinite inertinite maceral not measured. Fluorescence and reflected white light. |
| | | | | | | |
| **8038** | **68-08** | 2 | 0.560 | 0.065 | 14 | Pyrite and amorphous kerogen rich black shale with yellow fluorescing liptinite (mainly *Leiosphaeridia (L)* , thick walled *Tasmanites*- like (T) and Prasinophyte (P)) and weak orange brown fluorescing bitumen (B). Rare weak orange fluorescing sporinite like liptinite were also observed, including chitinous fossil (ch). Calcite filled pore canal of siliceous microfossils (S) derived from radiolaria. Some yellow fluorescing oil are released from microfracture under UV light causing staining. |
| | | 4 | 0.320 | 0.020 | 2 | |
| | | 2.2 | 0.951 | 0.096 | 8 | |
| | | 2.2 | 1.208 | 0.047 | 2 | 0.151 |
| **8680** | **54-08** | 2 | 0.467 | 0.054 | 17 | Liptinite and pyrite (framboidal) rich shale with mostly yellow fluorescing *Leiosphaeridia* and some rare thick walled unicellular *Tasmanites* and Prasinophyte. Most vitrinite are derived from alginite. Also present are amorphous bitumen (phosphatic) with micrinite inclusion. |
| | | 2.2 | 0.659 | 0.040 | 3 | |
| | | 2.2 | 0.857 | 0.062 | 2 | |
| **8682** | **55-08** | 2 | 0.493 | 0.092 | 42 | a) Liptinite rich shale, with mostly yellow fluorescing alginite (thick walled Tasminites (T), Prasinophytes (P) and cocoidal alginite) and yellow to orange fluorescing solid bitumen (B). Fluorescent and reflected white light.<br>b) Weak orange fluorescing bituminite in pyrite-rich marl matrix and acanthomorphic acritarch (species?). Fluorescent and reflected white light. |
| | | 2.2 | 0.910 | 0.042 | 2 | |
| | | 2.2 | 1.273 | 0.160 | 3 | |
| | | 4 | 0.320 | 0.100 | 2 | |
| **8686** | **56-08** | 2 | 0.526 | 0.110 | 11 | Shale with mostly yellow fluorescing alginite (thick walled Tasminites (T), Prasinophytes and Microhystridium sp. acanthomorphic acritarch (ac) and yellow orange fluorescing solid to non-fluorescing bitumen (B). Fluorescent and reflected white light. |
| | | 2.2 | 0.946 | 0.084 | 8 | |
| | | 4 | | | 1 | |
| **8688** | **57-08** | 2 | 0.734 | 0.068 | 5 | Pyrite rich shale with orange weak fluorescing liptinite (*Leiosphaeridia* (L) and Prasinophyte (P) alginite ?). Also contains some reworked inertinite (I) particles. Most of the organic matter are from amorphous kerogen lenses (non fluorescing granular hebamorphinite (H) lenses). |
| | | 2.2 | 1.252 | 0.189 | 3 | |
| | | 2.2 | 0.510 | 0.000 | 2 | |
| **8692** | **58-08** | 2 | 0.761 | 0.101 | 8 | Black shale and calcite with mainly amorphous kerogen (am) and rare weak orange fluorescing bitumen (B). Some hcfi annealed in carbonate matrix. Very small amount of measureable bitumen or vitrinite particle. |
| | | 4 | 0.253 | 0.016 | 2 | |
| | | 4 | 0.420 | | 1 | |
| | | 2.2 | 1.318 | 0.176 | 7 | |
| | | 2.2 | 3.040 | | 1 | |
| **8695** | **59-08** | 2 | 0.805 | 0.069 | 10 | Organically lean calcitic mudstone with silt, with rare thin lenses of amorphous kerogen (alginite derived). Some migrabitumen and rare chitinous particle (fish bone ?) also observed. Calcareous non-fossil (cf) rich matrixes. |
| | | 2.2 | 1.083 | 0.081 | 11 | |
| | | 2.2 | 1.362 | 0.088 | 8 | |
| **8699** | **60-08** | 2 | 0.627 | 0.080 | 11 | Calcitic mudstone containing mainly small lenses of weak dull yellow to orange fluorescing alginite, possibly Prasinophyte (P); and reworked vitrinite and inertinite macerals. Fluorescent and reflected white light. |
| | | 4 | 0.370 | | 1 | |
| | | 2.2 | 0.847 | 0.095 | 5 | |
| | | 2.2 | 1.428 | 0.203 | 8 | |

## Appendix 8. Banff/Exshaw Formations Organic Petrography Photographs

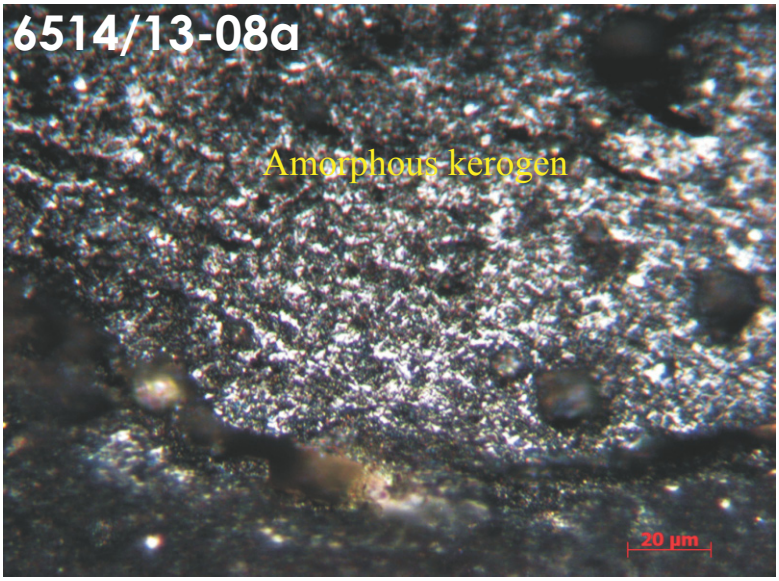


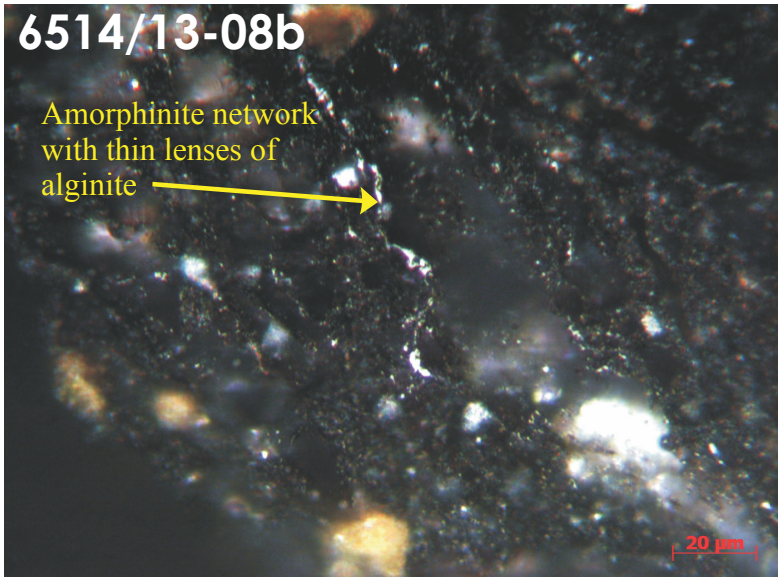



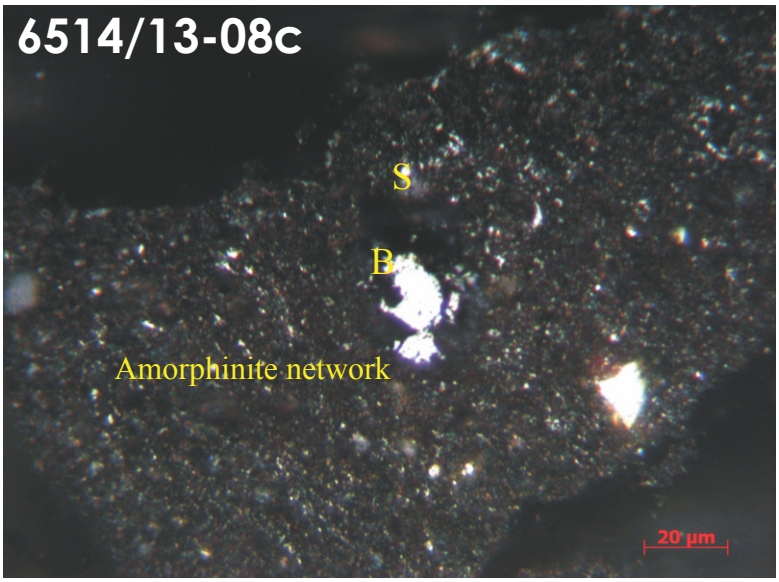



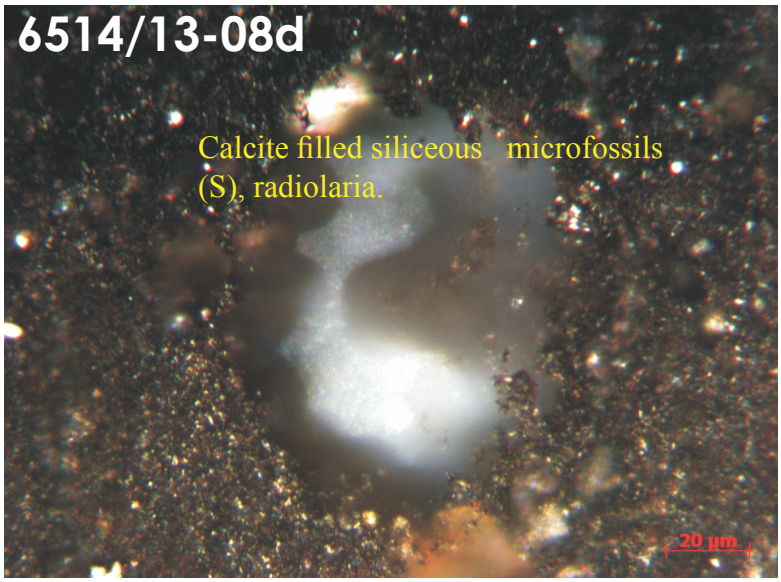



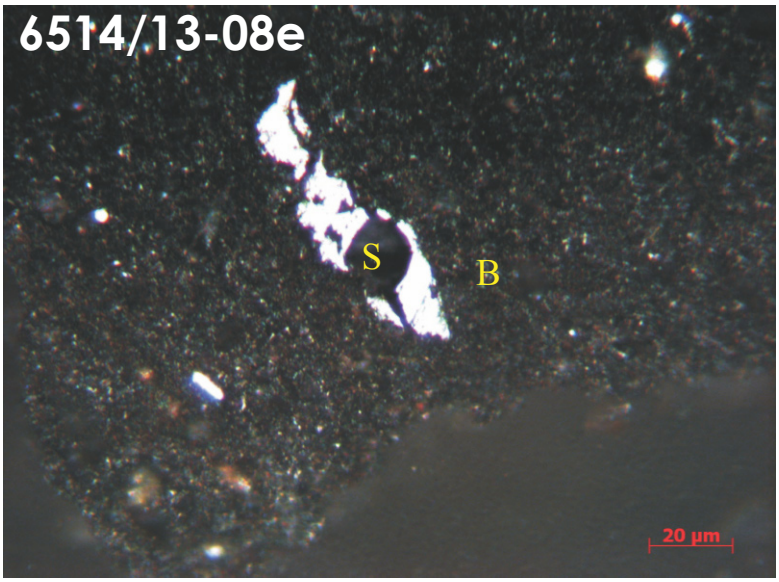

6510/12-08. Black shale with mostly non-fluorescing amorphinite and continuous network of amorphous kerogen, possibly from alginite. Also higher reflecting isotropic migrabitumen (B) within carbonate pores.

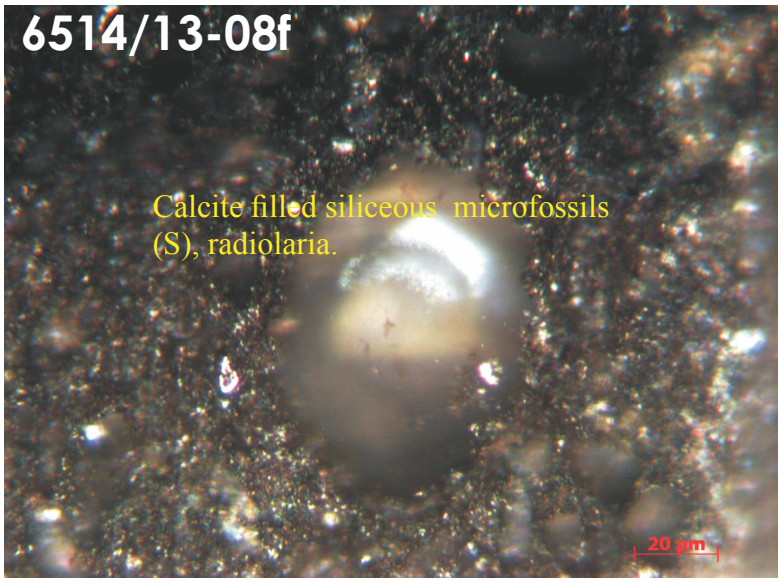

6514/13-08a
Amorphous kerogen
20 µm

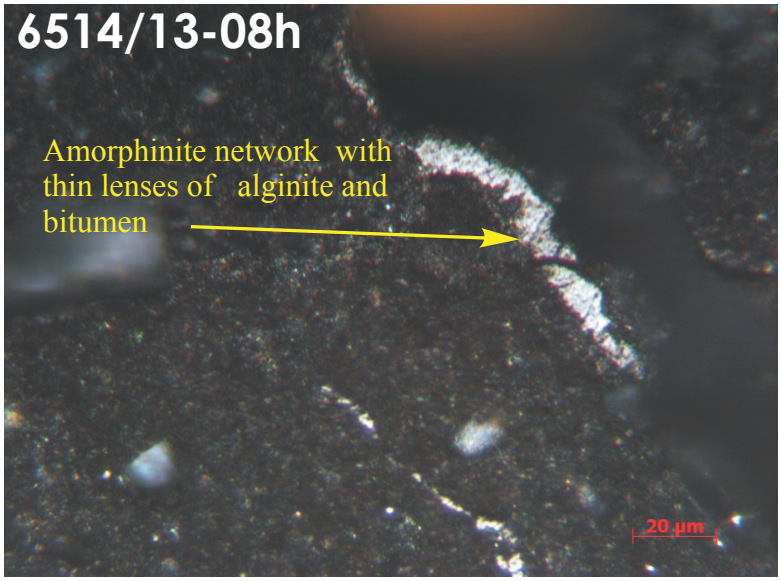

6514/13-08b
Amorphinite network
with thin lenses of
alginite
20 µm


6514/13-08c
S
B
Amorphinite network
20 µm

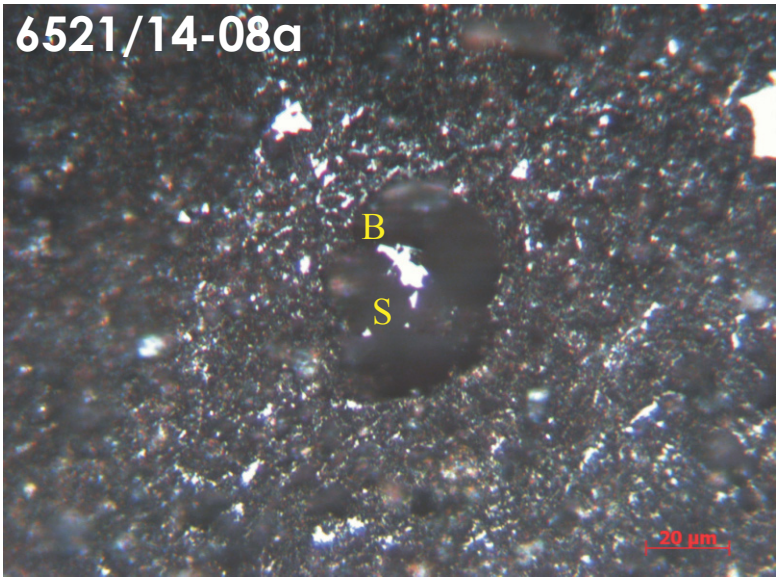

6514/13-08d
Calcite filled siliceous microfossils
(S), radiolaria.
20 µm

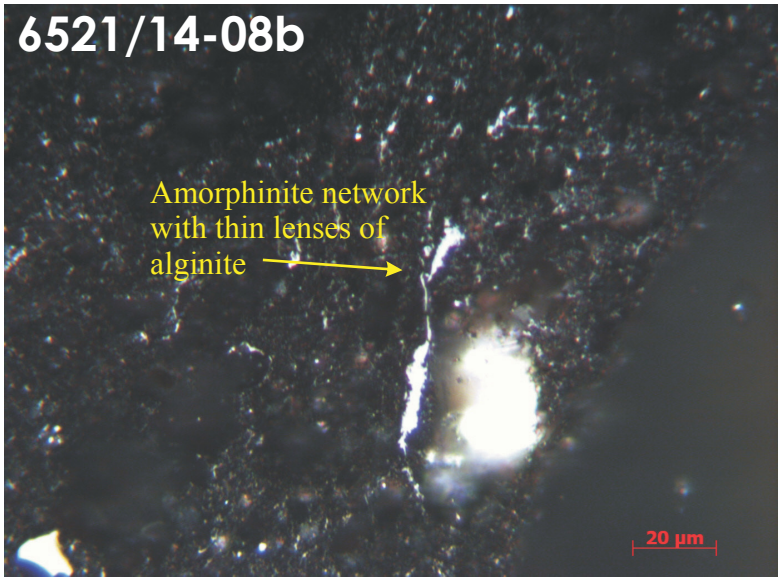

6514/13-08e
S
B
20 µm

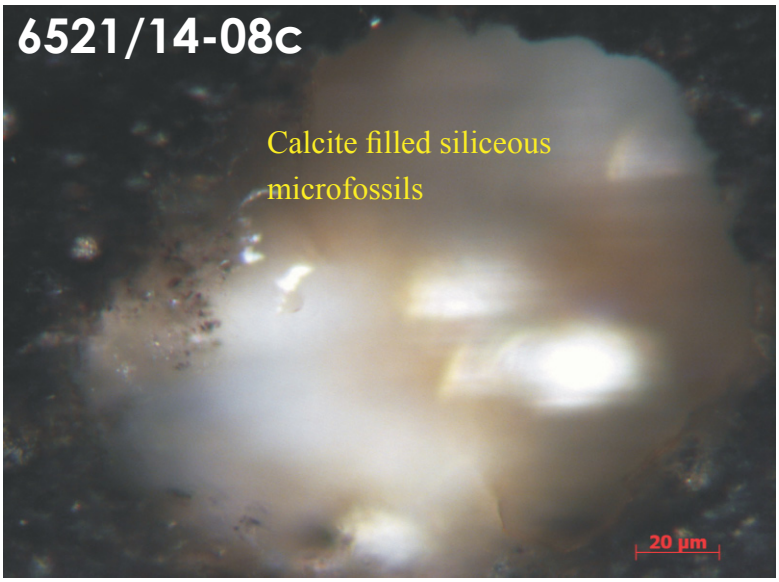

6514/13-08f
Calcite filled siliceous microfossils
(S), radiolaria.
20 µm

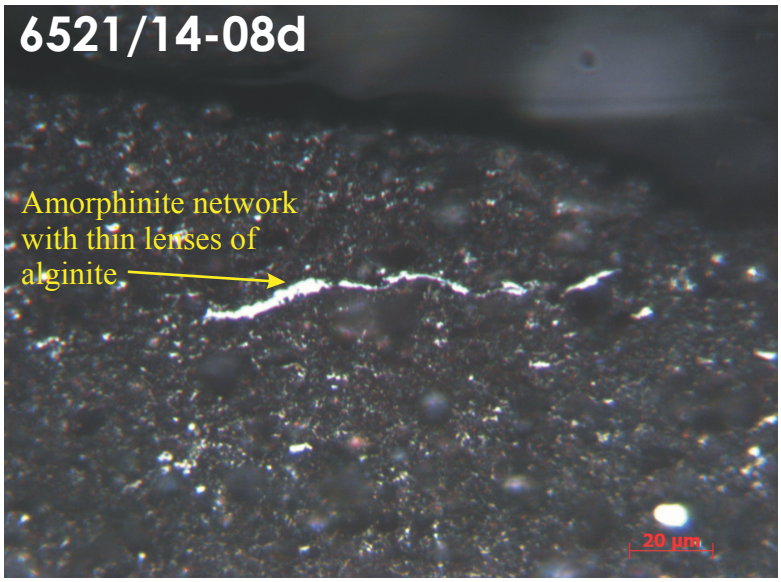



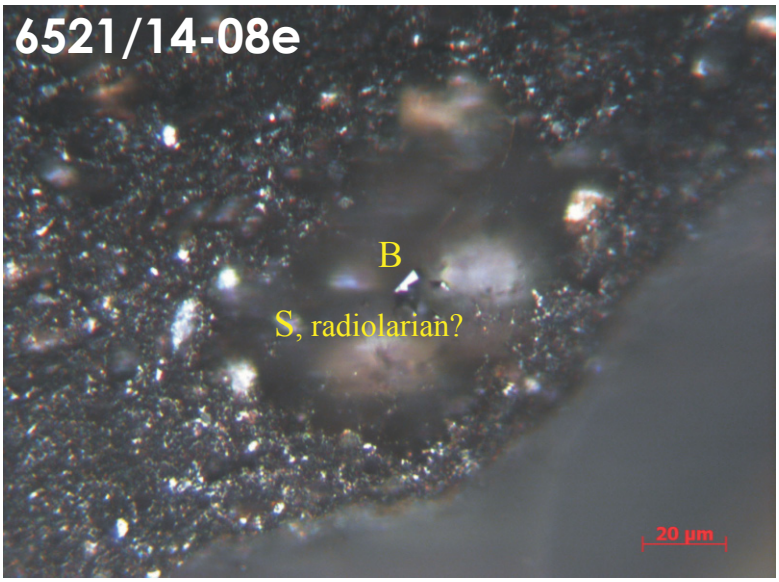

6514/13-08. Black shale with calcite cement and bitumen-filled siliceous microfossils (S) derived from radiolaria. Mostly thin lenses of isotropic vitrinite derived from alginite within the network of amorphinite and amorphous kerogen. Very few can be measured accurately. B=non-fluorescing solid bitumen; S=calcite-filled siliceous microfossil, radoilaria.

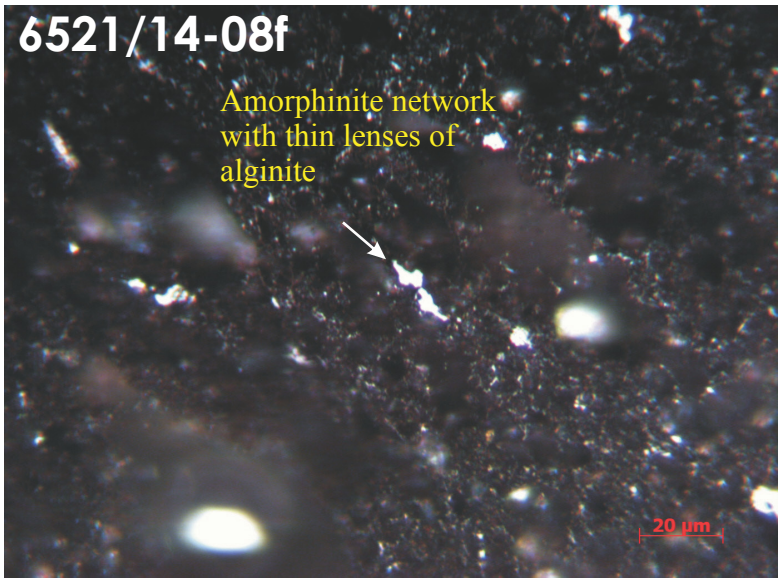


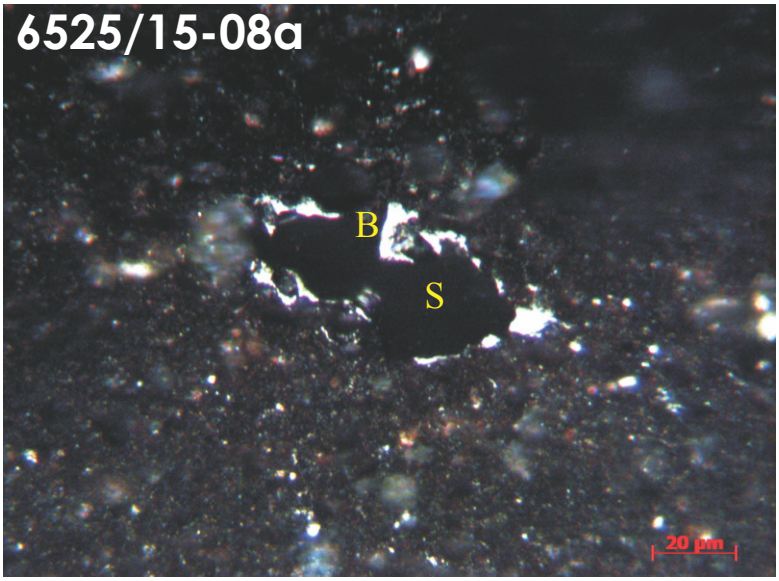



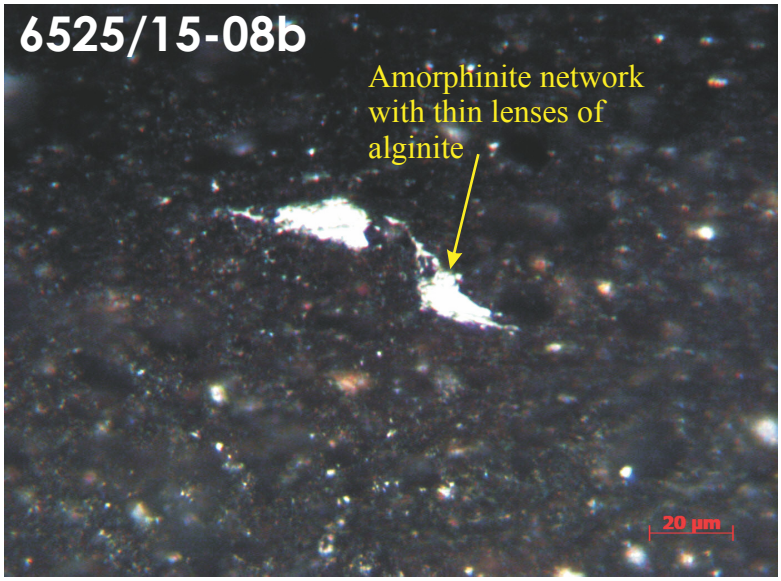



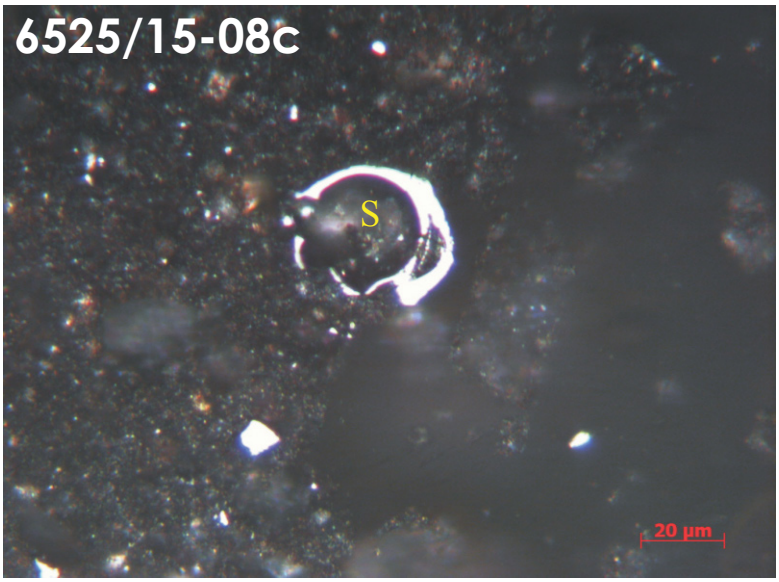



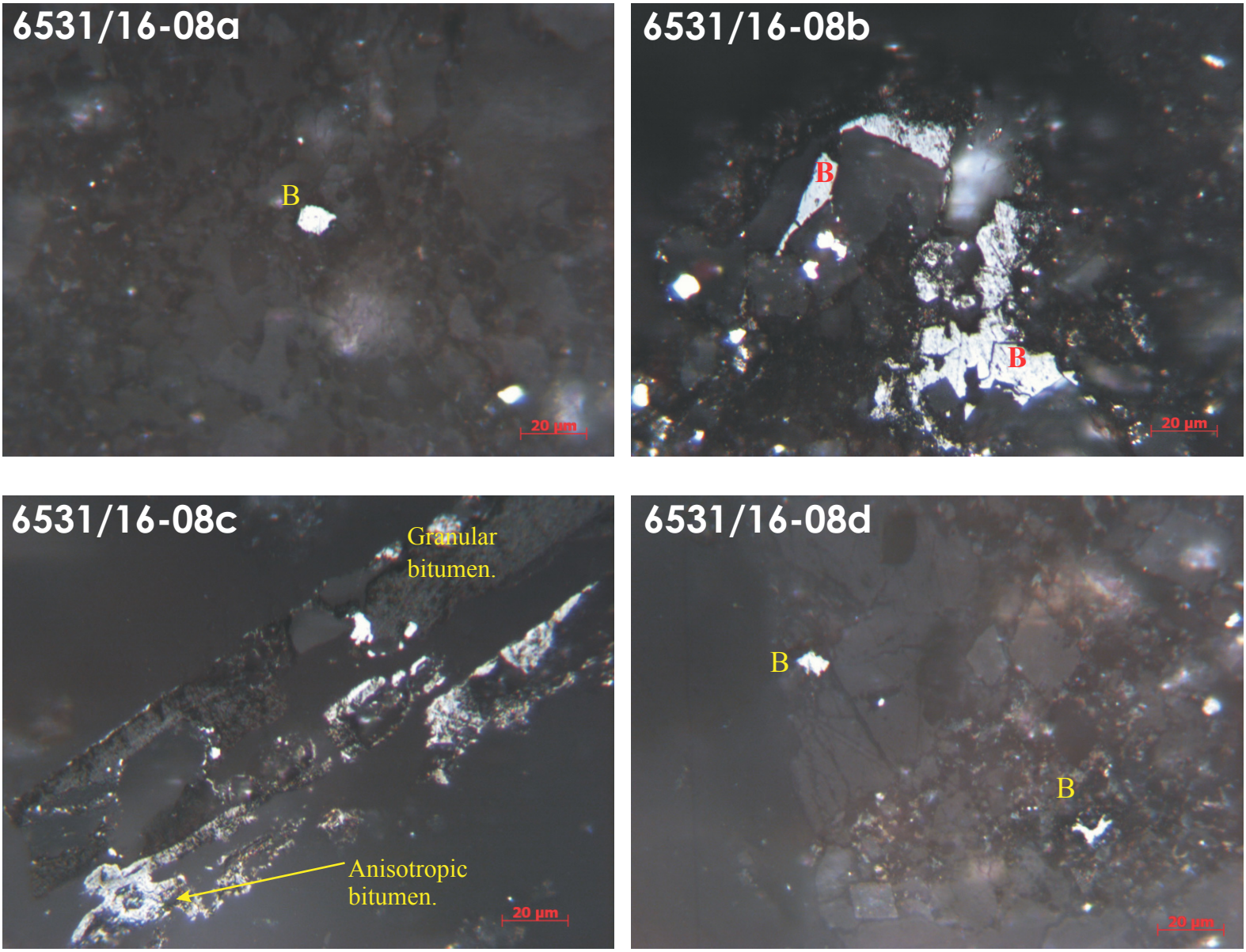

6521/14-08. Black shale with siliceous microfossils derived from radiolaria, some filled with calcite cement and bitumen. Mostly thin lenses of isotropic vitrinite derived from alginite within the network of amorphinite and amorphous kerogen. White light. B=non-fluorescing solid bitumen; S=calcite-filled siliceous microfossil, radiolaria.



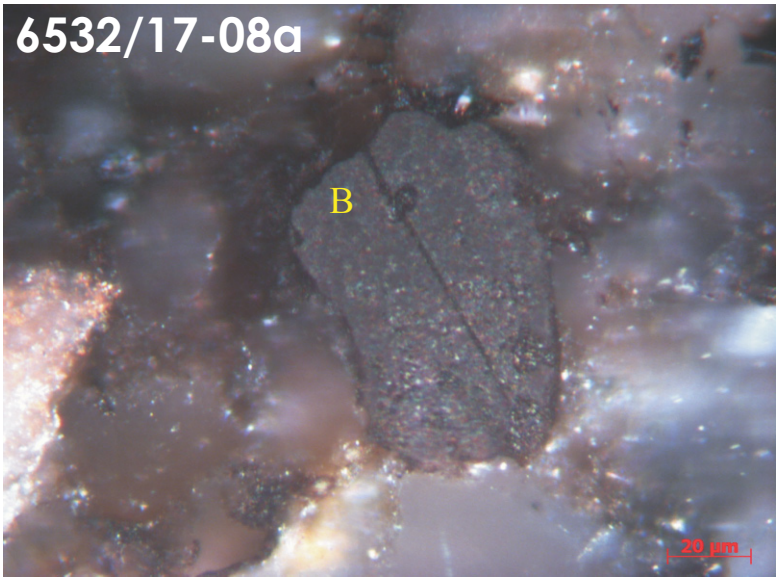



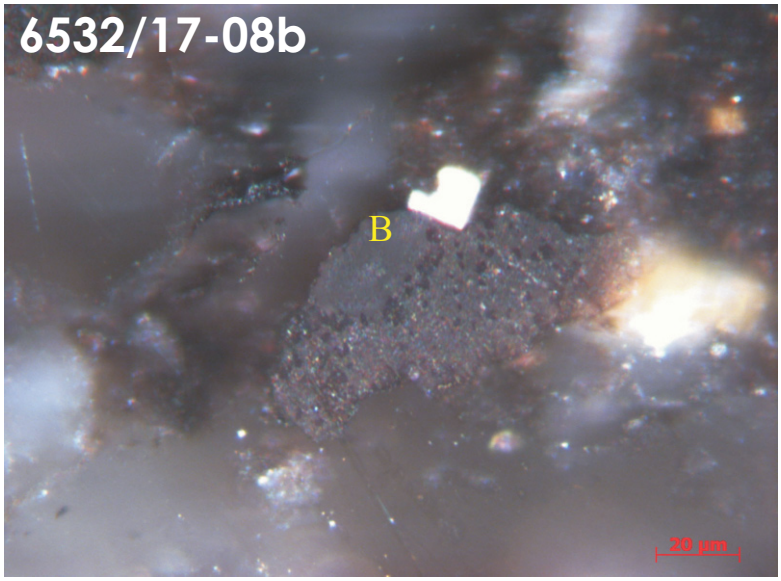



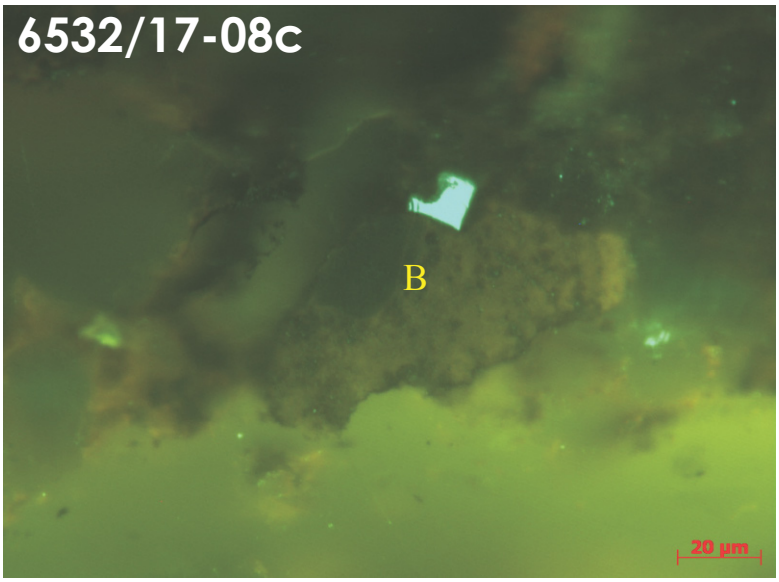

6525/15-08. Shale with mostly non-fluorescing amorphinite kerogen with very few measureable vitrnite/kerogen particles. B=non-fluorescing solid bitumen; S=calcite-filled siliceous microfossil, radiolaria.

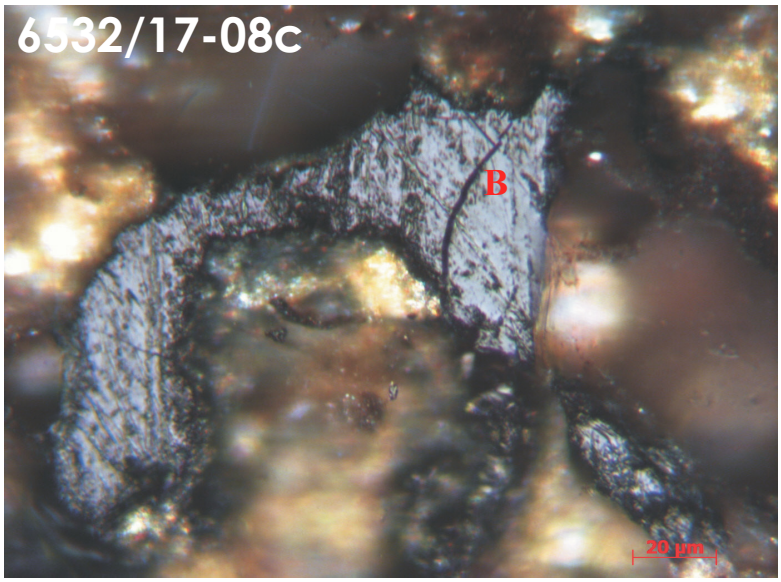


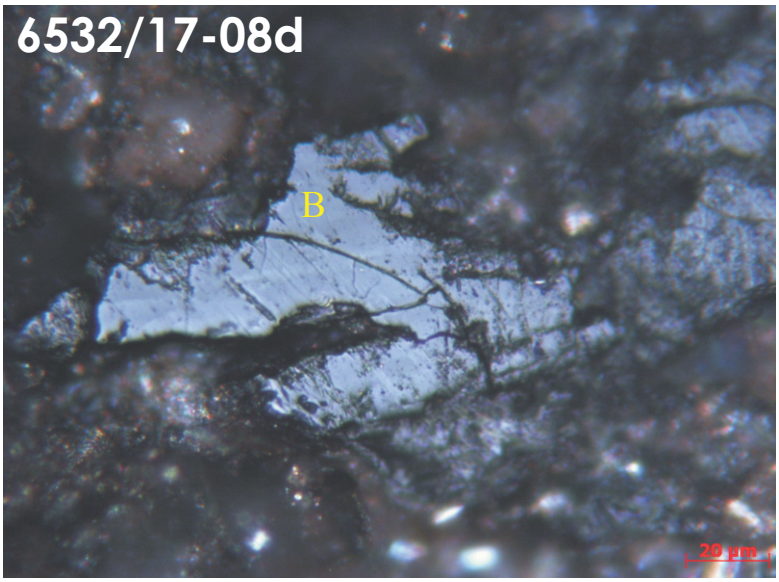

6531/16-08. Organically lean carbonate/limestone with very few measureable vitrnite/kerogen particles. Some amorphous kerogen between pores and fractures. B= non-fluorescing solid bitumen; anisotropic and granular. White Light.

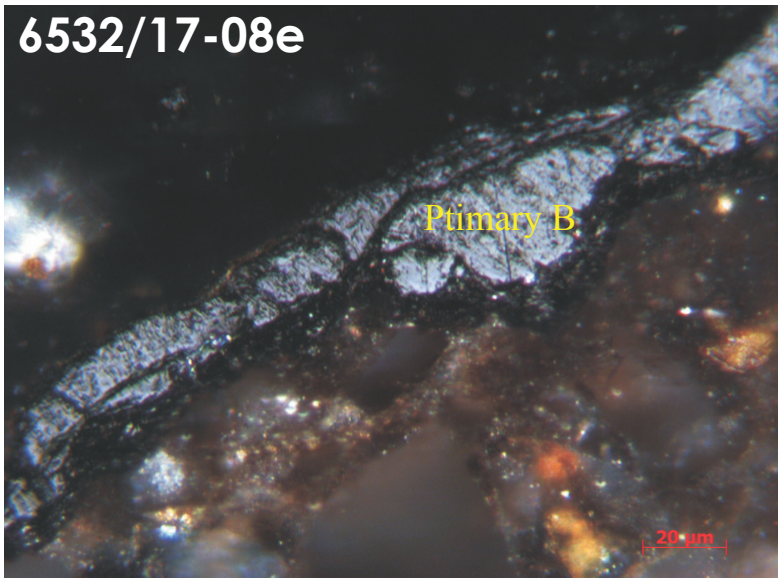


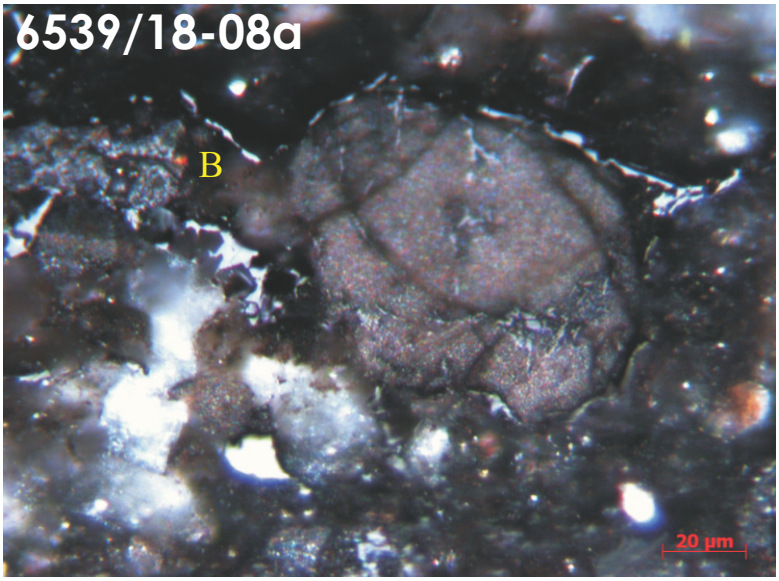



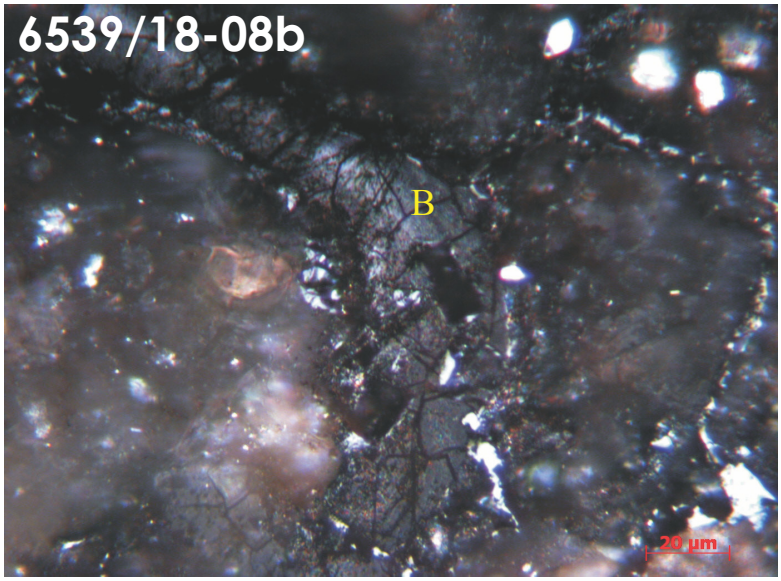



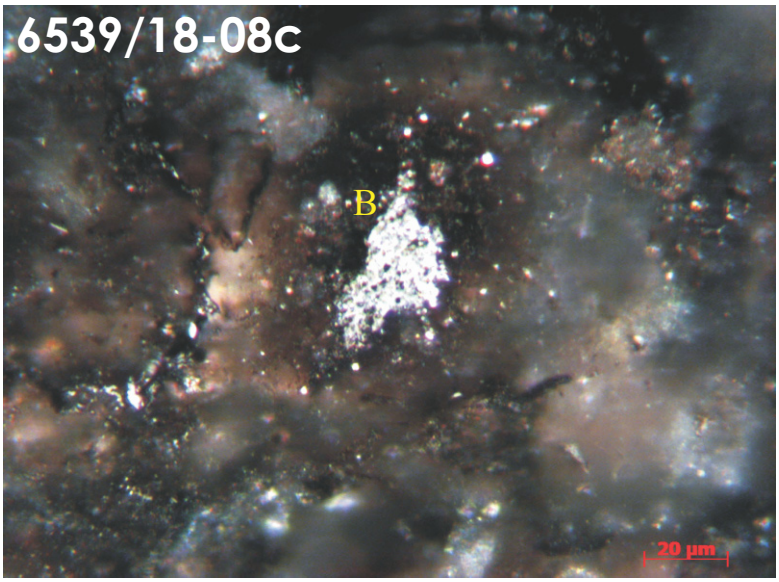



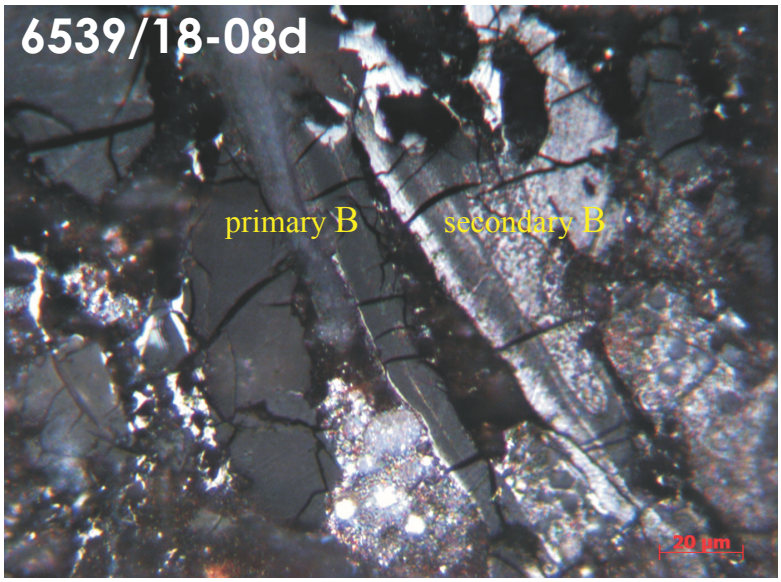



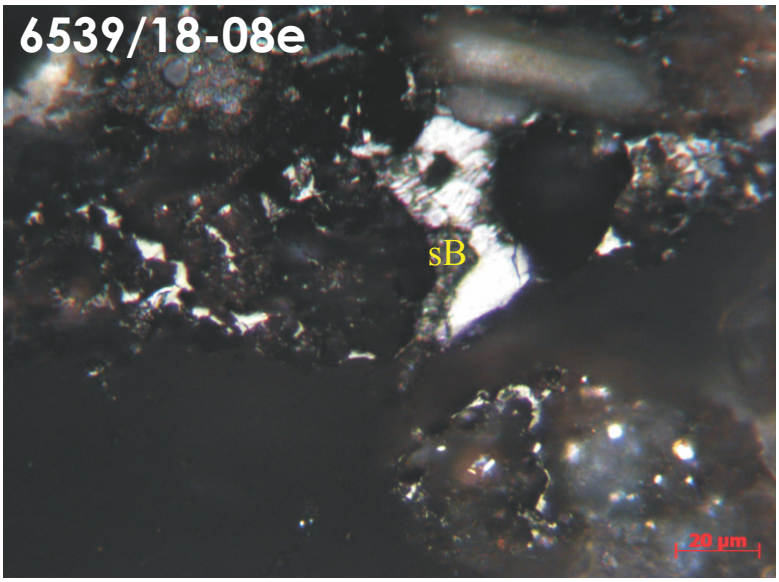

6532/17-08. Organically rich shale with rare weak yellow fluorescing bitumen with micrinite inclusions brecciated within carbonate matrix (6532/17-08a and b). Low and high reflecting primary and secondary bitumen (B). Some high reflecting solid bitumen showing anisotropy. Sample is showing signs of oxidation. Fluorscent and white light.
B = non-fluorescing solid bitumen.

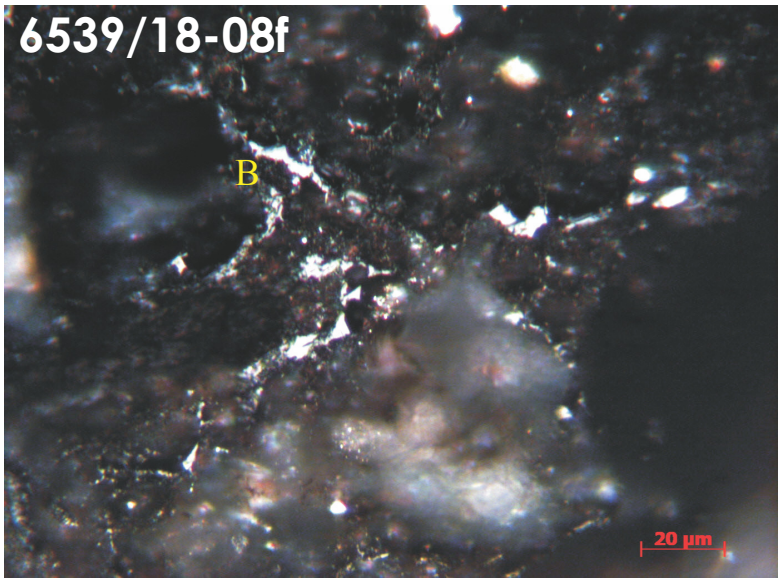


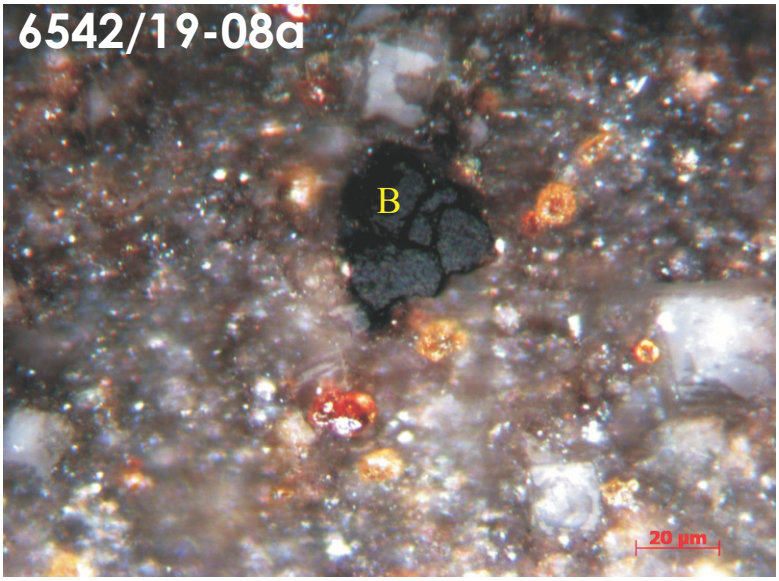



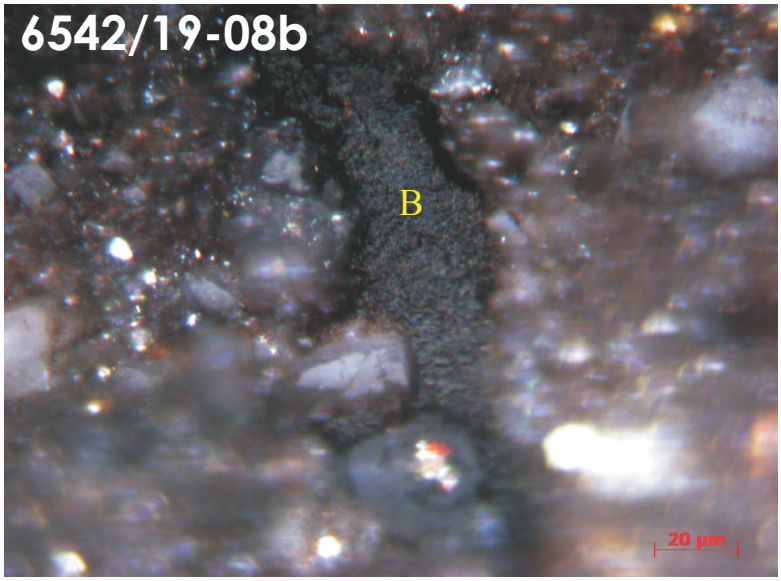



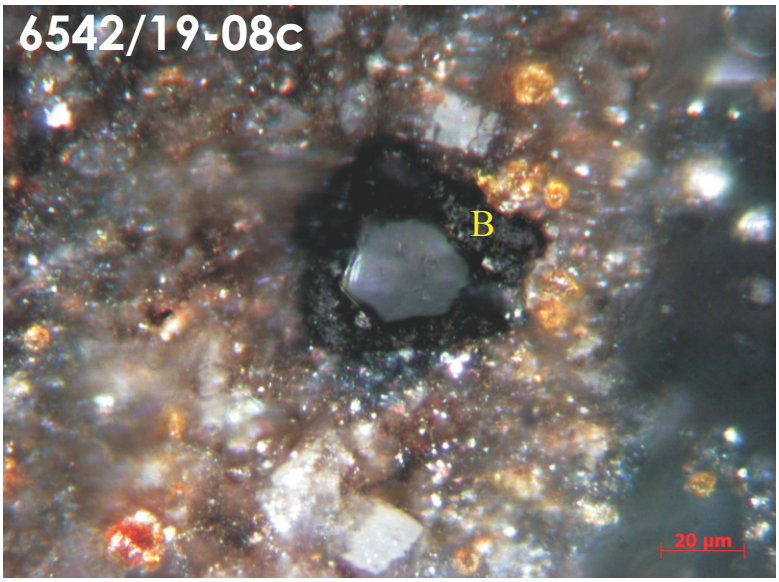



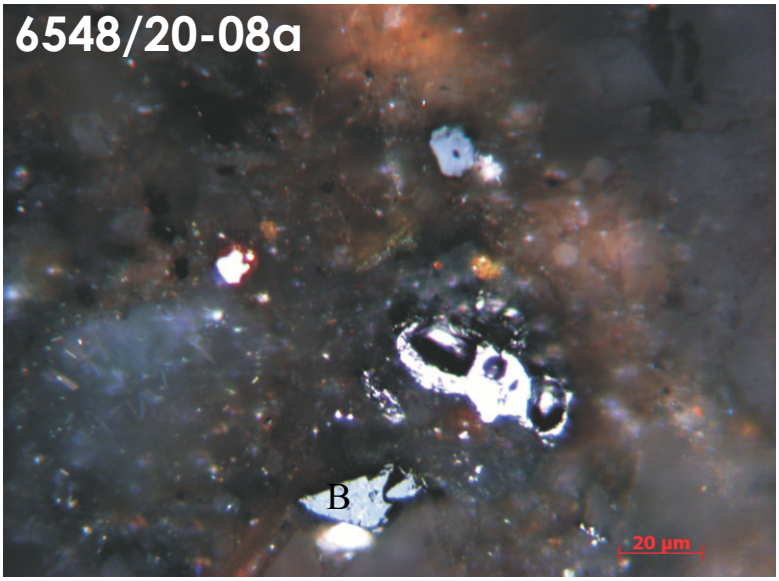

6539/18-08. Organically rich shale with high amount of amorphous low reflecting primary bitumen (B) and isotropic high reflecting secondary migrabitumen (sB) brecciated in between pores. Also rare anisotropic granular bitumen. High iron oxides content found in some shale matrix (possibly due to oxidation). White light. B = non-fluorescing solid bitumen.

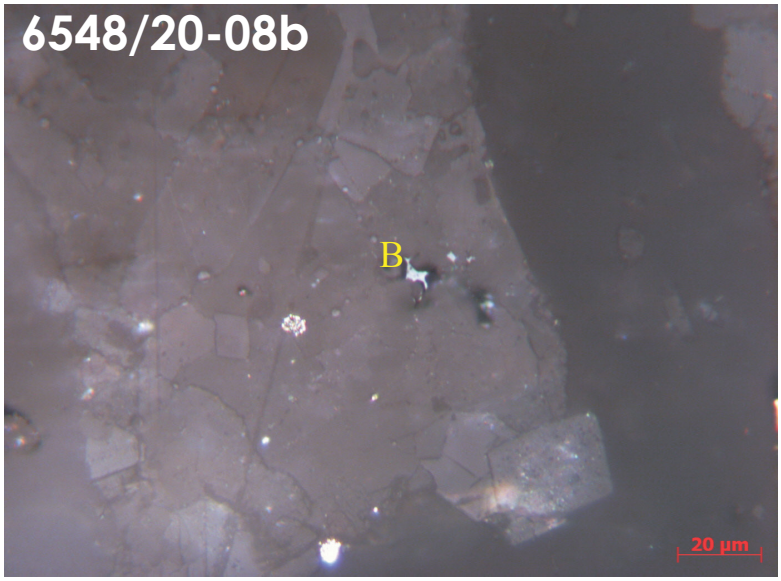


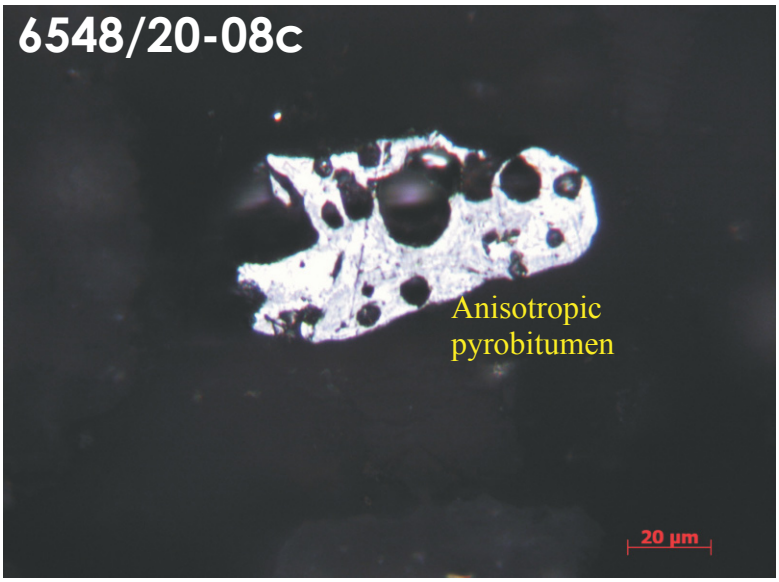



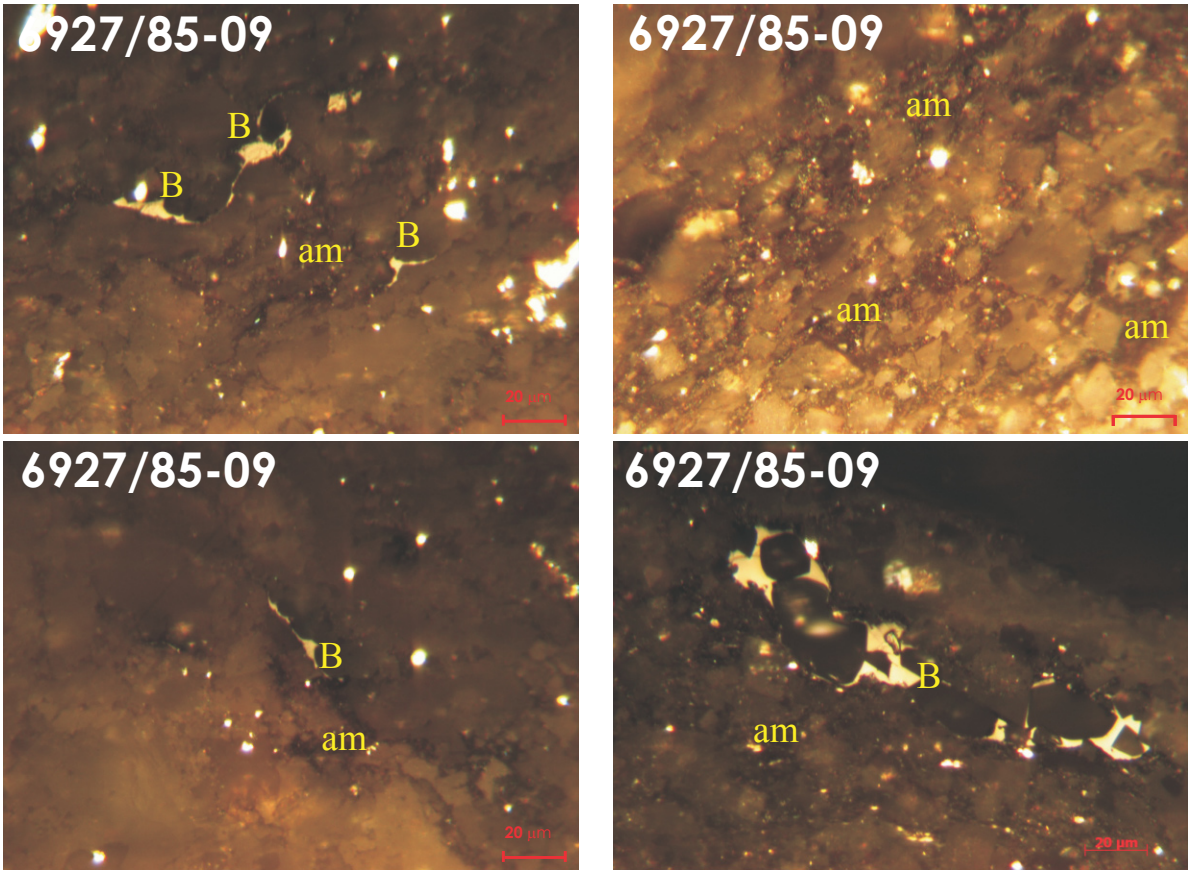

6542/19-08. Organically lean shale with rare lenses of spent and amorphous kerogen. White light. B=non-fluorescing solid bitumen.



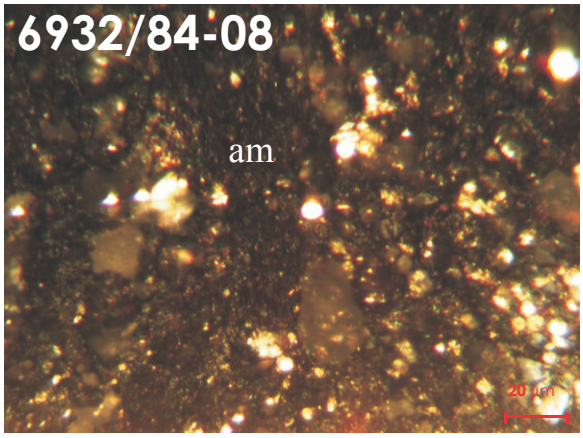



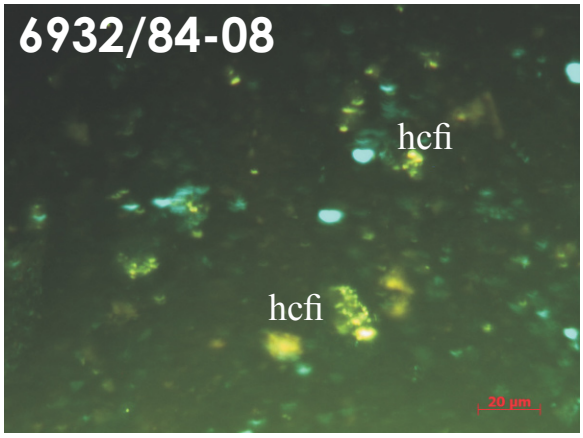



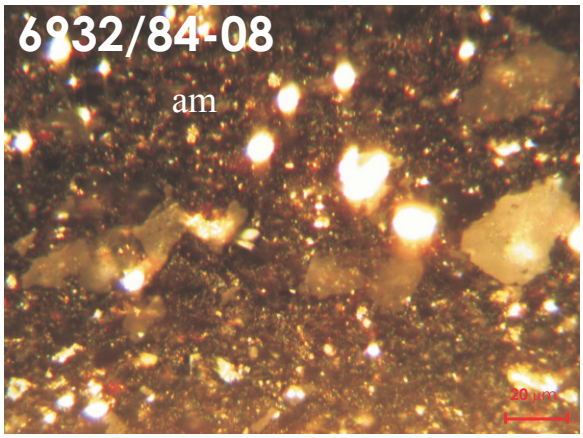

6548/20-08. Lime/mudstone with some occurance of amorphinite, migrabitumen and anistropic fine grain mosaic pyrobitumen (possibly reworked). White light. B = non-fluorescing solid bitumen.

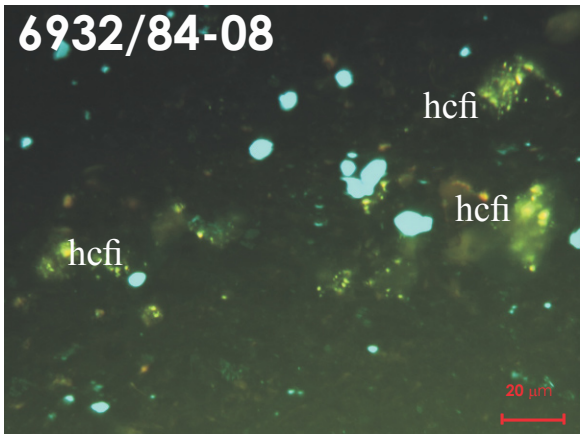


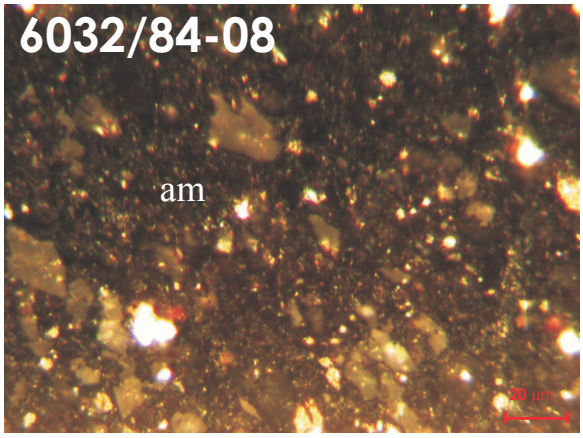

6927/85-08. Laminated silt with mostly small lenses of amorphous kerogen (am) and bitumen and migrabitumen (B) within fractures and intergranular pores of carbonates matrix. Reflected white light.

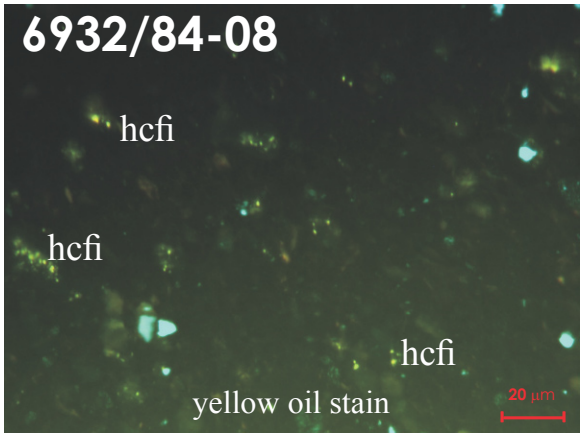

6932/84-08
am
20 µm

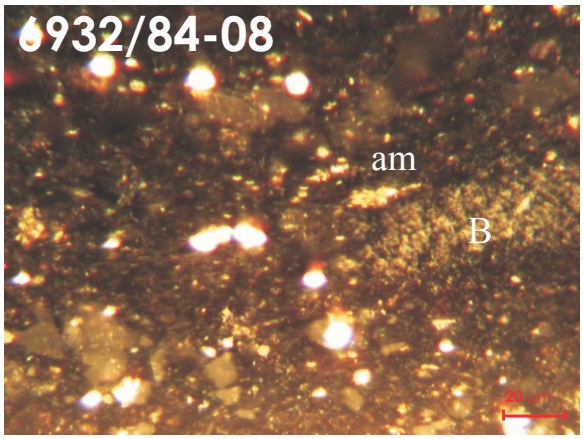

6932/84-08
hcfi
hcfi
20 µm

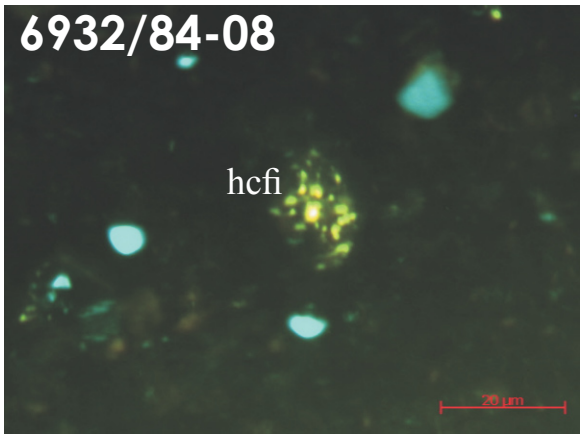

6932/84-08
am
20 µm

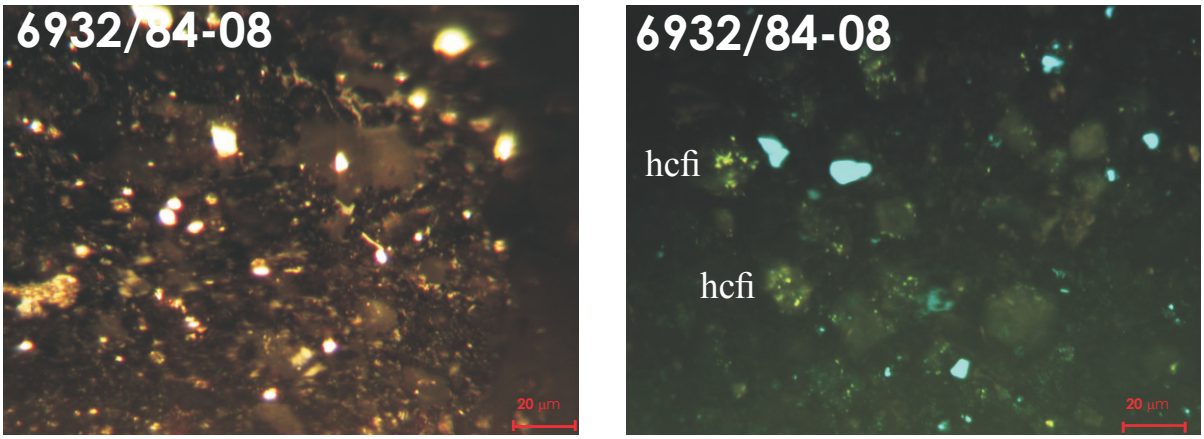

6932/84-08
hcfi
hcfi
hcfi
20 µm


6032/84-08
am
20 µm

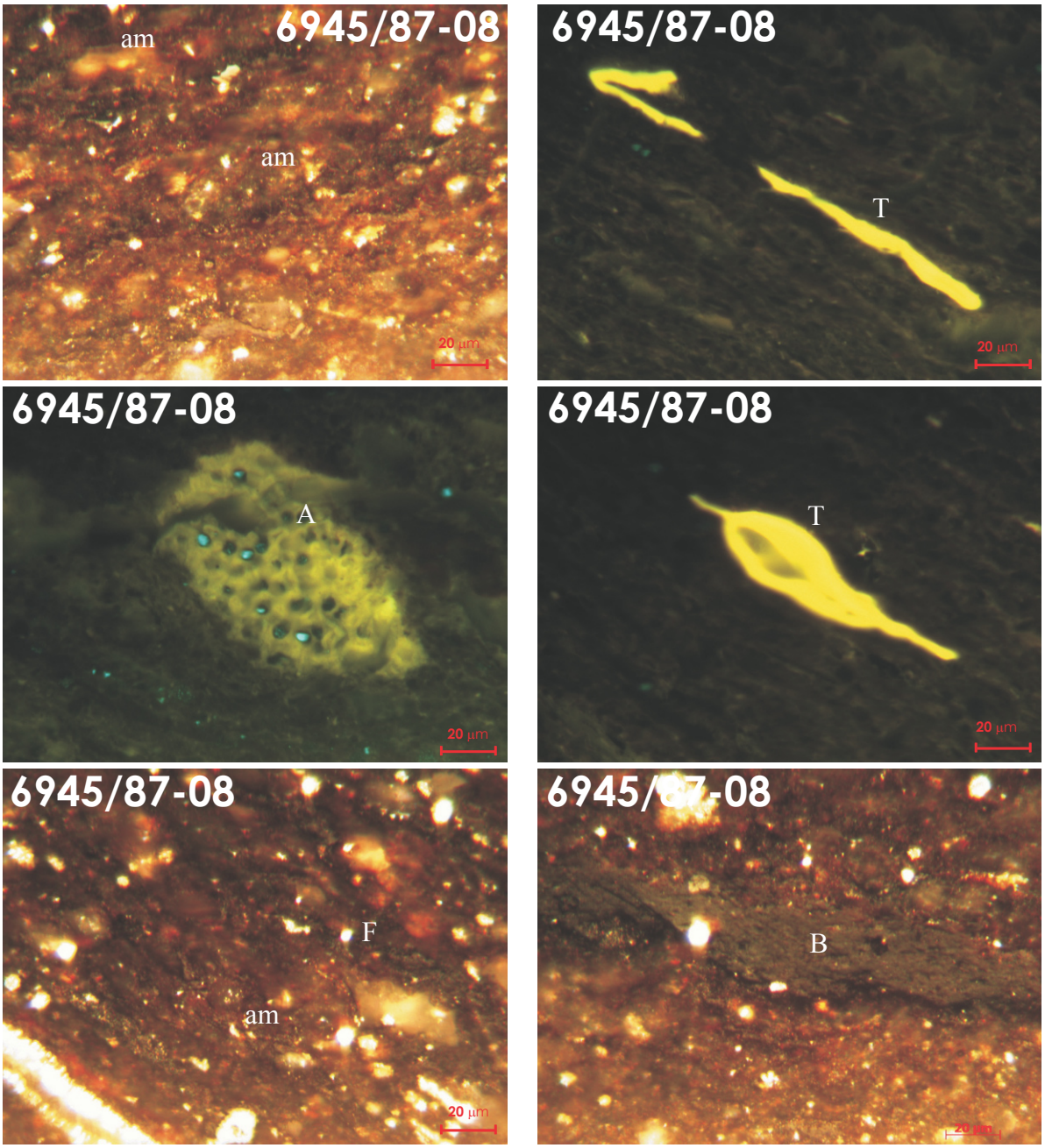

6932/84-08
hcfi
hcfi
hcfi
yellow oil stain
20 µm


6932/84-08
am
B
20 µm

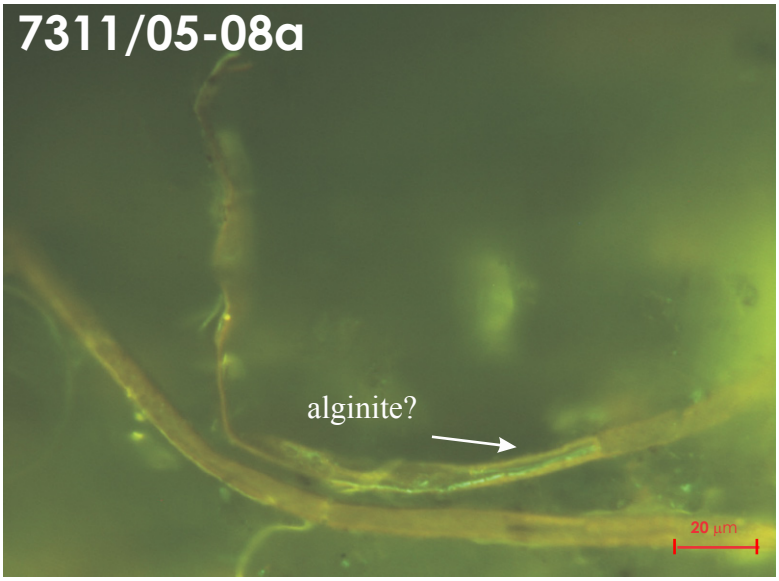

6932/84-08
hcfi
20 µm

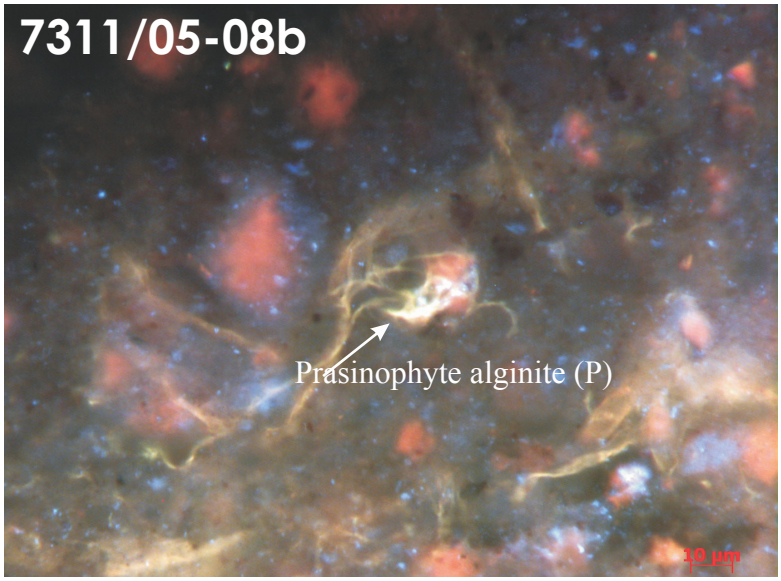


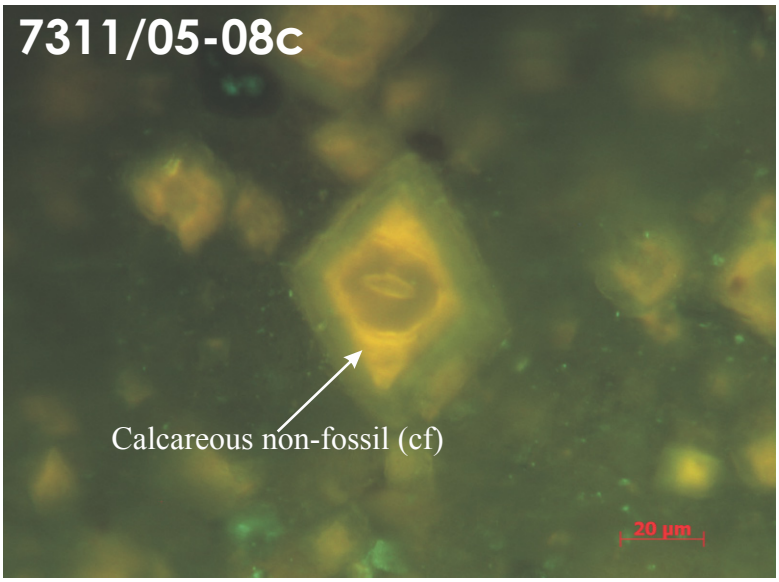

6932/84-08. Pyrite-rich black shale/calcite within a network of dark amorphous kerogen (am) (some still showing staining), grey granular bitumen (B) and a high concentration of yellow fluorescing hydrocarbon fluid inclusion (hcfi) (all yellow fluorescing globules) within carbonate matrix. Fluorescent and reflected white light.

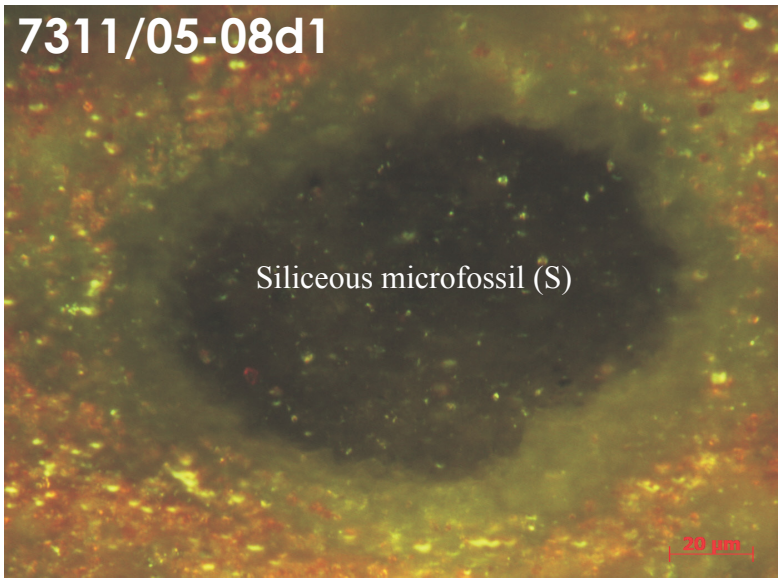


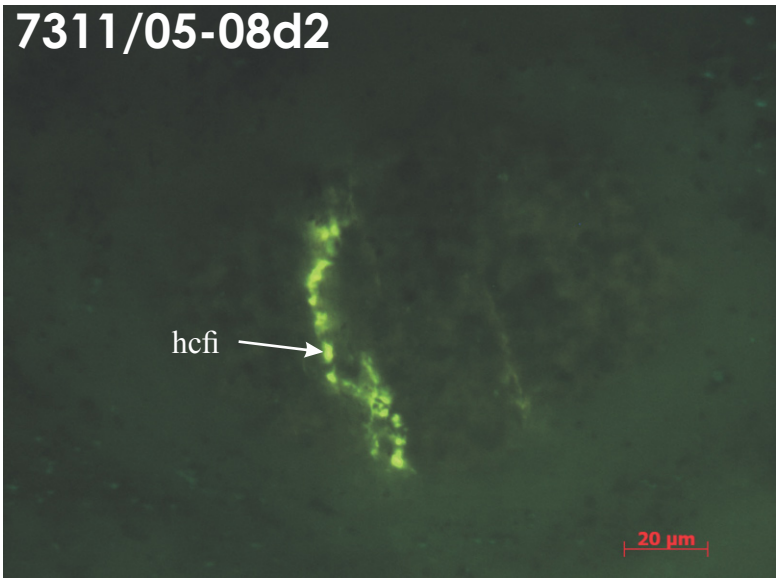

6945/87-08. Organic and pyrite rich shale with mainly continuous network of grey amor-phous kerogen (am) with some bright yellow fluorescing alginite (*Tasmanites* (T), and coccoidal Pila-Botryococcus like alginite (A)) and weak fluorescing fluoramorphinite (F), (with dull yellow fluorescing alginite and orange fluorescing bitumen (B)) and hebamorphinite with marl matrix. Fluorescence and reflected white light.

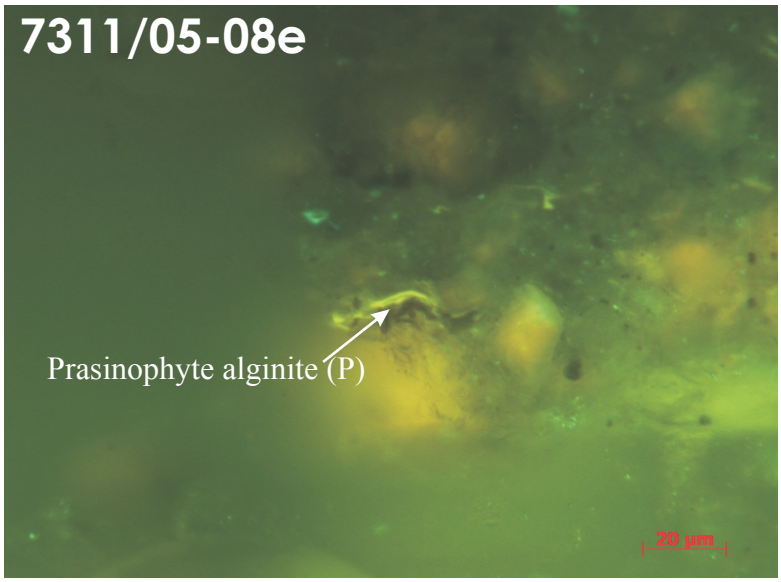


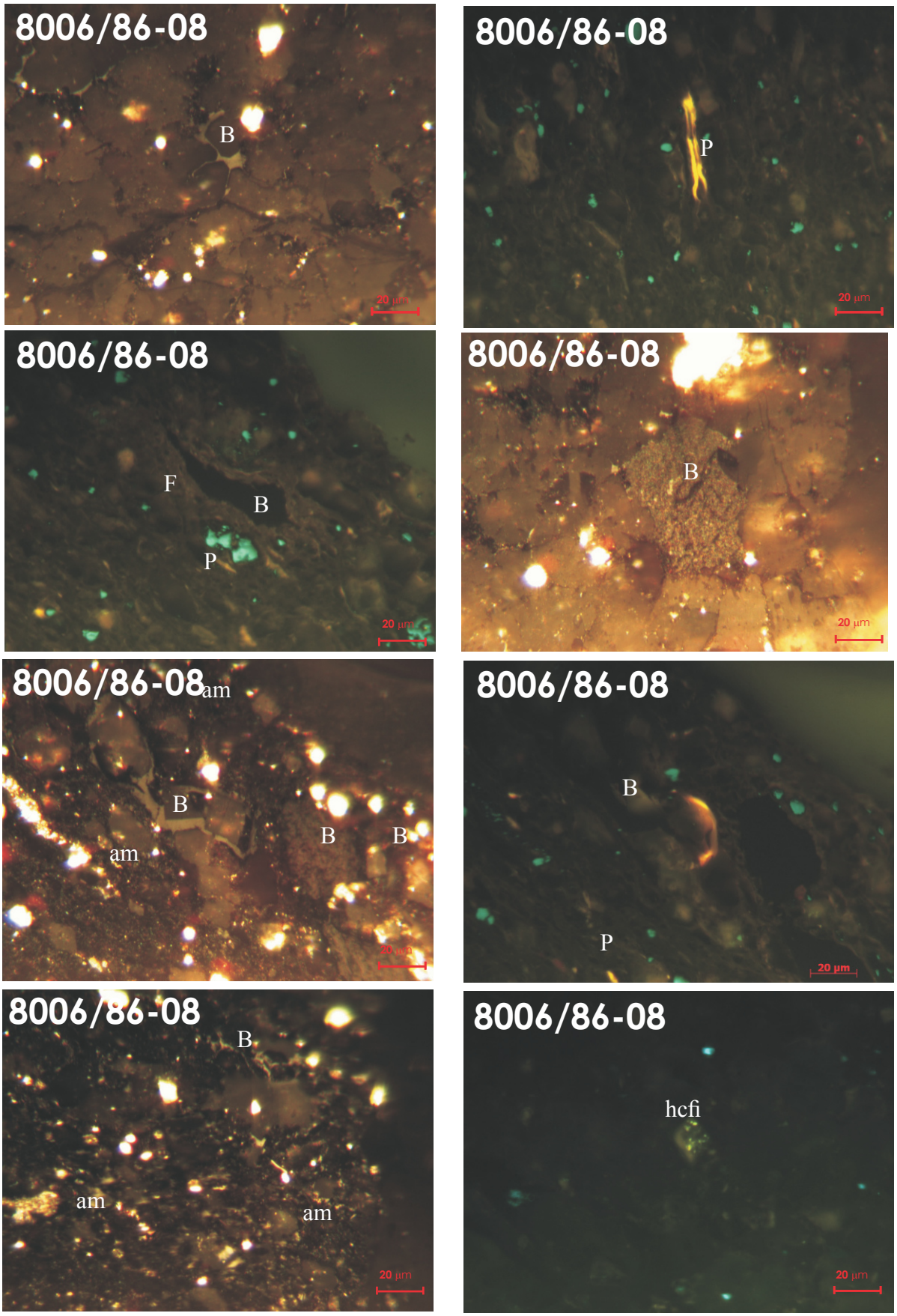



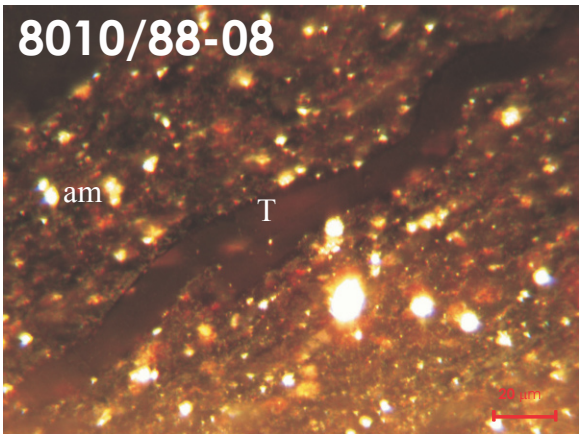



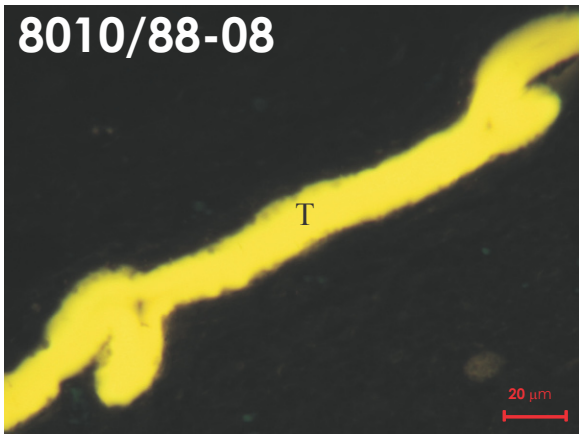



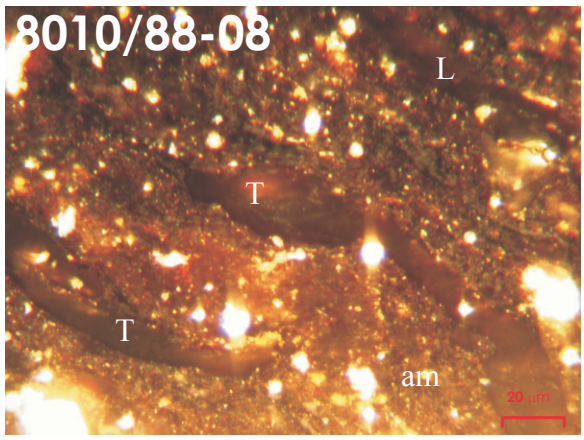

7311/05-08. Mostly calcareous non-fossils (cf) with some greenish to yellow fluorescing Prasinophyites alginite (P), and rare siliceous microfossil ((S) possibly from radiolaria) and hydrocarbon fluid inclusion (hcfi).

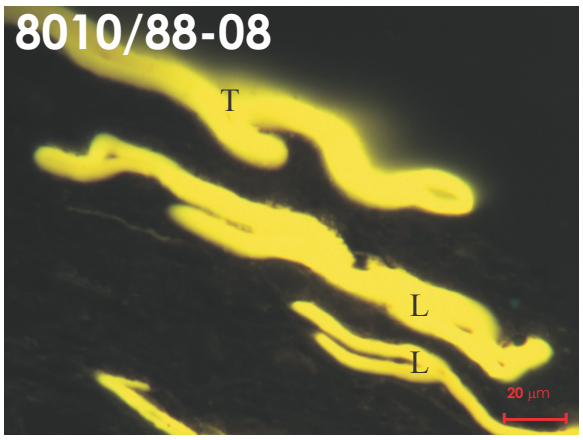


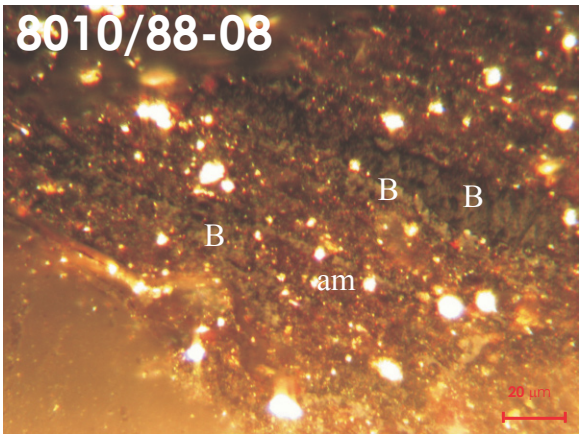

8006/86-09. Calcareous shale source rock with continuous network of dark amophous kerogen (am), grey granular bitumen ((B) some associated with high micrinite inclusion) and migrabitumen (B) between intergranular pores and microfractures. Some dull yellow to orange fluorescing alginite, yellow fluorescing hcfi within quartz matrix (Prasinophyte alginite (P)). Fluorescent and reflected white light.

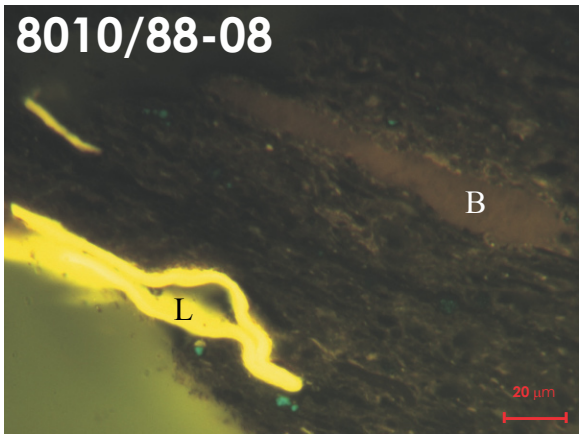

8010/88-08
am
T
20 µm

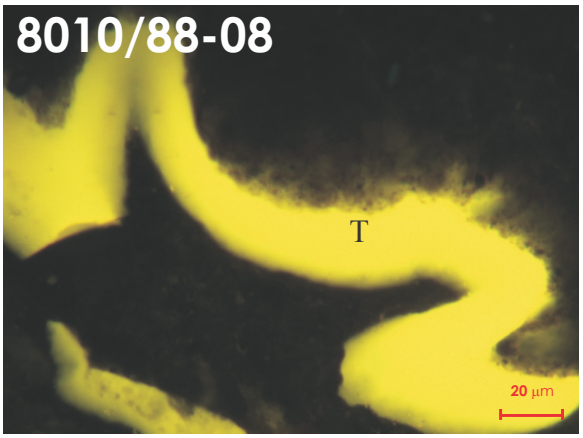

8010/88-08
T
20 µm

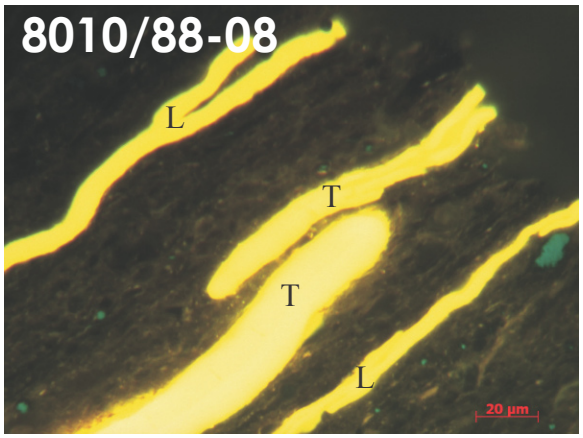

8010/88-08
L
T
T
am
20 µm

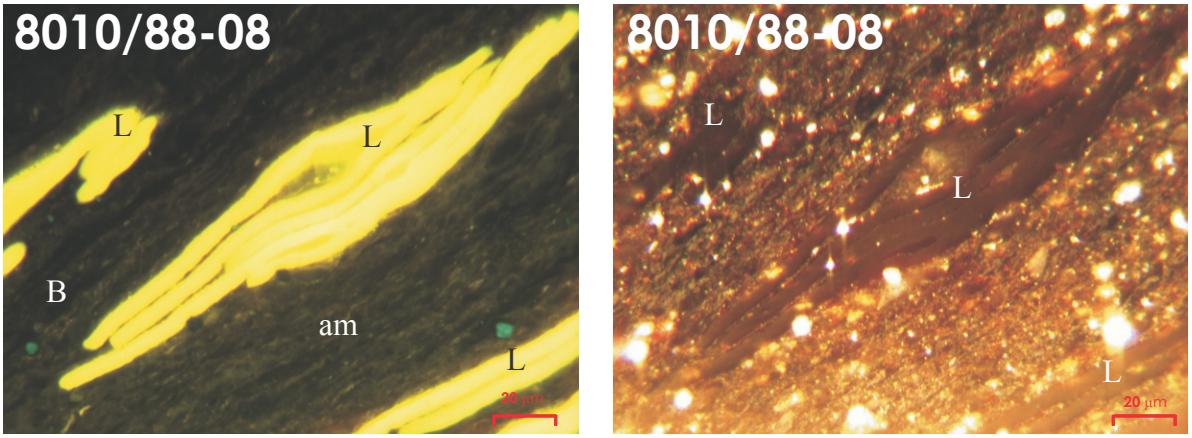

8010/88-08
T
L
L
20 µm


8010/88-08
B
B
B
am
20 µm

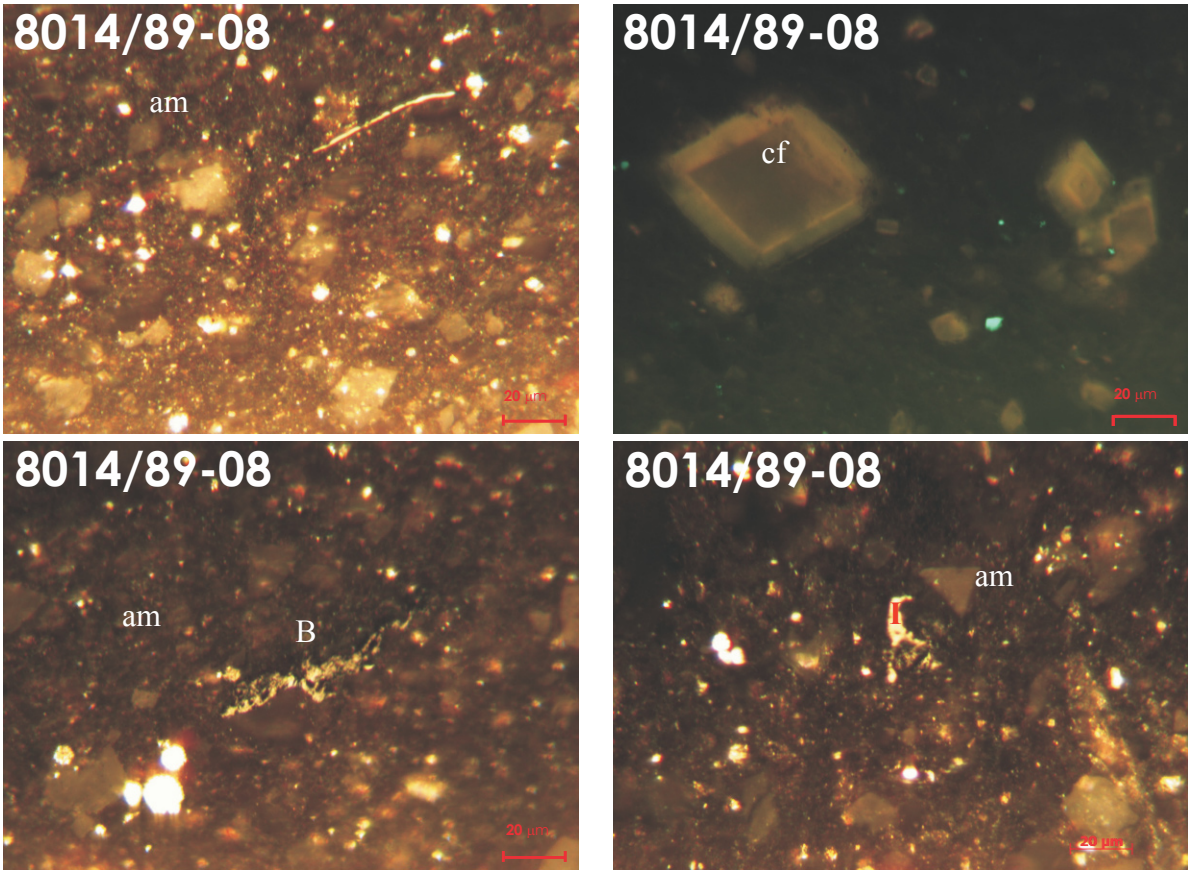

8010/88-08
B
L
20 µm


8010/88-08
T
20 µm

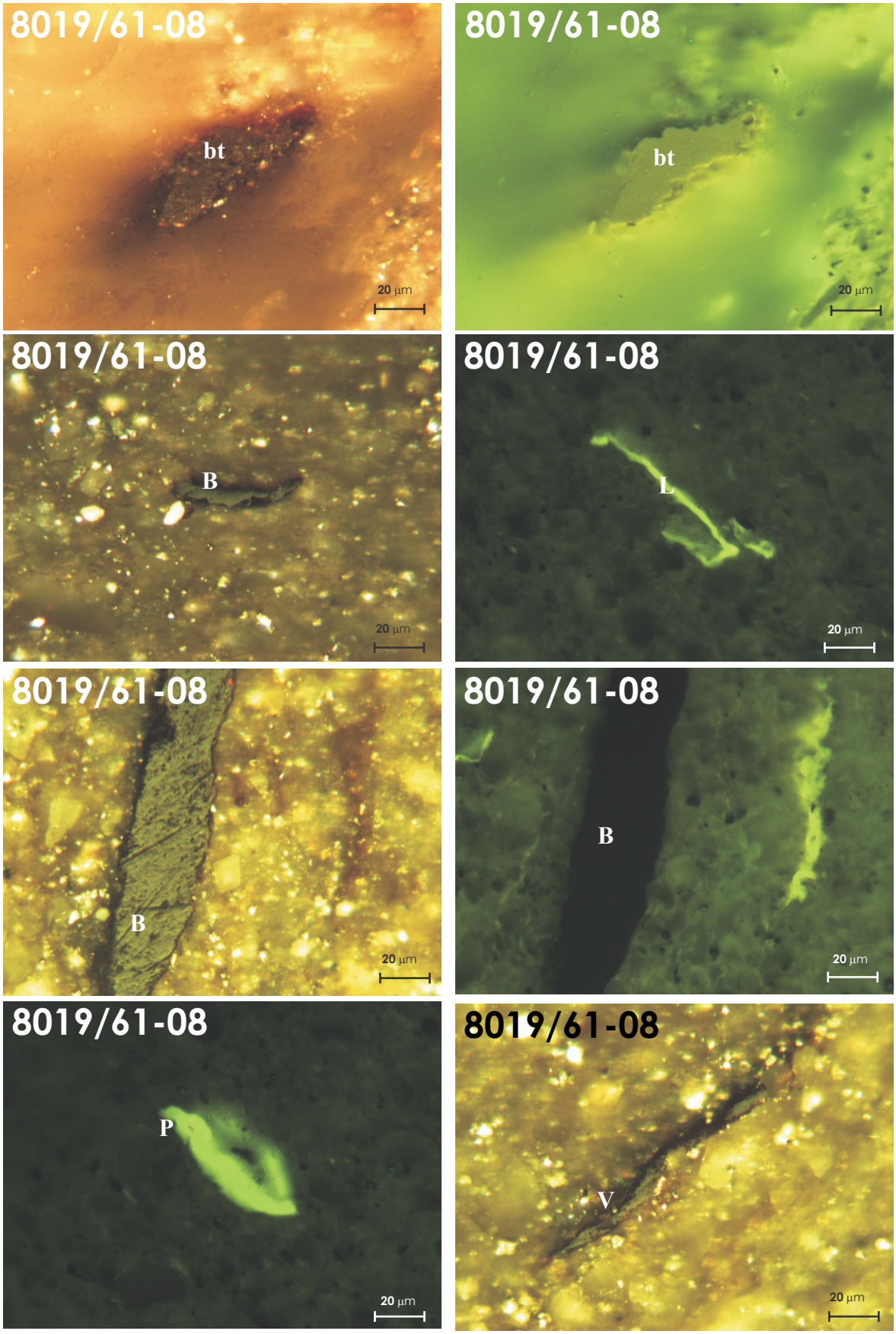

8010/88-08
L
T
T
L
20 µm



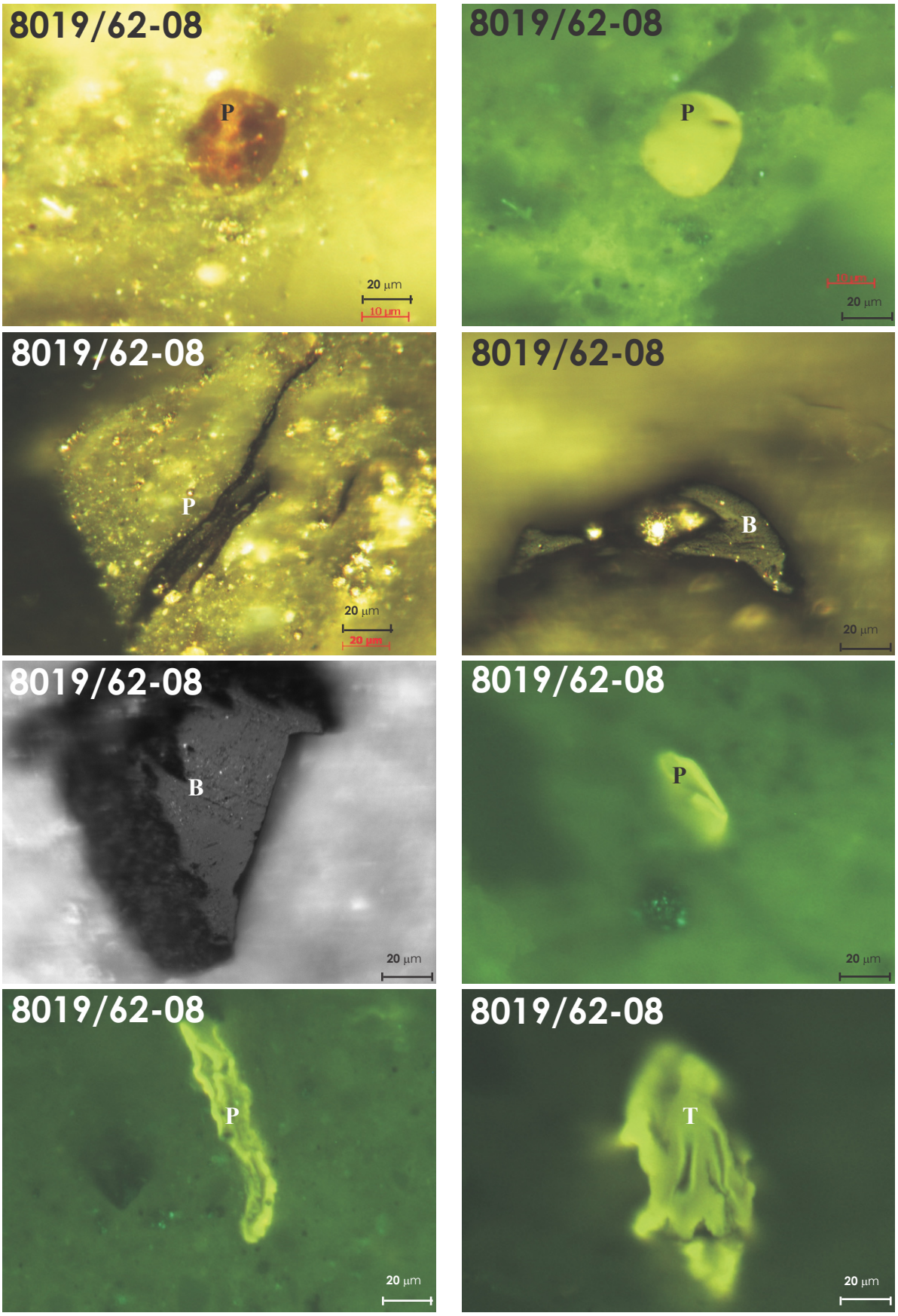

8010/88-08. Organic and pyrite rich shale with mainly spent amorphous kerogen (am), bright yellow fluorescing *Tasmanites* (T) and *Leiosphaeridia* (L) alginite, weak fluorescing fluoramorphinite and bitumen with dull yellow fluorescing alginite (mostly Prasinophyte (P)). Orange fluorescing bitumen (B) inclusion also observed. Fluorescent and reflected white light.



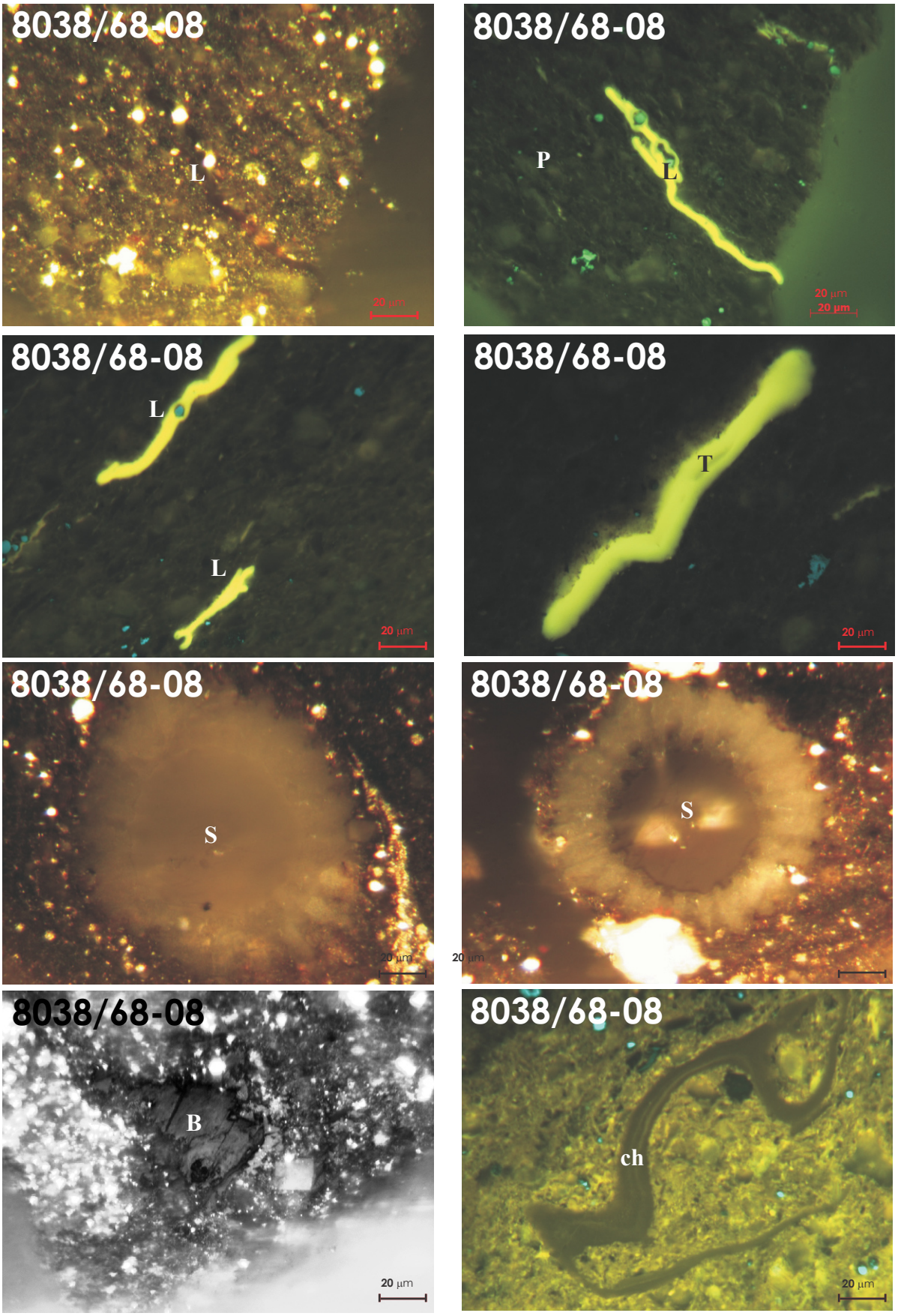

8014/89-08. Organic and pyrite rich shale/calcite consisting mostly of dark amophous kerogen (am), calcareous non-fossil (cf) and rare bitumen, migrabitumen (B) and reworked intertinite (I). Fluorescent and reflected white light.



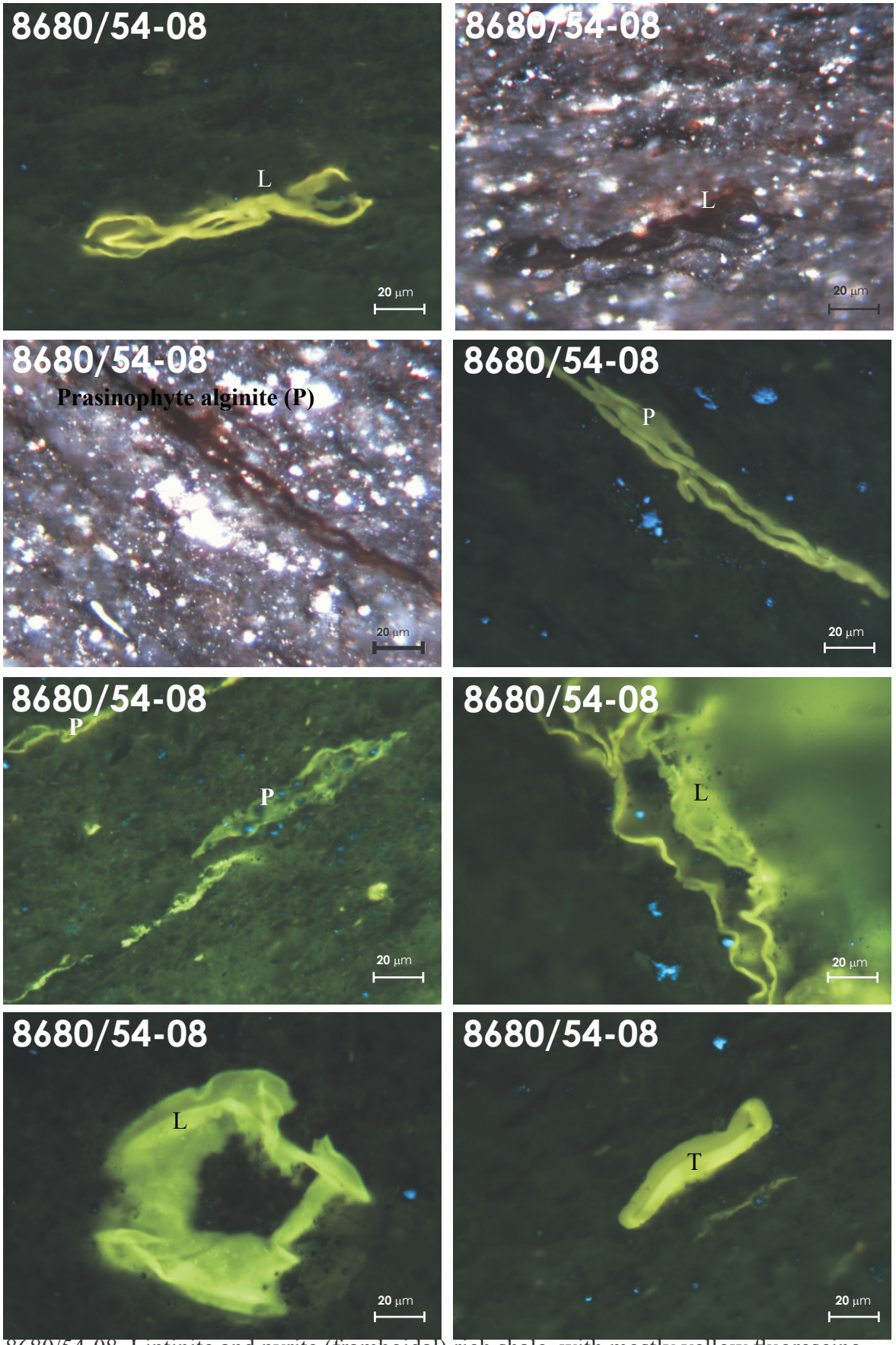

8019/61-08 Calcareous mudstone with rare yellow to orange fluorescing Prasinophyte (P) and Leiosphaeridia-like alginite (L), orange flourescing bituminite (bt) with micrinite inclusion. Some weak orange fluorescing sporinite-like liptinite. Fluorescent and reflected white light. V = Vitrinite.



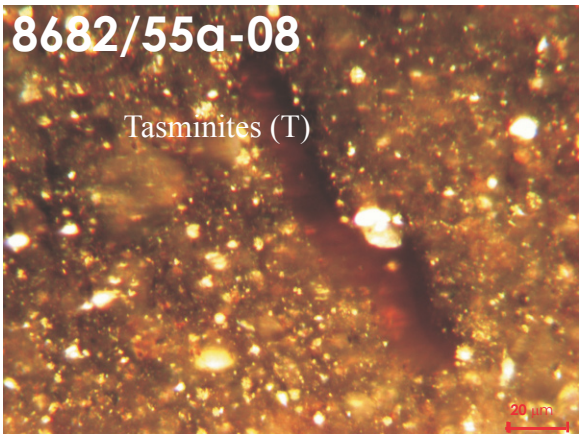

8019/62-08. Organically lean calcareous shale with some weak yellow fluorescing alg-inite, mainly Prasinophyte (P) and thick walled *Tasmanites* (T). Bitumen (B) with micrinite inclusion. Rare reworked vitrinite inertinite maceral not measured. Fluorescent and reflected white light.

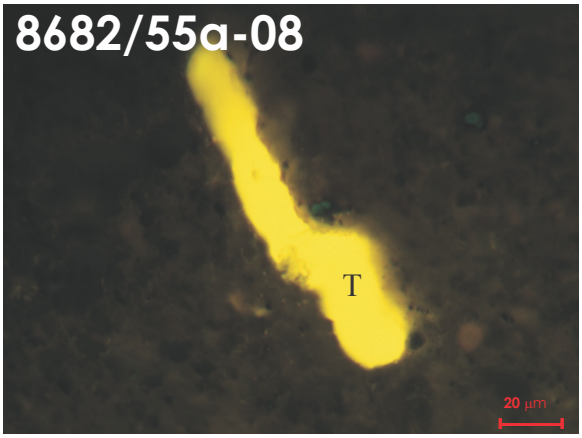


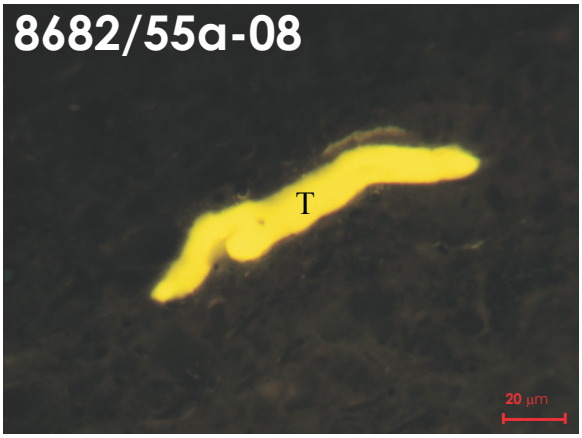

8038/68-08. Pyrite and amorphous kerogen rich black shale with yellow flluorescing liptinite (mainly *Leiosphaeridia* (L), thick walled Tasmanites-like (T) and Prasinophyte (P)) and weak orange brown fluorescing bitumen (B). Rare weak orange fluorescing sporinite like liptinite were also observed, including chitinous fossil (ch). Calcite filled pore canal of siliceous mifcrofossils (S) derived from radiolaria. Some yellow fluorescing oil is released from microfracture under UV light causing staining.

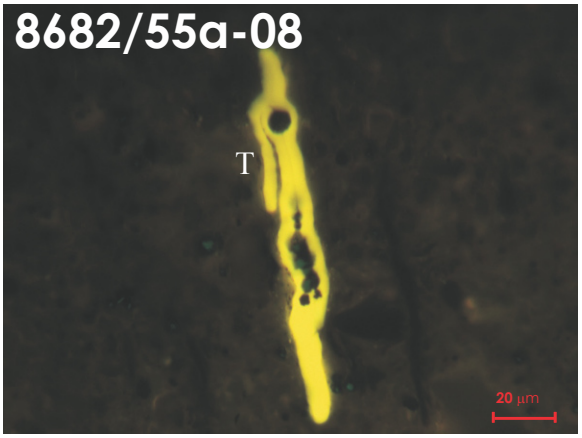


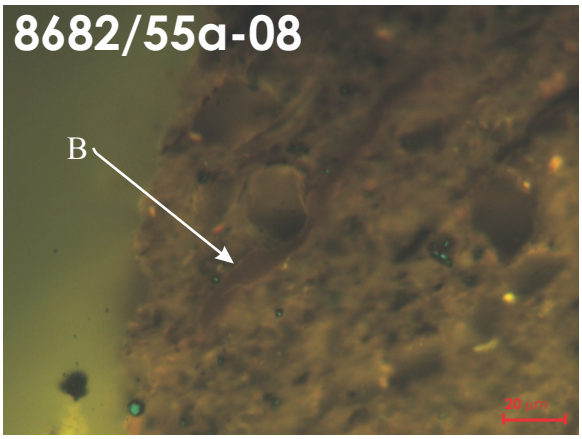

8680/54-08. Liptinite and pyrite (framboidal) rich shale, with mostly yellow fluorescing alginite (*Leiosphaeridia* (L) Prasinophytes (P)) and some rare thick-walled unicellular *Tasminites* (T)). Also present are amorphous bitumen (phosphatic) with micrinite inclusion Fluorescent and reflected white light.

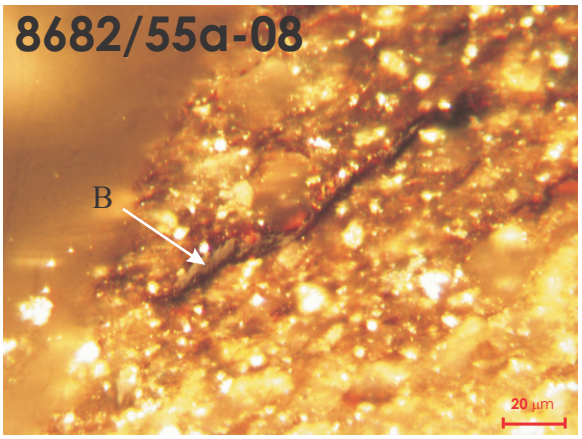

8682/55a-08
Tasmanites (T)
20 µm

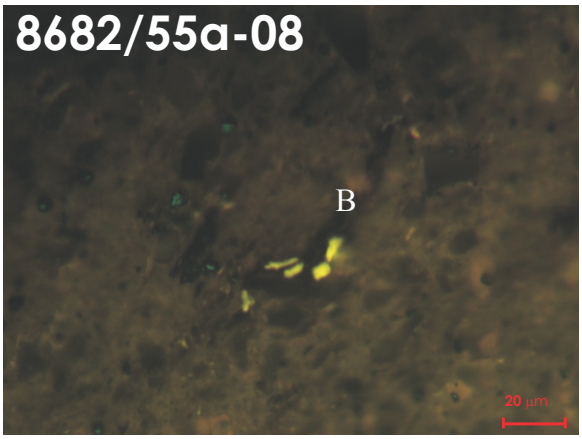

8682/55a-08
T
20 µm

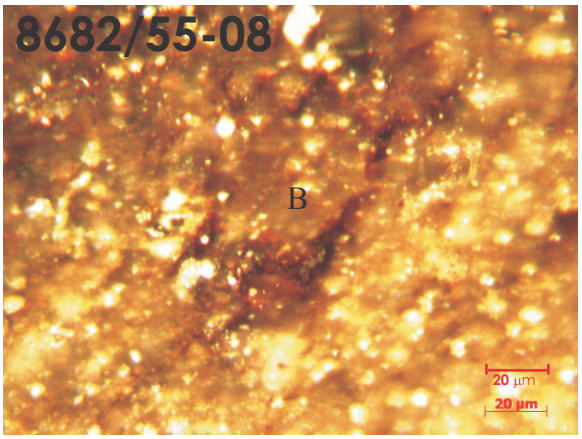

8682/55a-08
T
20 µm

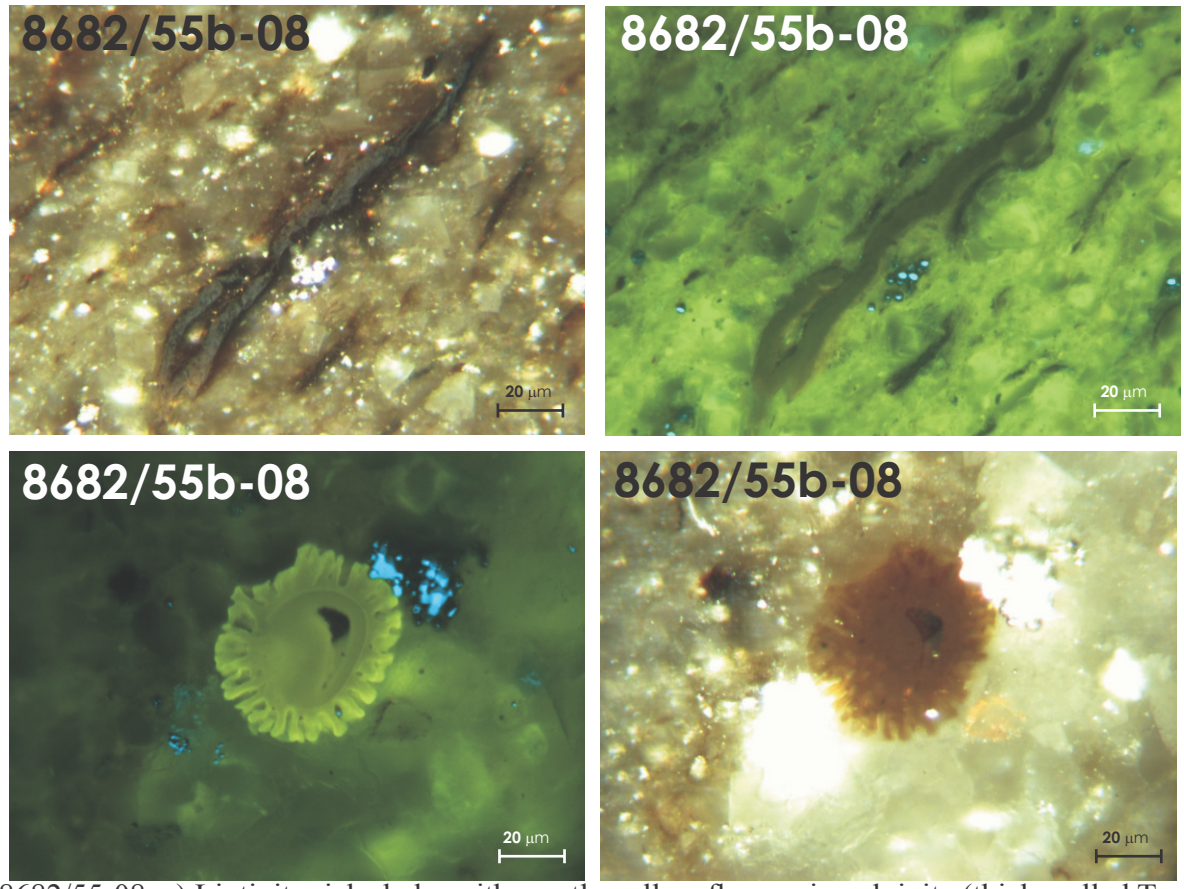

8682/55a-08
T
20 µm


8682/55a-08
B
20 µm


8682/55a-08
B
20 µm

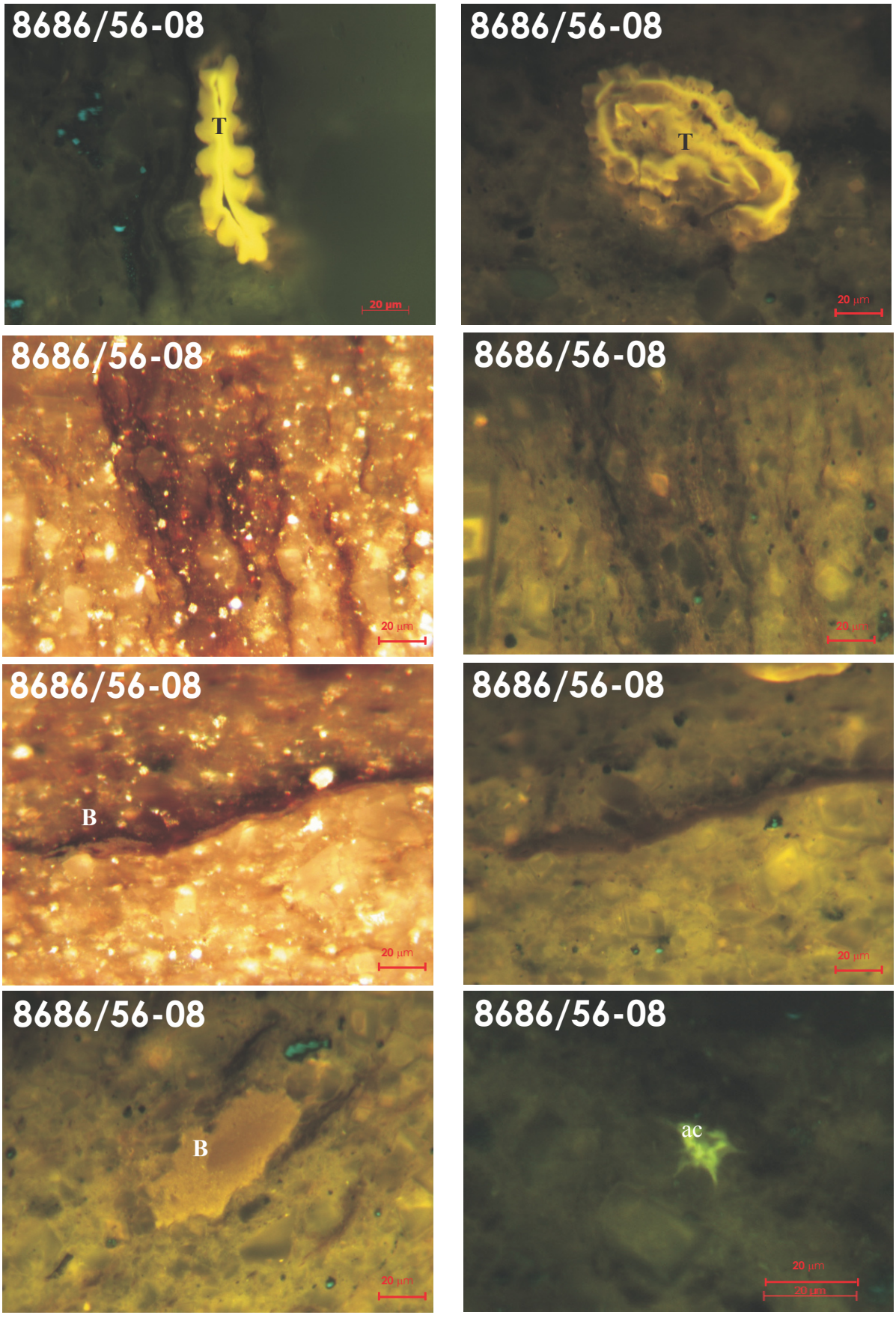

8682/55a-08
B
20 µm


8682/55-08
B
20 µm
20 µm

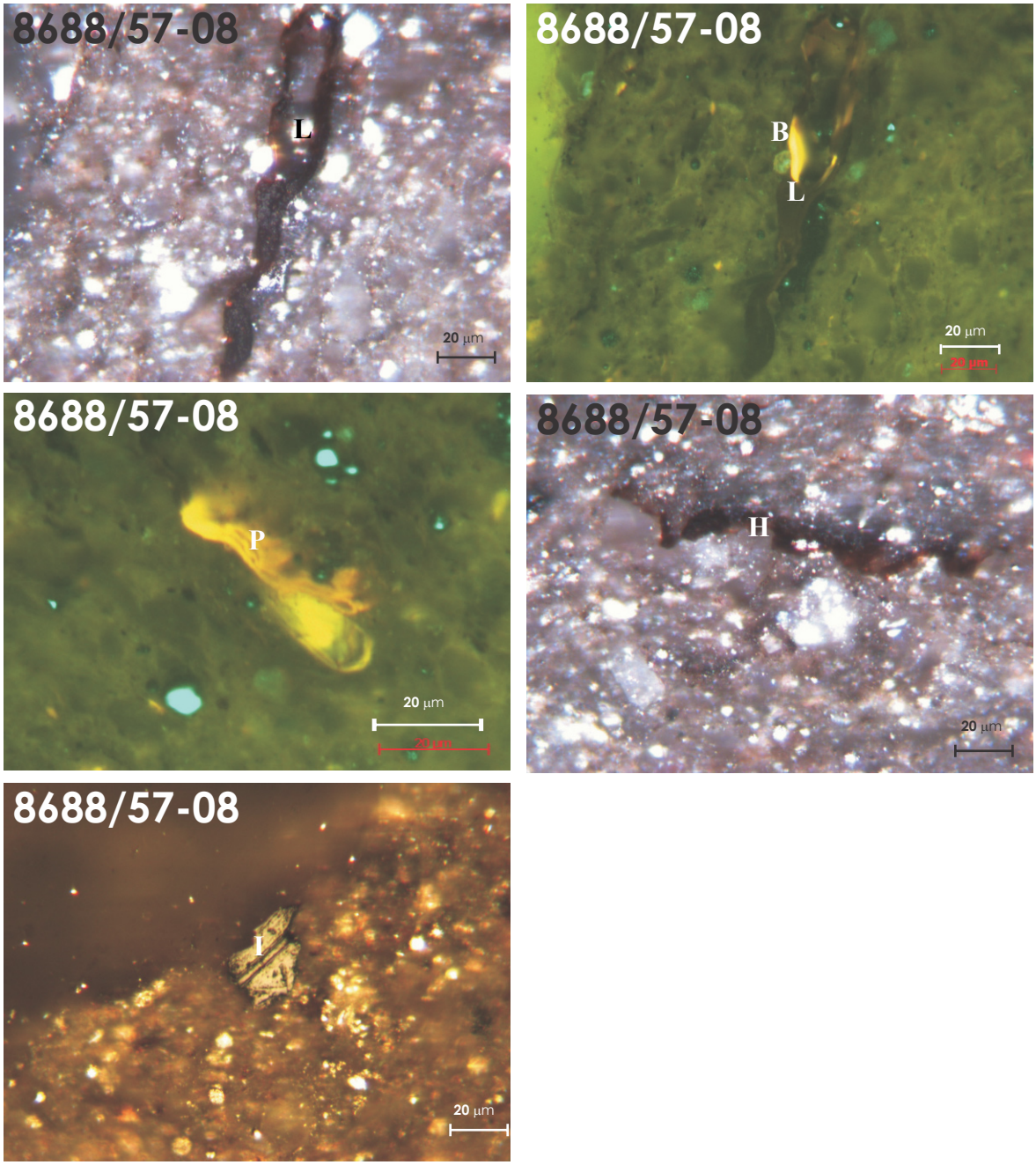



8682/55-08. a) Liptinite rich shale, with mostly yellow fluorescing alginite (thick walled Tasminites (T), Prasinophytes (P) and coccoidal alginite) and yellow to orange fluorescing solid bitumen (B). Fluorescent and reflected white light.

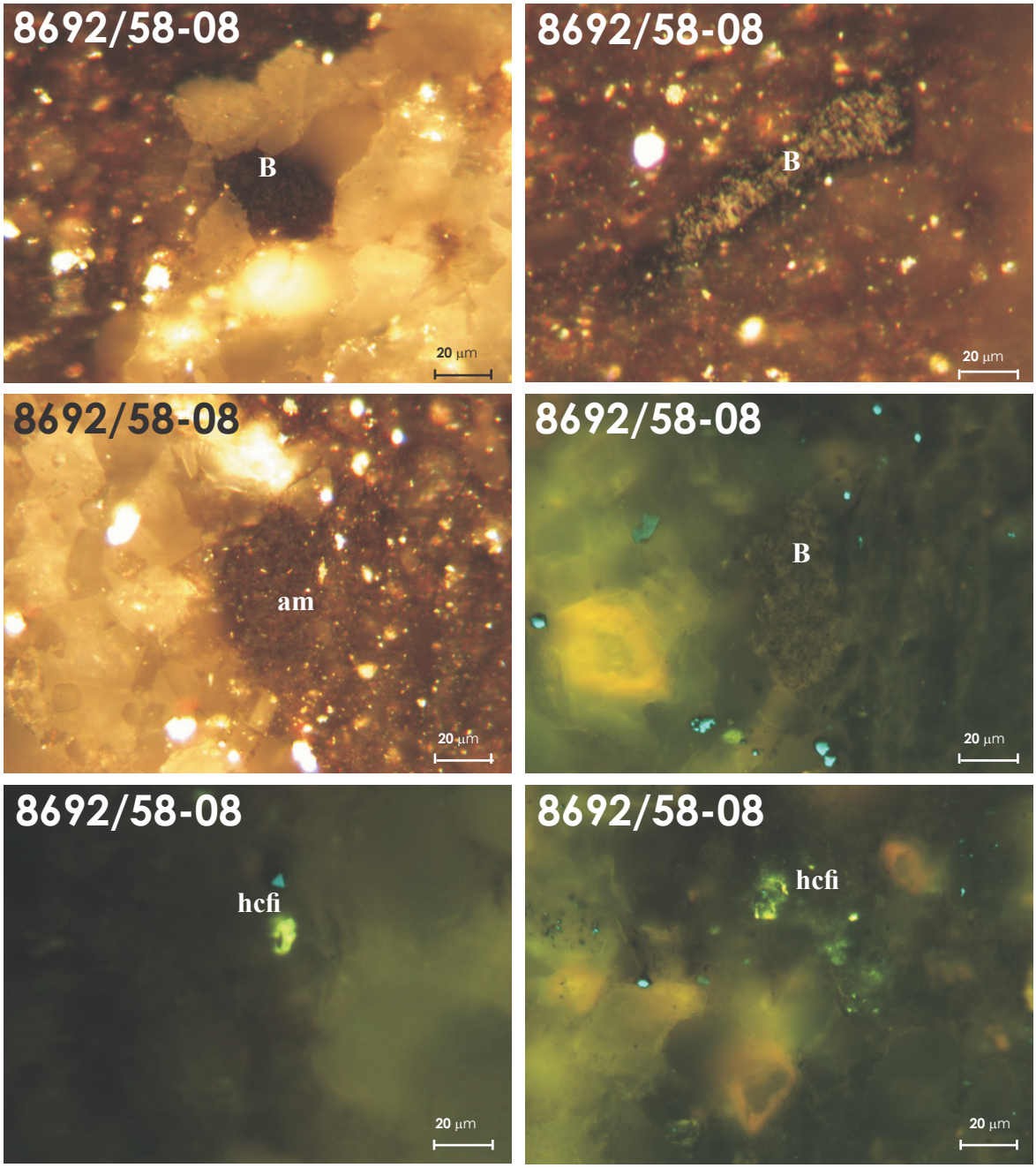
b) Weak orange fluorescing bituminite in pyrite-rich marl matrix and acanthomorphic acritarch (species?). Fluorescent and reflected white light.



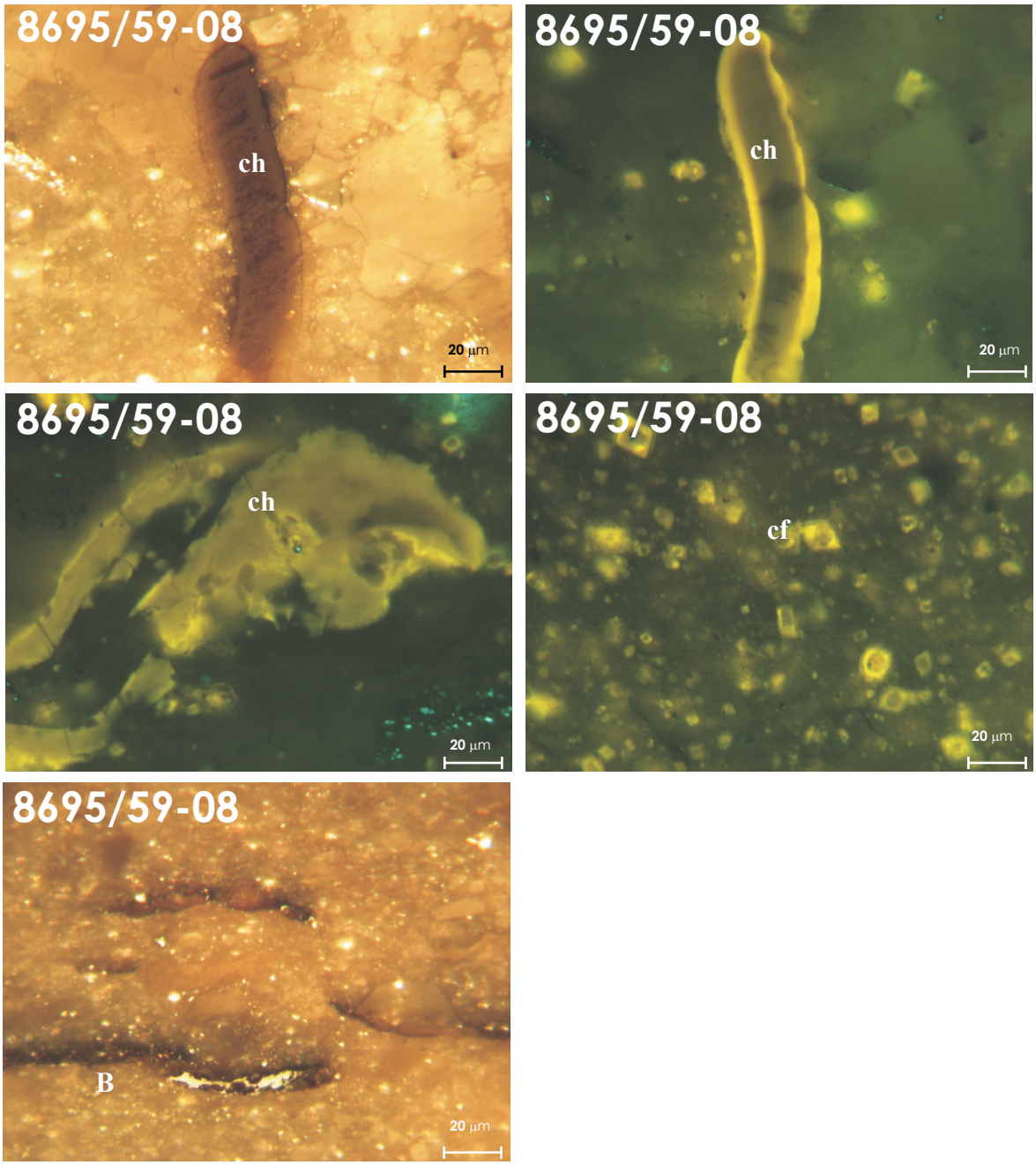

8686/56-08. Shale with mostly yellow fluorescing alginite (thick walled *Tasminites* (T), Prasinophytes and *Microhystridium sp*. acanthomorphic acritarch (ac) and yellow orange fluorescing solid to non-fluorescing bitumen (B). Fluorescent and reflected white light.



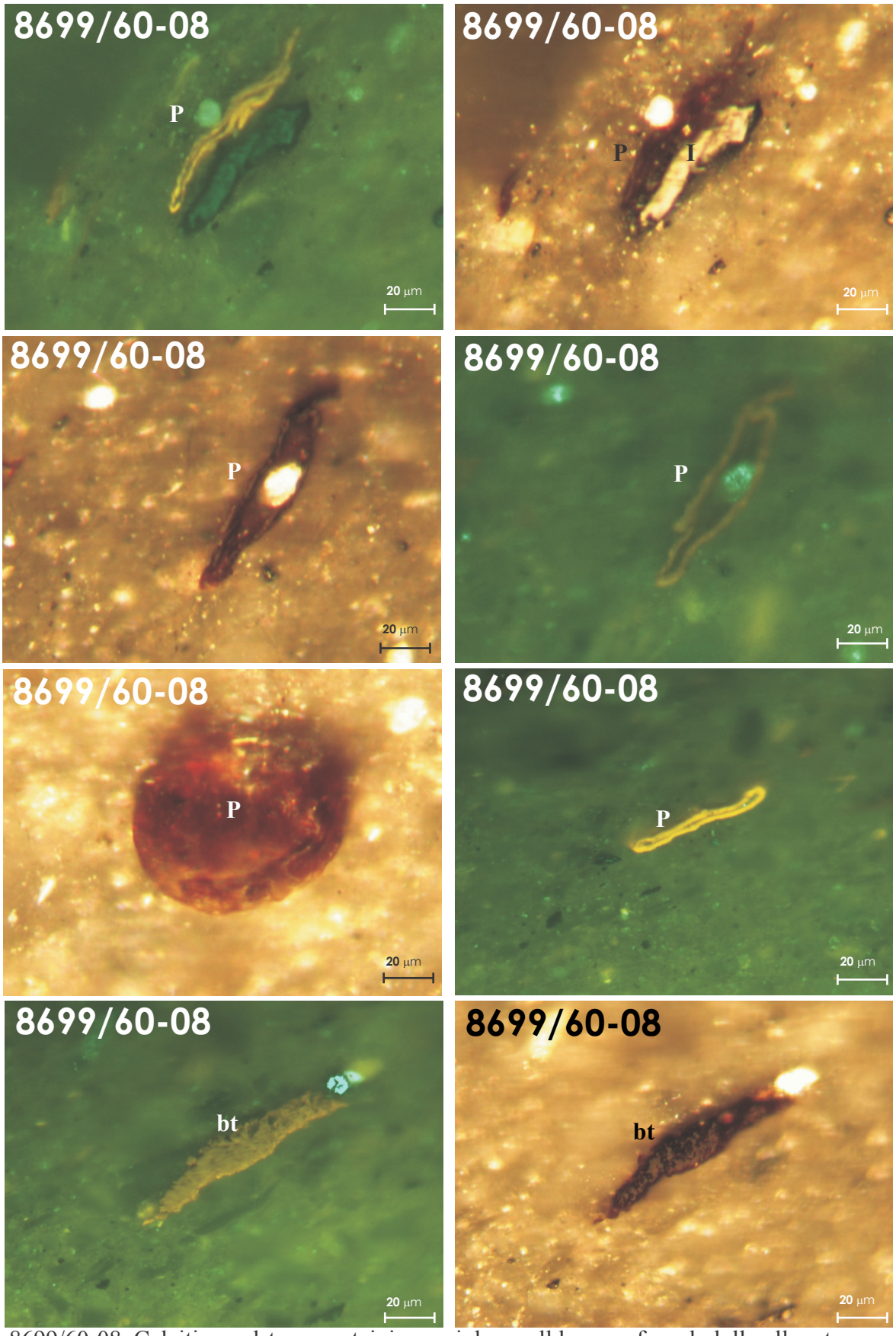

8688/57-08. Pyrite rich shale with weak orange fluorescing liptinite (*Leiosphaeridia* (L) and Prasinophyte (P) alginite (?)). Also contains some reworked inertinite (I) particles. Most of the organic matter are from amorphous kerogen (non fluorescing granular hebamorphinite (H) lenses). B = non-fluorescent solid bitumen. Fluorescent and reflected white light.




8692/58-08. Black shale and calcite with mainly granular amorphous kerogen (am), granular grey bitumen and rare weak orange fluorescing bitumen (B). Some hydrocarbon fluid inclusion (hcfi) annealed in carbonate matrix. Very small amount of measureable bitumen or vitrinite particle. Fluorescent and reflected white light.




8695/59-08. Organically lean calcitic mudstone with silt; rare thin lenses of amorphous kerogen (alginite derived). Some migrabitumen (B) and rare chitinous (ch) particle (fish bone ?) also observed. Calcareous non-fossil (cf ) rich matrix. Fluorescent and reflected white light.




8699/60-08. Calcitic mudstone containing mainly small lenses of weak dull yellow to orange fluorescing alginite, possibly Prasinophyte (P); and reworked vitrinite and inertinite macerals (I). Fluorescent and reflected white light. bt = bituminite.