ALASKA GEOLOGICAL SOCIETY

2023 TECHNICAL CONFERENCE

RESPONSIBLE RESOURCE INDEPENDENCE

April 22, 2023

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Alaska Geological Society 2023 Technical Conference, ConocoPhillips Integrated Science Building, University of Alaska Anchorage & Zoom				
Date: 4/22/2023		RESPONSIBLE RESOURCE INDEPENDENCE		
TIME START	TIME END	PRESENTER NAME	Affiliation	TITLE
8:30	9:00			Doors Open Coffee and Refreshments
9:00	9:15	Sarah Frey	Hilcorp	Opening Remarks
9:15	10:15	Colby VanDenburg	Armstrong Oil & Gas Inc.	An evolution in exploration thinking: From play-opening discovery to the direct detection of hydrocarbons on the North Slope of Alaska
10:15	10:30			Coffee Break
10:30	11:30	Doug Kreiner	USGS	Earth Mapping Resources Initiative (Earth MRI): A path towards understanding the distribution of domestic sources of critical minerals
11:30	12:00	Sue Karl	USGS	AGS Scholarship Award Winners and Pathfinders Innagural Class
12:00	13:00			Lunch
13:00	13:30	Marwan Wartes	DGGS	Evaluating Alaska Coal and Associated Sediments as Potential Unconventional Sources of Rare Earth Elements and Critical Minerals
13:30	14:00	Anna Lewallen	Santos	Optimism on the North Slope; Pikka: Investment for the future
14:00	14:15	Robert G. McDermott	USGS	Geochemistry of detrital magnetite as a provenance tool in Alaska's Yukon-Tanana Upland
14:15	14:30	Elizabeth Freeman	UAA	Fluid Inclusion Analysis of Auriferous Type 2 and Type 3 Veins Across the Estelle Pluton Complex
14:30	14:45	Nolan Vlahovich	UAA	Qualitative Petrographic Analysis of Silicate Melt Inclusions Hosted in Novarupta Rhyolitic Dome
14:45	15:00			Coffee Break
15:00	15:15	Greg Wilson	AOGCC	What's Going on with Carbon Capture, Utilization, and Storage in Alaska?
15:15	15:30	Austin Routt	UAF	Pingo STARR 2023: Tales From Tuk
15:30	15:45	Robert J. Gillis	DGGS	The Doone Creek fault: A newly identified structure in the Talkeetna Mountains, Alaska, that belongs to a system of north- and northeast-trending faults that may delineate the Paleogene forearc basin boundary
15:45	16:00	Kenneth P. Helmold	AK DOG (retired)	Controls on Reservoir Quality of the Nanushuk Formation (Albian–Cenomanian), North Slope, Alaska
16:15	16:30	Sue Karl	USGS	The transition from convergence to translation on the western margin of North America: evolution of the ancestral Denali Fault in southeast Alaska
16:30	16:45	Cameron R. Kuhle	UAA	Quantifying peat carbon mass using ground- penetrating radar (GPR) and probing in peatlands of the Kenai Peninsula, Alaska
16:45	17:00	Kurt Johnson	DGGS	The State of the Alaska Geologic Materials Center Address

An evolution in exploration thinking: From play-opening discovery to the direct detection of hydrocarbons on the North Slope of Alaska

Keynote Speaker – Colby Vandenburg

Vice President of Geology, Armstrong Oil & Gas, Inc., Denver CO

The Cretaceous Nanushuk Group has been recognized for its petroleum potential since the U.S. Navy's oil discovery at Umiat field in the foothills of the Brooks Range in 1946. Subsequent oil discoveries on the coastal plain at Fish Creek in 1949 and Simpson in 1950 confirmed the regional extent of the Nanushuk petroleum system. Despite these early discoveries, the potential of the Nanushuk Group wasn't fully appreciated until 2013, with the discovery of the multi-billion-barrel Pikka field.

The oil accumulation at Pikka field is stratigraphically trapped within topset and upper foreset portions of a series of prograding clinothems. These clinothems are part of the Brookian sequence, a lower Cretaceous through Tertiary progradational system that extends from Eastern Russia across the North Slope into Northwest Canada. The seismic expression of the shelfal portion of the clinothem is typically characterized by high-amplitude planar continuous reflections. These relatively high amplitude events often mask the more subtle expression of the lower topset sandstones, which were deposited in a distal shelf to shelf-edge environment. This shelf-edge environment provides ample accommodation space to preserve a tremendous thickness of sandstone, like those comprising the accumulation at Pikka field.

Although the clinothem geometry is readily apparent on 2D seismic, the internal details within each clinothem require 3D seismic for detailed analysis of stratigraphy. Amplitude versus offset (AVO) attributes help to understand the reservoir architecture as well as the distribution of hydrocarbons within the reservoir. Application of AVO analysis in onshore conventional plays is rare due to typically poor-quality seismic data and the fact that most modern onshore exploration is limited to low-quality reservoirs. In contrast, the emerging Brookian topset play benefits from both high-quality reservoirs and an abundance of high-quality 3D seismic data that allows the prediction of lithology and fluid type in topset targets across the North Slope. The result is the holy grail of exploration: a shallow, low-risk, onshore, conventional oil play spanning hundreds of miles containing multi-billion-barrel targets in one of the most prolific petroleum systems in the world.

Earth Mapping Resources Initiative (Earth MRI): A path towards understanding the distribution of domestic sources of critical minerals

Keynote Speaker – Doug Kreiner

U.S. Geological Survey, Alaska Science Center, Anchorage, AK

Critical minerals are presently defined as non-fuel mineral or mineral material essential to the economic or national security of the U.S. and which has a supply chain vulnerable to disruption (https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals). These metals are essential to meet modern mandates for zero-emission vehicles and transition to a low-carbon economy. The U.S. Geological Survey's Earth Mapping Resources Initiative (Earth MRI) program was developed to acquire new high-quality datasets (geological, geophysical, geochemical, and topographic) over areas that are favorable for containing critical mineral deposits. Initially, ~$1M/year was provided to Alaska Division of Geological & Geophysical Surveys to support new data collection, and that investment has increased to more than $6.5M in the current year to bolster data collection. The state of Alaska has also prioritized critical minerals exploration and production in Alaska through the establishment of the Office of Energy and Innovation.

The mineral systems concept provides a holistic framework connecting regional-scale geologic factors to the formation and preservation of mineral systems. Mapping mineral systems and their host geologic terranes provides essential insights into the potential formation and distribution of deposits to predict which critical minerals may also be enriched as by- and co-products. Processes that occur over large time and space scales have a profound influence on the enrichment of metals in ore deposits. Focusing on the mineral system rather than the any individual deposit provides a more complete and integrated understanding for sources and sinks of critical minerals.

We have developed a mineral systems framework for Alaska that relates individual deposits and mineral districts to the geologic environments that host them using a process-based approach. We have mapped the general extent of 17 distinct mineral systems that are known or suspected to exist within Alaska, and we delineated more than 100 associated focus areas known or suspected to include most of the commodities that are presently listed as critical. Our mapping was guided by publicly available geologic, geochemical, geophysical, and mineral occurrence datasets that cover most of the state. Mineral resource prospectivity models published by the U.S. Geological Survey for Alaska in recent years provided guidance for evaluating the footprints of mineral systems. The Yukon-Tanana upland of eastern interior AK was selected as the first priority region for new data collection under the USGS Earth MRI program because it has the most spatial overlap of different mineral systems in a single focus area. Our mapping of mineral systems and critical mineral prospectivity and the resulting focus areas provide a strategic framework for prioritizing new research and data collection in Alaska to advance our understanding of domestic critical mineral potential.

Optimism on the North Slope

Pikka: Investment for the Future

Keynote Speaker – Anna Lewallen

Senior Development Geologist, Santos, Anchorage, AK

Overview of the history, growth and presence of Santos in Alaska. Details about the upcoming Pikka Development project and the important role a Geoscientist plays in the exploration and development of a new oil field from the very beginning of first discovery to execution.

Evaluating Alaska Coal and Associated Sediments as Potential Unconventional Sources of Rare Earth Elements and Critical Minerals

Marwan Wartes (Presenter) (Alaska DGGS), Nina Harun (Alaska DGGS), and Brent Sheets (UAF Institute of Northern Engineering)

Critical minerals are essential components in many modern products ranging from cell phones to clean energy technology. However, the United States lacks domestic sources for many of these minerals, resulting in economic and national security risk due to potential supply chain disruptions. In light of this growing challenge, a number of federal programs have been created to help stimulate the exploration and production of critical minerals. One of these efforts is the Carbon Ore, Rare Earths and Critical Minerals (CORE-CM) initiative sponsored by the U.S. Department of Energy's National Energy Technology Laboratory (NETL). This program is supporting 12 teams in the lower 48, each of which is focused on a specific coal bearing basin or region (i.e. Powder River basin, central Appalachian Basin, etc.). In contrast, the Alaska group is tasked with considering the entire state, which includes 50+ coal bearing basins. Our team includes representatives from Alaska Division of Geological & Geophysical Surveys (DGGS) and the University of Alaska, as well as a number of private sector companies and Native organization partners.

The primary focus of the program is carbon ores (mainly coal) and associated waste products such as powerplant ash. However, there is flexibility to consider other unconventional sources of critical minerals such as waste streams from hardrock mines and legacy tailings. The major component of this initial phase of the project is the assessment and characterization of critical mineral resources associated with coal bearing basins. Our approach has been to explore three principal sources of data to establish a reconnaissance framework for considering the state's CORE-CM potential: 1) Existing published and unpublished data, 2) New data from archived legacy samples, and 3) New data from newly acquired samples. A key aspect of our workflow for collecting new data involves the use of a SciAps X-555 handheld X-ray fluorescence analyzer as a screening tool to evaluate hand samples and core available at the Geologic Material Center (GMC). Promising samples are sent out for quantitative ICP-MS analysis.

Based on our initial evaluation and assessment of available data, we are developing working hypotheses for "play types" that capture key geologic characteristics that contribute to elevated concentrations of rare earth elements and critical minerals in Alaska's coal bearing basins. These include: detrital placer concentration, syngenetic precipitation, epigenetic mineralization, and airfall volcanic ash contributions.

Geochemistry of detrital magnetite as a provenance tool in Alaska's Yukon-Tanana Upland

Robert G. McDermott (Presenter), Douglas C. Kreiner (U.S. Geological Survey), James V. Jones III (U.S. Geological Survey), Sean P. Regan (University of Alaska Fairbanks)

Alaska is a frontier of untapped US domestic mineral resources, but understanding links between its geologic and metallogenic frameworks is hampered by poor rock exposure and remote field sites. Here, we test detrital magnetite (DMt) geochemistry as a tool for fingerprinting regional geologic units and associated resources in Alaska's Yukon-Tanana Upland. We present DMt minor and trace element geochemistry measured by electron probe microanalyzer (EPMA) and inclusion count data from stream sediments (N=9 samples, n=684 grains) that drain the Taurus porphyry Cu-Mo(-Au) deposit and its environs. Principal component analysis and Gaussian mixture modeling of EPMA data resolves ten geochemical populations across our dataset, with relative proportions of any one population comprising up to 57% of any given sample. The geologic significance of these populations is interpreted by comparisons to a dataset of known bedrock sources (N=20, n=164 EPMA analyses), Mg-in-Mt thermometry, published geochemical discrimination plots, and from characteristic inclusion assemblages of each population. DMt populations are compatible with derivation from multiple hydrothermal porphyry-related (HTP), metamorphic, and intermediate to felsic igneous sources. HTP Mt comprises ~≥30% of DMt adjacent to known mineralization centers and diminishes with downstream distance, but is identifiable (2-6% of grains) several km downstream. We identify HTP Mt where possible unrecognized Taurus-style alteration is suggested by surface water geochemical anomalies. Lastly, we show that local metamorphic units are distinguishable by Mt geochemistry, with DMt population distributions mirroring geologic map patterns. DMt is thus a promising tool in geologic and metallogenic framework studies in Alaska, and potentially other regions.

Fluid Inclusion Analysis of Auriferous Type 2 and Type 3 Veins Across the Estelle Pluton Complex

Elizabeth Freeman (Presenter) (UAA), Claudia Cannatelli (UAA)

The prolific Estelle Gold Project is located approximately 150 km (93 miles) northwest of Anchorage in the Alaska Range. The current project is classified as a reduced intrusive related gold system (IRGS), and it hosts auriferous sheeted quartz veining. Mineralization is primarily low grade and follows a north/south trend across the property. The reported results suggest that two main vein types contain the bulk of Au mineralization, and three fluid inclusions assemblages (FIAs) were identified (Flagg ,2014). The objective of this current study is to gather additional information by collecting samples from new high-grade prospects on the Estelle property and determine if a correlation exists between fluid inclusion assemblages and gold grade using petrography, microthermometry, and Laser Ablation ICPMS (LAICPMS) methods. Fluid inclusions (FIs) are small droplets of fluid trapped in minerals during their growth or along fractures that develop and heal after the crystal has formed. (Randive et al.,2014). FIs represent an invaluable tool in mineral exploration due to their ability to provide constraints on temperature/pressure conditions and ore fluid genesis. The 2022 Estelle drill program focused on increasing and proving the resource located on the Korbel portion of the property and the further exploration of RPM South, Cathedral, and Isabella prospects. These new drill cores offer a unique opportunity to continue vein analysis and conduct geochemical analysis on associated fluid inclusion assemblages.

Qualitative Petrographic Analysis of Silicate Melt Inclusions Hosted in Novarupta Rhyolitic Dome

Nolan Vlahovich (Presenter) (UAA), Claudia Cannatelli (UAA)

The 1912 Novaruta eruption was the largest eruption of the 20th century, ejecting 17 km3 of fallout and 13 km3 dense rock equivalent of magma. The composition of the eruptive products range from andesitic to rhyolitic. Silicate Melt Inclusions (SMI) are little volumes of magma trapped during crystal growth in a magma chamber and record pre-eruptive chemical compositions, including volatiles. This study serves as a preparatory stage in a larger SMI study on Novarupta. Here we qualitatively examine thin sections and grain mounts from the final rhyolitic dome that plugged the Novarupta vent. Samples consist of thin sections and mounted quartz crystals that were examined using a petrographic microscope. Samples contain mostly glass (90%), and 10% phenocrysts, comprising feldspars (80-85%), quartz (5-10%), pyroxenes (3%), and olivine (2%). Plagioclase exhibited zoning and sieve texture potentially resultant form magma mixing or volatile loss during magma ascent. Quartz hosted-SMIs were selected based on several criteria, such as size (diameter >30um due to minimum beam aperture for later microprobe analyses), glassy texture (for a high degree of compositional homogeneity within the inclusion), fractures (free of fracture that would cause leakage of volatiles). Abundant glassy inclusions were found, including several melt inclusion assemblages that run from core to rim of quartz crystals suitable for tracing magmatic evolution. Petrographic analysis has identified many promising SMIs for the next phase of this study.

What's Going on with Carbon Capture, Utilization, and Storage in Alaska?

Greg Wilson (Alaska Oil and Gas Conservation Commission), Dave Lepain (Alaska Division of Geological and Geophysical Surveys), Haley Paine (Alaska Division of Oil and Gas)

The Infrastructure Investment and Jobs Act (IIJA) enacted by the 117th US Congress and signed into law by President Biden in 2021 contains significant funding and incentives for carbon capture and storage (CCS). The overall goal of CCS is to reduce greenhouse gas emissions and potentially alleviate CO2 effects related to climate change. Incentives in the IIJA are expected to accelerate development of businesses and state activity to accomplish the goal. Storage of the CO2 is as a supercritical fluid injected into deep geological formations with pore space to accept the CO2. Alaska has favorable geology – including depleted oil and gas fields and unmineable coal seams – and existing industry to participate in CCS. As such, two bills (HB50, SB49) are working their way through the 2023 Alaska Legislature regarding carbon capture, utilization, and storage (CCUS) in Alaska. The legislation will provide the statutory framework surrounding licensing of pore space, amalgamation of property rights, project permitting, and obtaining Class VI injection well primacy from the EPA, among other things. The Alaska Supreme Court has previously ruled that the mineral estate reserved by the State includes pore space. The EPA defines Class VI wells as those used for injection of carbon dioxide (CO2) into subsurface rock formations for long-term storage, or geologic sequestration. Only two states (North Dakota and Wyoming) have obtained Class VI Well primacy from the EPA. Alaska currently has Class II Well primacy, which is for injecting fluids associated with oil and gas production, including those used for enhanced oil recovery (EOR).

Pingo STARR 2023: Tales From Tuk

Austin Routt (Presenter) (UAA), Kynan Hughson (UAA), Matthew Siegfried, John Bradford, Britney Schmidt, Alexia Kubas, Andrei Swidinsky, Venezia Follingstad, Hannah Sizemore, Andrew Mullen

Pingos are enigmatic periglacial landforms canonically described as ice-cored hills which form either hydrostatically or hydraulically. Pingos are important indicators of subsurface cryohydrologic activity and recent remote sensing observations suggest they may also exist on Mars as well as the dwarf planet, Ceres, representing potentially significant future hydrological resources for future explorers. Pingo STARR, an ongoing NASA PSTAR project, aims to probe the internal structure of pingos using a suite of geophysical techniques including ground-penetrating radar (GPR), capacitively coupled resistivity (CCR), transient electromagnetics (TEM), and frequency domain electromagnetics (FDEM). In March-April of 2023, Pingo STARR completed its second season of field work in the Canadian Arctic on the coast of the Beaufort Sea in Tuktoyaktuk. Initial findings from this season indicate an unexpected variability of the internal structure of coastal hydrostatic pingos, with some pingos seeming to conform to the canonical description, and others demonstrating heretofore undescribed structures. In combination with data from the first field season of Pingo STARR near Deadhorse, Alaska, our novel dataset demonstrates the efficacy of our geophysical methods for the investigation of ground ice in Arctic environments and suggests that pingo ice-cores may form by a variety of different mechanisms beyond basal freezing.

The Doone Creek fault: A newly identified structure in the Talkeetna Mountains, Alaska, that belongs to a system of north- and northeast-trending faults that may delineate the Paleogene forearc basin boundary

Robert J. Gillis – Alaska DGGS

New 1:25,000 scale bedrock geologic mapping in the southern Talkeetna Mountains, Alaska, has revealed a previously unrecognized fault (the Doone Creek fault, DCF) that places granitic Middle–Late Jurassic Talkeetna arc rocks to the west-northwest against late Paleocene Arkose Ridge Formation forearc basin strata (Tar) to the east-southeast. The contractional, steeply west-northwest-dipping structure is well exposed at two locations in the south and middle forks of Doone Creek west of the Chickaloon River, where kinematic indicators at both sites suggest that reverse motion on the fault was preceded by an earlier episode of sinistral strike slip. Offset hangingwall and footwall unconformities constrain approximately 320 to 465 m of vertical separation along the fault. At its southern limit, the DCF sweeps westward into parallelism with the Castle Mountain fault near Castle Mountain, whereas the fault decays into a syncline-anticline pair to the north. Nearby to the east, broad, diffuse shear zones up to several hundred meters wide parallel the Chickaloon River and deform Early Jurassic Talkeetna Formation volcanic rocks (Jtk). The zone separates the Paleocene unconformity in the same sense as the DCF, elevating the Tar/Jtk contact to the west approximately 750 m higher than the corresponding unconformity to the east. The faults may be bounded to the north by crudely mapped, relatively unstudied northeast-trending faults that follow the exhumed Jurassic intrusive arc margin with the Mesozoic forearc basin for approximately 75 km and define the northwestward limit of Paleocene-Eocene sedimentary outcrops. Thus, the system appears to delineate the structural margin of the Paleogene forearc basin.

Controls on Reservoir Quality of the Nanushuk Formation (Albian–Cenomanian), North Slope, Alaska

Kenneth P. Helmold, David L. LePain (Alaska DGGS)

The Nanushuk Formation forms a segment of the Brookian sequence which comprises part of a giant clinothem filling the western two-thirds of the Colville basin. It consists of intertonguing marine and nonmarine strata interpreted as shelf, deltaic, strandplain, and fluvial deposits. Deposition occurred in two deltaic complexes, one sourced from large drainage basins extending west of Alaska, the other from smaller catchment areas with headwaters in the ancestral Brooks Range to the south.

The Nanushuk consists of medium- to very fine-grained lithic sandstone comprised largely of quartz, chert, and argillaceous rock fragments. With progressive burial and compaction, ductile deformation of the argillaceous detritus is the principal mechanism of porosity and permeability loss. Cements are a minor component and have minimal effect on diagenesis of the strata. Reservoir quality varies extensively across the North Slope and deciphering the controls on reservoir potential is a critical aspect of recent exploration programs.

Two groups of sandstone are recognized based on differences in reservoir quality: a low-porosity group with maximum porosity less than 20 percent, and a high-porosity group with higher porosity values for a given permeability and maximum porosity exceeding 30 percent. Variation in reservoir quality within each group is delimited by depositional texture which is a primary, local control. The disparity between the groups results from differences in maximum burial depth (Dmax) the rocks experienced which is a secondary, regional control. Linear regression models for porosity–Dmax and permeability–Dmax relations enable forecasting the reservoir potential of Nanushuk sandstone prior to drilling.

The transition from convergence to translation on the western margin of North America: evolution of the ancestral Denali Fault in southeast Alaska

By S.M. Karl[1], L.D. Miller[2], P.J. Haeussler[1], J.S. Caine[3], J.P. Norton[4]

The Denali Fault (DF) is a crustal scale strike-slip fault that extends >2000 km from central interior Alaska to southeast Alaska (SEAK). The DF postdates mid-Cretaceous accretion of oceanic Insular terranes to the North American margin, locally juxtaposes a 10-15 km contrast in Moho depth, and geologic markers indicate >400 km of dextral separation along the fault in east-central Alaska, Yukon, and northwestern British Columbia, mainly since early Eocene time. Models to accommodate post-Eocene separation of >400 km in SEAK vary from a single structure to several interactive dextral faults. We outline the mid-Cretaceous to Tertiary structural history of SEAK, describe the structures that host Tertiary gold mineralization, and consider evidence to constrain tectonic models.

Mid-Cretaceous accretion of the Insular terranes was accommodated by structures that are represented regionally by rock fabrics assigned to five deformation events. Initial D1 deformation is represented by west-vergent contractional fabrics that are truncated by ca. 90 Ma plutons and contain ca. 89 Ma white mica. Northwest (NW)-trending, moderately to steeply northeast (NE)-dipping D2 structures involve the ca. 90 Ma plutons, have a fabric defined by peak metamorphic minerals, and include faults that place Laurentian-affinity terranes westward over oceanic plate-derived Insular terranes, accommodate contraction within Insular terranes, and involve Cenomanian fossil-bearing Gravina belt strata that were deposited on the continental margin and on Insular terranes. These structures are locally cut by ca. 72-60 Ma plutons of the Coast batholith. D3 structures are oriented as much as 45° counterclockwise from D2 structures, are southwest vergent with moderate to steep NE dips, and guided emplacement of km-scale syndeformational tonalitic sills that intruded accreted continental- and oceanic-affinity terranes diachronously from northwest to southeast in the interval of ca. 80-55 Ma. D1-D3 structures are locally truncated and overprinted by the latest Cretaceous to Eocene Coast shear zone (CSZ), which is 1-6 km wide and extends >800 km from SEAK to coastal British Columbia. The CSZ (D4) dips moderately to steeply NE, contains quartz-filled foliations and shear structures as wide as 20 m, and has moderately NW- or SE-plunging fold hinges and mineral lineations. Its eastern margin is locally characterized by a mylonitic foliation up to several hundred meters thick that deforms the magmatic foliation in hanging wall tonalitic sills as young as 55 Ma in the Coast batholith. CSZ structures cross terrane boundaries and truncate the tonalitic sills. D5 shear zones cut the CSZ, lie mainly southwest of the CSZ, and contain steeply dipping boudinaged quartz veins, compatible with regional shortening. The D5 structures include gold-quartz veins of the Juneau gold belt, which is 160 km long and 5-8 km wide in northern SEAK. The Alaska Juneau (AJ) gold deposit formed in D5 shear zones within the Insular composite terrane. Biotite from ore-bearing diorite yielded Ar-Ar dates of 57-58 Ma and white mica in mineralized structures in the diorite is ca. 56 Ma. Within the Insular composite terrane and roughly 3 km west of the strike of AJ shear structures, the >350 m wide Kensington megashear hosts the Kensington gold deposit, which consists of mesothermal gold-bearing quartz veins that yielded Ar-Ar white mica dates of 53-56 Ma. Gold mineralization formed in tensional and compressional quartz veins, suggesting an Eocene transition to transtensional structures.

In Gastineau Channel, a steep to vertical NW-trending ductile-brittle fault zone containing quartz vein breccia and gouge postdates mineralized gold-quartz veins, indicating post-53 Ma activity. This fault is a segment of the regional Coast Range Megalineament (CRML), which extends from Chatham Strait southeastward to coastal British Columbia. This regional fault crosses and locally overprints D1-D5 structures and includes structures indicating reverse-dextral motion. This transition from dominantly contractional to wrench-dominated transpressional deformation is inferred to correlate with a shift in oceanic plate trajectories relative to North America at 55-52 Ma during D5. Previous workers have suggested that the Gastineau Channel fault and CRML represent an ancestral DF. Our work suggests the CRML evolved in response this early Eocene change in relative plate motions, which is corroborated by recent work on the DF in central Alaska and Yukon that indicates >400 km of dextral separation was initiated around this time.

Southwest of the CRML, a network of steep dextral faults is overlain by alkaline felsic to mafic volcanic rocks dated at 30 to 25 Ma. A series of transtensional step-over basins that contain Late Paleocene to Miocene fossils, extending from the Kelsall River in northwestern British Columbia to Eagle Island in southern SEAK, are also overlain by these volcanic rocks. These basins, 30-25 Ma volcanic rocks, 26 Ma granite, and the Gastineau Channel-CRML are truncated by the north-trending Chatham Strait Fault (CSF), on which Paleozoic stratigraphic markers indicate ca. 180 km of total dextral separation that likely occurred since 26 Ma.

In northwestern SEAK, merging of the trace of the DF in the Chilkat River with the trace of the CSF in Chilkat Inlet is supported by well-defined linear bathymetric structures in Chatham Strait. This segment of the DF shows little seismicity; the CSF is not currently active, and seismicity is lacking east of the CSF. Oligocene initiation of the CSF corresponds to transfer of dextral translation from the CRML and coeval dextral faults in SEAK to the CSF-DF. Less than 35 km separates the CRML from the DF on the CSF, which is significantly less than the 180 km of separation on the CSF, requiring additional Eocene to Oligocene dextral translational faults that may be part of an ancestral DF system in SEAK. If 400 km of separation occurred on the DF, then the ca. 180 km offset on the CSF leaves as much as 220 km of unaccounted-for separation to be accommodated on an ancestral DF in SEAK prior to or coeval with CSF activity. The missing slip may be accommodated on the network of dextral faults mapped southwest of the CRML during the ca. 25 m.y. time interval between initiation of activity on the CRML and initiation of the CSF. The combined evidence suggests that the ancestral DF in SEAK, prior to truncation by the CSF in the Oligocene, consisted of an array of dextral strike-slip and transtensional faults.

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Quantifying peat carbon mass using ground- penetrating radar (GPR) and probing in peatlands of the Kenai Peninsula, Alaska

Cameron R. Kuhle (UAA), Eric S. Klein

Peat carbon is known to be one of the largest pools of soil carbon globally and is sensitive to environmental and climatic changes. Peatlands in the Kenai National Wildlife Refuge (KENWR) have been studied for their hydrology, vegetation composition and succession, peat accumulation, and similar characteristics, but the mass of stored carbon is yet unknown. We expect KENWR peatlands to comprise significant reserves of sequestered carbon and are using a synthesis of soil and wetland surveying techniques to better constrain estimates of regional contributions to global values. A low-frequency (100 MHz) GPR instrument was utilized at two sites selected for suitable topography and hydrology to measure peat basal layer depth. Radar velocity was calibrated with manual depth probing to ensure accuracy of measurements, allowing GPR to be used to collect many more data points than probing alone. Peat cores were extracted from each site and sampled at regular intervals for elemental analyses to conducted at the University of Alaska Stable Isotope Laboratory. Carbon content by mass percent informs the primary study objective, while ancillary analyses of carbon isotopes, organic content, nitrogen content, radiocarbon dating, and bulk density contextualize the data and potentially identify historical trends. Carbon content and bulk density data enable the calculation of total carbon mass given the basin volume estimate developed from the GPR survey. Estimates calculated from the point-depth interpolations and organic matter content data indicate an areal density of approximately 1000 metric tons carbon per hectare.

The State of the Alaska Geologic Materials Center Address

Kurt Johnson – Alaska DGGS

The Alaska Geologic Materials Center (GMC) is approaching its eighth year of operation in the rejuvenated 100,000 square foot Anchorage facility. Join the Curator for a hypothesis free examination of recent events and changes at Alaska's largest rock shop. Topics take in what's so good about fees, critical successes, cutting-edge reconnaissance, a better web experience, and more. Questions and feedback are encouraged.

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