PALYNOLOGICAL AND THERMAL MATURITY ANALYSIS OF OUTCROP SAMPLES FROM THE KENAI, SELDOVIA, AND TYONEK QUADRANGLES, COOK INLET REGION, ALASKA

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Raw Data File 2021-8

2021
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Suggested citation:
Zippi, P.A., Gillis, R.J., Montayne, Simone, and Loveland, A.M., 2021, Palynological and thermal maturity analysis of outcrop samples from the Kenai, Seldovia, and Tyonek quadrangles, Cook Inlet region, Alaska: Alaska Division of Geological & Geophysical Surveys Raw Data File 2021-8, 4 p. https://doi.org/10.14509/30660

PALYNOLOGICAL AND THERMAL MATURITY ANALYSIS OF OUTCROP SAMPLES FROM THE KENAI, SELDOVIA, AND TYONEK QUADRANGLES, COOK INLET REGION, ALASKA

Pierre A. Zippi[1], Robert J. Gillis[2], Simone Montayne[2], and Andrea M. Loveland[2,3]

ABSTRACT

This data release provides palynomorph assemblages, kerogen observations, thermal maturity estimates, age interpretations, and field station locations of palynology samples collected (2006–2011) from measured stratigraphic sections and key middle Eocene to early Pliocene sedimentary rock outcrops throughout the Kenai, Seldovia, and Tyonek quadrangles. Palynological analysis of surface rock samples offers supporting data for geologic mapping and stratigraphic research conducted by the Alaska Department of Natural Resources' (Alaska Division of Geological & Geophysical Surveys [DGGS] and Alaska Division of Oil & Gas [DOG]) Cook Inlet Basin Analysis Program. The Cook Inlet program provides publicly available baseline outcrop data and geologic findings from the petroleum source, seal, and reservoir rocks of the prospective Cook Inlet hydrocarbon basin. Program products inform interpretations of the geologic processes that shaped the petroleum system's basin evolution. The analytical data tables associated with this report are available in digital format as comma-separated value (CSV) files. All files are available from the DGGS website https://doi.org/10.14509/30660.

DATA PRODUCTS

This data release provides palynomorph assemblages, kerogen observations, thermal maturity estimates, age interpretations, and sampling locations of palynology samples. This report and accompanying data supersede a prior release (Zippi and Loveland, 2012) and provide 39 additional analyses from the west side of Cook Inlet. The west Cook Inlet basin palynological age determinations accompany $^{40}Ar/^{39}Ar$ and zircon U-Pb data presented in Gillis and others (2021). Laboratory slides and surplus sample material are archived by the Geological Materials Center in Anchorage, Alaska, and are available for public viewing on request.

DOCUMENTATION OF METHODS

Sample collection

Samples were collected from mudstone, silty mudstone, and, less commonly, muddy siltstone. Coal underclays were a common lithology targeted for analysis. When possible, composite samples were collected over a meter or more of the stratigraphic interval, and fresh material was excavated from several centimeters deep to avoid surface contamination.

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Location data were collected using handheld recreational grade Garmin GPS units. These devices have a typical reported error of 1-10 m. However, the location accuracy of the sample site coordinates varies according to the sampling context and recording conventions of the observer. This work incorporates careful review of sample sites relative to basemap imagery and field notebooks (Esri, 2009). Observers corrected sample numbering and location transcription errors that may have been incorporated in prior releases (Zippi and Loveland, 2012, Lepain, 2009). A location confidence range, when known, is reported in the data. Locations for samples collected along a measured stratigraphic section reflect the GPS reading at the base of the measured section. Latitude and longitude are reported in the NAD27 datum.

Sample numbering

Samples were collected in conjunction with geologic mapping and stratigraphic and structural investigations by David Mauel (DGGS), David LePain (DGGS), Emily Finzel (Purdue University), Jacob Mongrain (UAF and DGGS), Laura Gregersen (DOG), Marwan Wartes (DGGS), Paul McCarthy (UAF), Paul Decker (DOG), Robert Gillis (DGGS), and Trystan Herriott (DGGS). Sample numbers include year collected, collector initials, field location number, and if tied to a measured section, sample location along the section.

An example of the sample numbering scheme follows:

07DL085-35 indicates the sample was collected in 2007 by Dave LePain at his field location 85. The dash indicates the sample is tied to a measured stratigraphic section, and the last number shows its position in meters above the base of the section. Composite samples may also include the interval span, for example, 09DL033-0.0-1.5a.

Another example:

08BG184b indicates Bob Gillis collected the sample in 2008 at his field location 184. A suffix letter indicates that multiple samples were collected at that location.

Sample numbers with the following prefixes deviate from the numbering convention outlined above:

ST1 –
TY –
BG1 –

These samples were collected by Emily Finzel (Purdue University). ST1=Sterling Formation; BG1 = Beluga Formation; TY = Tyonek Formation.

Laboratory numbers sometimes vary from sample numbers. The sample numbering system reflects the number the geologist assigned to the sample in the field, whereas the laboratory label is the interpretation of the sample number by the laboratory analyst. Therefore, the number etched on the palynomorph mount archived at the GMC may vary slightly from the true sample number. Since the initial release of a subset of this data (Zippi and Loveland, 2012), DGGS staff have completed a comprehensive review of the field sample numbering, laboratory labels and sample metadata to correctly cross reference sample and laboratory numbers.

Sample preparation

Raw outcrop samples were water washed to remove surficial contaminants. Carbonate minerals were dissolved using HCl, and silicate minerals were removed using HF. Heavy liquid separation may have been required if insoluble minerals were present. The organic residue was washed with HNO_3, followed by a wash with ammonia or KOH. The residues were sieved through a 7–10 µm mesh screen to remove small particles that would be unidentifiable in transmitted light microscopy. Organic residues were mounted on a coverslip with polyvinyl alcohol and fixed to a microscope slide with polyester resin. All samples in this report were processed by Russ Harms of Global Geolab Limited in Medicine Hat, Alberta, Canada.

Analytical methods

The prepared slides were examined for palynological analysis with a research-grade Zeiss Axio Imager microscope with phase contrast and differential interference contrast illumination using oil immersion objectives at a minimum of 500X. When possible, palynomorph occurrence data were collected until the total count reached 100 specimens for relative abundance data, after which the remaining area of the slide was scanned for rare taxa that may have stratigraphic significance. Rare taxa were added to the count data. The age zones are reported with reference to the palynostratigraphic terminology used in the Cook Inlet Palynology Database of Zippi, 2006, which follows the nomenclature of Wolfe and others (1966). Kerogen residues are typically separated from the palynology residues after demineralization with HCl and HF but before oxidation. For samples that do not require strong oxidation, the kerogen can be described from the lightly oxidized palynology slides. Vitrinite reflectance and maximum temperatures were estimated from pollen/spore color. Dr. Pierre Zippi, Biostratigraphy.com, LLC, performed the palynological, kerogen, and spore color analyses. Dr. Zippi has more than 35 years of experience working with palynology and organic residues in oil and gas exploration.

ACKNOWLEDGMENTS

Pathfinder Aviation and pilots Merlin (Spanky) Handley, Marty Staufer, Chuck Redd, Ray Hodges, Hightower Paxton, and Bob Fell, along with Tom (Rat) Ratledge of Yukon Helicopters, safely and skillfully provided transportation to rock outcrops throughout the Cook Inlet region. Jack Barber at Alaska Air Taxi flew personnel and gear to field base camp. Bob Freeman at Three-Mile Camp provided food and lodging on the west side of Cook Inlet; lodging on the Kenai Peninsula was provided by the Ocean Shores Hotel and Best Western Bidarka Inn in Homer, and Aspen Hotel in Soldotna. Land access was kindly permitted by Cook Inlet Region, Inc., and Tyonek Native Corporation. This project was funded by State of Alaska Capital Improvement Project funds and the U.S. Geological Survey's National Cooperative Geologic Mapping Program STATEMAP component (award numbers G09AC00177 & G10AC00321).

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