

The Scott Inlet-Buchan Gulf Oil Seeps: Actively Venting Petroleum Systems on the Northern Baffin Margin Offshore Nunavut, Canada*

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Abstract

New analyses of legacy geophysical, geological, and geochemical data have been integrated with modern multibeam bathymetry, RADARSAT imagery, and onshore geological mapping into a regional study of the petroleum system on the northern Baffin shelf offshore Nunavut. Industry seismic reflection profiles show that the Scott Inlet Graben is the southern end of an elongated basin (200-300 km by 25-50 km wide) extending to the northwest along the Baffin Margin – now named Scott Inlet Basin – which contains up to 6 km of Mesozoic and Cenozoic strata. The seismic data define the outer edge of the Scott Inlet Basin; however, the landward edge is largely unknown and may locally outcrop onshore.

Discussion

Recent multibeam bathymetry data have been collected over the Scott Inlet Seep location ([Figure 1](#)) as part of the ARCTICNET Research Program to study benthic habitats and geohazards in the Canadian Arctic waterways. The bathymetric mapping has identified complex patterns of Quaternary seafloor sedimentary processes and modern iceberg scouring. Also imaged are (Precambrian?) bedrock outcrops on the seafloor along the western edge of Scott Inlet Basin with indications of fault structures controlling basin development, as well as pock-marks interpreted to be petroleum escape features. In 2009, video was collected using a remotely operated vehicle showing petroleum actively venting from the seafloor. Repeat satellite radar sea surface mapping confirms the existence of extensive and persistent oil slicks. Large slicks exceed 250 km², each representing over 50,000 barrels of oil on the sea-surface. Whether these slicks are formed from continuous venting of petroleum or episodic events (possibly triggered by local seismicity) is unknown.

New palynological analysis of the 1980s GSC short rock cores of sedimentary strata in the Scott Inlet Basin indicate a Turonian to Campanian age for the mudstones of Home Bay and Buchan Gulf, and the black shales at Scott Inlet. Geological mapping onshore Bylot Island, northwest of the Scott Inlet Basin has identified middle Albian to possible Turonian strata suggesting a correlative equivalent with the Hassel Formation, widespread in the Canadian Arctic. A 500 m thick coarse grained sandstone unit that is widespread on southwest Bylot Island may be a possible coeval equivalent for the reservoir rocks within the Scott Inlet Basin. New geochemical analysis of the 1985 Pisces-IV oil sample confirms a biodegraded mature oil with biomarkers suggesting an upper Cretaceous marine source. The sample has similarities to the Itilli oil type identified in West Greenland, thought to be generated from Cenomanian to Turonian marine shales.

The Scott Inlet Basin contains an active petroleum system with a significant potential for a viable hydrocarbon discovery. Mapping of the area is sparse and continued research would greatly improve the understanding of the geological history of the area as well as provide a natural laboratory for studying the effects of petroleum contamination in an Arctic marine environment.

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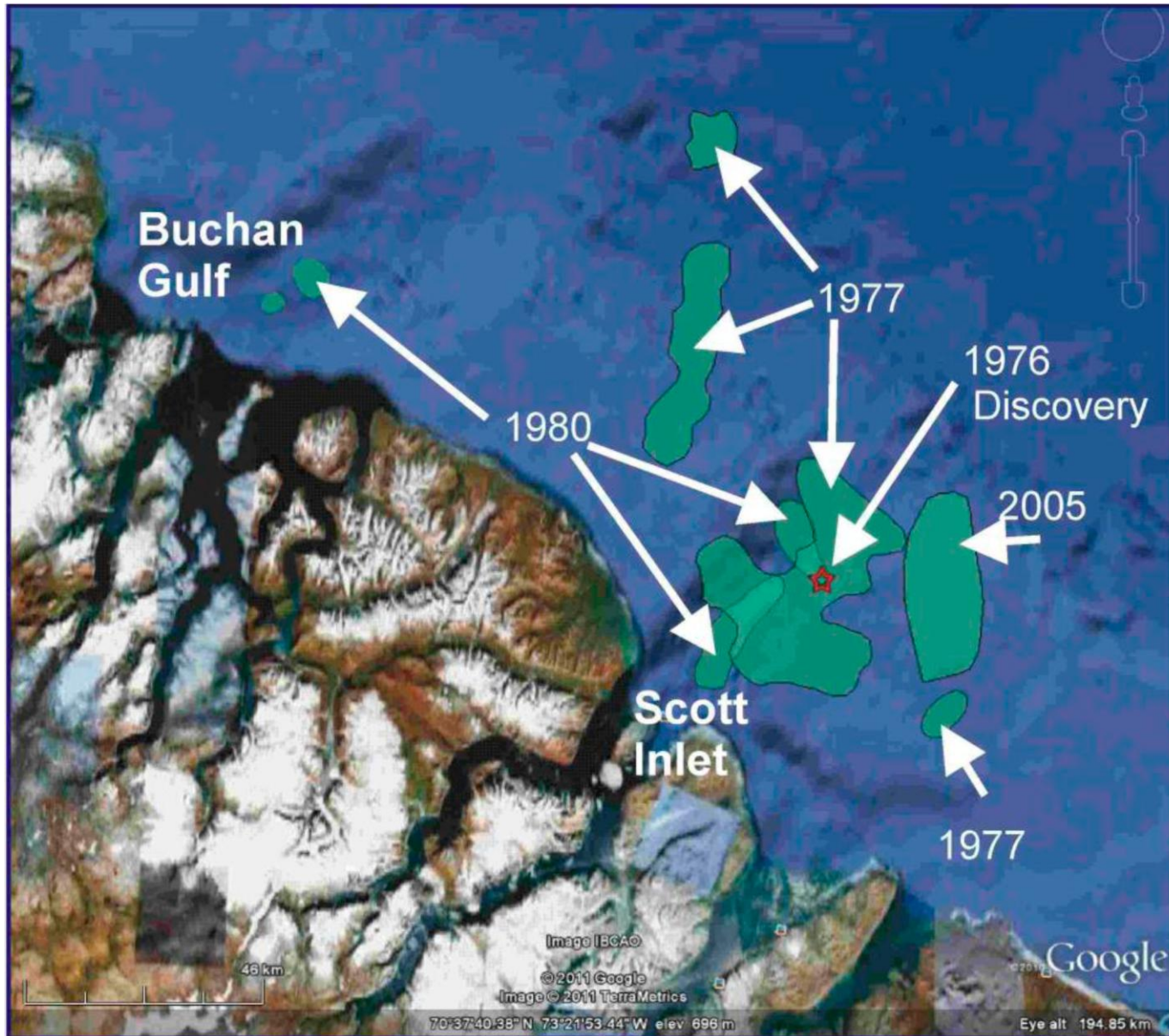


Figure 1. Scott Inlet and Buchan Gulf area with slick outlines from: 1977 slicks by Levy, 1978; 1980 slicks mapped by Levy and MacLean, 1981; and 2005 slick extent from Budkewitsch, 2006.