Evidence for widespread oil migration in the 1.88 Ga Gunflint Formation

by Birger Rasmussen, Janet R. Muhling

Figure DR1. A, B. Reflected light (RL) images of pyrobitumen streaks (brown) in band of fine-grained hematite (white) and magnetite (pink). C. Back-scattered electron (BSE) image of pyrobitumen (black) in 1B. D-H, SEM-EDS element maps for carbon (D), iron (E), silicon (F), potassium (G) and oxygen (H). Sample drill-hole 89-MC-1 (+88.0 m).
Figure DR2. A. Back-scattered electron (BSE) of pyrobitumen (black) in hematite-rich band. B. Reflected light (RL) image of pyrobitumen streaks (brown) in band of fine-grained hematite (white) and magnetite (pink). C. Back-scattered electron (BSE) image of pyrobitumen (black) in 2B. D-H, SEM-EDS element maps for carbon (D), iron (E), silicon (F), potassium (G) and oxygen (H). Sample drill-hole 89-MC-1 (+88.0 m).
Figure DR3. A, B. Reflected light (RL) images of pyrobitumen (brown) intergrown with magnetite (white) in granule-rich chert band. C. Back-scattered electron (BSE) image of pyrobitumen (black) in magnetite-rich granule (inset in 3B). D-H, SEM-EDS element maps for carbon (D), iron (E), silicon (F), potassium (G) and oxygen (H). Sample drill-hole 89-MC-1 (+124.55 m).
Figure DR4. A. Transmitted light image of chert granule (centre) with internal pyrobitumen (black). B. Reflected light (RL) image of pyrobitumen (pb; brown) in chert granule. C. Back-scattered electron (BSE) image of chert granule with pyrobitumen (black) in 4B, surrounded by interstitial chert cement. D-H, SEM-EDS element maps for carbon (D), iron (E), silicon (F), potassium (G) and oxygen (H). Sample of Gunflint Formation from outcrop at Kakabeka Falls.
Figure DR5. A. Transmitted light image of chert granule with internal pyrobitumen (black). B. Reflected light (RL) image of pyrobitumen (pb; brown) in chert granule. C. Back-scattered electron (BSE) image of granule with pyrobitumen (black) in 5B. D-H, SEM-EDS element maps for carbon (D), iron (E), silicon (F), potassium (G) and oxygen (H). Sample of Gunflint Formation from outcrop at Kakabeka Falls.
Figure DR6. **A.** Back-scattered electron (BSE) image of pyrobitumen (black) in hematite-rich band with accompanying EDS spectra of main phases (spectra 1-4). **B.** BSE image of pyrobitumen (black) in hematite-rich band with EDS spectra for main phases (spectra 5-9). Sample drill-hole 89-MC-1 (+88.0 m).
Figure DR7. A. Back-scattered electron (BSE) image of pyrobitumen (black) in hematite-rich band with accompanying EDS spectra from main phases (spectra 10-14). B. BSE image of pyrobitumen (black) in carbon-rich stylolite seam in granule-rich iron formation with EDS spectra for main phases (spectra 31 and 33). Sample drill-hole 89-MC-1 (+124.55 m).
Figure DR8. A, B. Back-scattered electron (BSE) images of pyrobitumen (black) in magnetite-rich band with accompanying EDS spectra from main phases (spectra 16-22). Sample drill-hole 89-MC-1 (+124.55 m).
Figure DR9. A, B. Back-scattered electron (BSE) images of pyrobitumen (black) in chert granules with accompanying EDS spectra from main phases (spectra 34-38). Sample of Gunflint Formation from outcrop at Kakabeka Falls.
Figure DR10. Image of polished thin section comprising a hematite-rich band (bottom), silicified granules (white, middle) and iron-silicate granules (green, top). B-K. Reflected light images of bedding parallel streaks of pyrobitumen (pb) in hematite-rich band (see 10A) surrounded by a thin rim of magnetite crystals (mag). The hematite-rich bands comprise randomly oriented, minute, interlocking plates of hematite (hem).
Figure DR11. A. Image of polished thin section containing hematite-rich band (bottom) in sample of granular iron formation (drill-hole 89-MC-1, +111.9 m). B. Reflected light image of hematite-rich band comprising granule beds and two fine-grained beds comprising mud-sized particles. The central granule bed contains abundant residues of pyrobitumen (pb) surrounded by hematite and magnetite (see 11C-K). C-K. Reflected light images of pyrobitumen (pb) in hematite-rich band containing abundant micropores, ranging from <1 μm up to 5 μm in width. The pyrobitumen occurs in intergranular spaces and in granules, and is adjacent to hematite (hem) and magnetite (mag).