

# ALASKA GEOLOGY

Newsletter of the  
*Alaska Geological Society*



## Tar Mapping in the North Slope of Alaska Using Volatile Low Molecular Weight Signatures

**Christopher Smith**

Advanced Hydrocarbon Stratigraphy, Houston, TX

[christopher@advancedhydrocarbon.com](mailto:christopher@advancedhydrocarbon.com)

The volatile chemistries (<150 daltons) from legacy geological materials, core chips and cuttings, with known tar from the Kuparuk River and Prudhoe Bay fields from the North Slope of Alaska were analyzed with rock volatile stratigraphy, commercially available as Volatiles Analysis Service (VAS) from Advanced Hydrocarbon Stratigraphy (AHS) through Baker Hughes. Core chips and drilling cuttings were analyzed from wells with known tar zones. Previous studies involving detailed lithology descriptions, petrography, saturates aromatics resins and asphaltenes MPLC analysis (SARA), and/or rock eval pyrolysis on these wells were used to identify the tar zones. These identified tar zones were correlated to enhanced small molecule signatures in the volatiles analysis data including aromatic molecules and carbon disulfide (CS<sub>2</sub>). Interestingly, while there was some previous data to suggest that aromatics would be a useful target for tar analysis, the use of CS<sub>2</sub> was theoretically predicted by AHS based on Hildebrand solubility parameters but had never been evaluated in the literature. This study is believed to be the first documented case of CS<sub>2</sub> being a useful indicator of a tar phase. The ability to map tar based on small molecule geochemical signatures has significant applications in laterals, especially coiled tubing drilled laterals, where other tools, or the collection of cores/side wall cores, that could traditionally be used are not possible. Such information can be crucial for planning EOR activities and evaluating the petroleum system.

(continued on page 2)

## AGS Meeting

Date & Time:	Thursday, October 22; doors open 11:30 am, announcements 11:45 am, talk 12:00 – 1:00 pm	
Program:	Tar Mapping in the North Slope of Alaska Using Volatile Low Molecular Weight Signatures	
Speaker:	Christopher Smith, Advanced Hydrocarbon Stratigraphy, Houston, TX	
Place:	Virtual online presentation	
Reservations:	Reservations are not required	
Login:	To log in to the presentation see the instructions at: <a href="http://www.alaskageology.org/events.html">http://www.alaskageology.org/events.html</a>	
How to Join:	Join with Google Meet <a href="https://meet.google.com/agq-hxru-meo">meet.google.com/agq-hxru-meo</a>	or Join by phone (US) +1 651-347-1877 (PIN: 403172644)

Additionally, the volatiles analysis of large continuous sections of Kuparuk River wells has provided key insights into the petroleum system of the field and appears to provide proof that the Kuparuk C Sands have a history of being charged at least twice with the second charge being a very light resource that occurred fairly recently in the history of the field. This is clearly seen in the analysis of the C Sand interval in 2U-16 where a GOR gradient from the volatiles analysis can be observed in opposition to the previously described asphaltenes proxy curve and also suggests that this second charge had a role in the development of tar mats in the field.

Finally, the analysis of these Alaskan samples has already shown applicability to mapping tar outside of the North Slope. The evaluation of these signatures has already provided great insights into cases in oil plays present in the midcontinent United States. An example from the Arkoma basin in Oklahoma clearly demonstrates this. Thus, research projects to advance oil and gas in the state of Alaska are leading the rest of the field in basins far beyond those in Alaska.

### About the Speaker:



Christopher Smith has been a Senior Chemist with Advanced Hydrocarbon Stratigraphy (AHS) since January 2019 and works in Houston on data analysis, instrumentation, client engagements, and business development. Most of his analysis work focuses on the North Slope in Alaska, the Haynesville in Louisiana, the STACK in Oklahoma, and the Marcellus in West Virginia. Prior to working for AHS, he completed his PhD in analytical chemistry from the University of Arizona in the Winter 2018 term with focuses on instrumentation, data analysis programming, spectroscopy, electrophysiology, surfactants, and surface modification chemistries. He also completed a MA in history at the University of Tulsa as a Henneke Research Fellow in 2012. He completed his undergraduate work *cum laude* in 2011 with degrees in chemistry, history, and biochemistry also from the University of Tulsa.

## Alaska Geological Calendar of Events



Date	Time	Organization	Event	Location
Sept 17, 2020	11:45 am	AGS	Stephen Hubbard, University of Calgary, "An outcrop analog for the Colville Foreland Basin from the southern Andes: Clinofolds of the Magallanes Basin, Chile"	Webex meeting
Oct 22, 2020	11:45 am	AGS	Christopher Smith, Advanced Hydrocarbon Stratigraphy, "A tar mapping in the North Slope of Alaska using volatile low molecular weight signatures"	Webex meeting
Nov 19, 2020	11:45 am	AGS	Jit Bhattacharya, Texas Bureau of Economic Geology	Webex meeting
Dec 17, 2020	11:45 am	AGS	Steven Bergman, Retired, "Large Igneous Provinces"	Webex meeting
Jan 21, 2020	11:45 am	AGS	Michael West, Alaska Earthquake Center, "Barry Glacier"	Webex meeting
Feb 18, 2021	11:45 am	AGS	Elyse Gaudreau, University of Victoria, "2018 Kaktovik Earthquake"	Webex meeting
March 18, 2021	11:45 am	AGS	To be announced	Webex meeting
April 15, 2021	11:45 am	AGS	To be announced	Webex meeting
May 20, 2021	11:45 am	AGS	To be announced	Webex meeting

**AMA:** Alaska Miners Association; **AGS:** Alaska Geological Society; **GSA:** Geophysical Society of Alaska

**AAEP:** Alaska Association of Environmental Professionals; **SPE** Society of Petroleum Engineers;

**UAA** University of Alaska Anchorage.

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<https://www.uaa.alaska.edu/academics/college-of-arts-and-sciences/departments/geology/seminar.cshtml>

## From the President's Desk:

Geology in a hurry. Many will recognize this phrase. But for those who do not, it refers to something much more important than a last-minute dash of work to finish the presentation you have been procrastinating.

In the days immediately following the March 1964 earthquake, around 40 local geologists quickly banded together to identify and delineate areas in the Anchorage vicinity that were susceptible to the dramatic urban landslides that cause so much damage. The Anchorage Engineering Geology Evaluation Group, as they were named, was racing against mounting pressure from landowners who wanted expedited permission to rebuild. "Geology in a hurry" published in Geotimes during October of 1964 is a recounting of the group's activities and results – which were not received with enthusiasm by many. Yet this work proved foundational for how the city of Anchorage is now populated.

AGS is beginning a new column in our Newsletter profiling geologists in our community. Our first profile is that of Ruth Schmidt. She led the group described above and authored the paper (attached). I will not restate her profile here. Instead, my request: for those who are not familiar with her, read this [AAPG Explorer Article](#) (have your AAPG credentials ready), her [Wikipedia](#) page, and her [obituary](#) from April 2014. Also, consider browsing the UAA/APU Consortium Library on her material, either the [online exhibit](#), or the [Special Collection](#). If you did know her, please reply to the editor with any of your favorite moments or anecdotes. We would love to publish them in next month's newsletter.

Finally, a special thank-you to the American Geosciences Institute for permission to reprint the Geotimes article for our members, to Arlene Schmuland at the Archives and Special Collections at the UAA/APU Consortium Library for providing us with a digital version of Ruth Schmidt's personal copy of the "Geology in a hurry" article, and to Ric Wilson for his knowledge and service through the [Schmidt Charitable Trust](#).

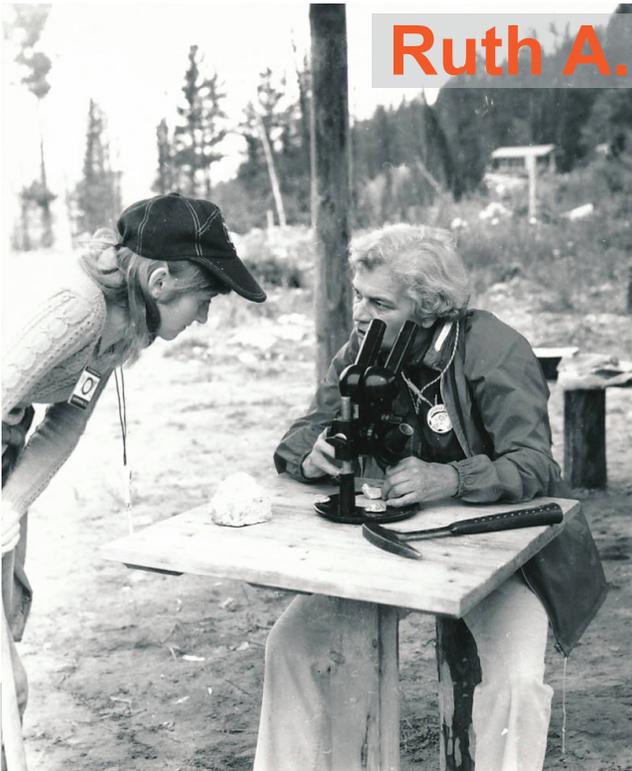
Andrew Dewhurst



General announcements:

- Thank you to Stephen Hubbard's September presentation. Though it may be hard to tell with virtual gatherings, we had over 60 participants, enough to fill the BP Energy Center auditorium.
- Speaking of which, we have received notification that the **BP Energy Center will be closed through the end of the year**. AGS will continue with virtual gatherings.
- The recent AAPG ACE [virtual] conference showcased Alaska geology: Jesse Sommer (Armstrong) discussed the Pikka discovery, two posters on the Cook Inlet from BOEM and UAA respectively, a talk on the Prince Creek Formation by Repsol, several talks co-authored by the DGGS and GMC, and others.
- Send us your stories and photos of Ruth Schmidt, or any other announcements to the newsletter editor: [ken.helmold@alaska.gov](mailto:ken.helmold@alaska.gov)

# Ruth A. M. Schmidt

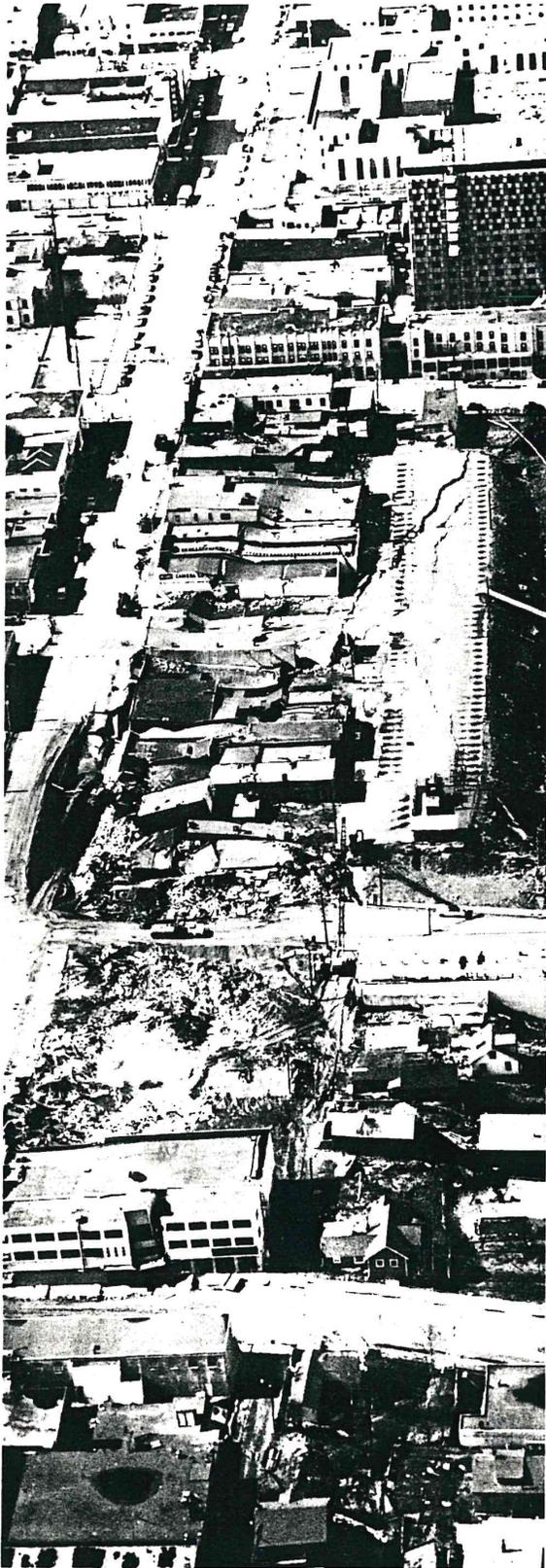


Photos courtesy of UAA/APU digital library

# Geology in a hurry

by RUTH A. M. SCHMIDT

*consulting geologist  
Anchorage*



Surface effects of subsurface slump and slide in downtown Anchorage were mapped by area geologists soon after the earthquake of March 27. (Photo by Mac's Foto, Anchorage)

The Alaskan earthquake of last March 27 not only triggered major landslides in Anchorage but also a major report on urban geology by local geologists—a report ready and being used within three weeks.

There are many resident geologists in Anchorage, working with government agencies and petroleum and mining companies and as consultants. Within 72 hours of the major shock and landslides, many of these geologists were organized as the Anchorage Engineering Geology Evaluation Group, base maps were procured, aerial photographs flown, and a drilling program started.

Within the first week, several interim reports outlining hazardous areas, both for use by city officials in replacing utilities, and Alaska State Housing Authority, for urban renewal, were issued, and on April 13 a preliminary report was read to the City Council, and later released to the public. The final report, completed May 8, provided the basic data for all subsequent programs by private and federal agencies.

On March 29, less than 48 hours after the earthquake, Lidia Selkregg, a geologist with Alaska State Housing Authority, realized the urgent need for mapping the landslide areas. She put the problem to her agency, and with the cooperation of city officials an announcement was broadcast on all radio stations, asking all geologists and soil scientists to meet the next morning in the Public Safety Building.

Some 40 geologists, soil scientists and engineers responded. Dr Selkregg explained to the group the need for immediate mapping to outline areas of damage and potential danger, to guide reconstruction and relocation to be made under the Urban Renewal Program for her agency, and to aid utility repairs and other public works. She was the only geologist on ASHA's staff, she said, and needed help.

By general agreement, I was appointed group coordinator. Before the day was over, aerial photographs had been flown, base maps obtained from the city, a drilling program contracted and space obtained in two house trailers (the 'Tremor Trailers,' we called them—one had to look outside at telephone wires to see whether it was another earthquake or just a heavy-footed geologist).

The State Housing Authority and the city of Anchorage sponsored the study and provided their local

resources and money for contracted services. In addition, many state and federal agencies supplied personnel and equipment for as long as six weeks. Several oil companies contributed personnel, stereoscopes and reproduction facilities. No control was exercised on the Evaluation Group's policy, investigative methods, or decisions.

On March 31, some 50 geologists and other earth scientists gathered to begin field mapping. Don H. Richter, of the State Division of Mines and Minerals, who had already started mapping downtown, discussed uniform mapping symbols and techniques. Reuben Kachadoorian of the U.S. Geological Survey spoke briefly, emphasizing items to be observed. The Greater Anchorage Area was divided into sectors, and maps assigned to two-man teams. Those who were not mapping set up office space in the trailers to gather data. Aerial photos that had been flown March 30 were delivered and Keith W. Calderwood of Phillips Petroleum Co. took charge of the photogeologic phase.

As teams came in, they were sent out to areas needing more mapping. By the end of the first week, most of the field mapping had been completed on a scale of 1 in.=500 ft, and was being transferred by draftsmen to Mylar bases and overlays. As this was done, it was correlated with the photogeology. When field maps did not appear up to standard, or if photos and field mapping disagreed, the areas were rechecked. The Downtown and Turnagain slide areas were remapped on a scale of 1 in.=100 ft for greater detail.

Drilling had started in the slide areas, but laboratory results did not start to come in until the end of the first week. On April 3, James A. Hamilton and other geologists from the Alaska Department of Highways started working on the results of the surface and subsurface sampling program.

A program of monitoring building movement and measuring displacement along streets in the slide areas was contracted for in the first week. The second week, Bill Bedford of Texaco, Gerald Ganopole—a consultant temporarily with the State Housing Authority—and Darrell Helmuth of Standard Oil Co. of California started assembling data for the written report. Even though laboratory results from only a few holes were completed by April 8, enough data were available to tentatively locate a zone of slippage within Bootlegger Cove Clay, which underlies much of Anchorage. Strongly urged on by the local press, the Group agreed to prepare a preliminary but incomplete report.

On April 13, as Group coordinator, I read the high spots of the preliminary report to the City Council, and by the end of that week, nearly 200 copies were ready for distribution, with city employees and the geologists helping collate them.

Other work by geologists in those first two weeks:

March 31 (4 p.m.)—A preliminary unofficial map to the city authorities outlining downtown landslide areas (scale: 1 in.=500 ft).

April 2—Preliminary map of Greater Anchorage Area, outlining all slide areas (1 in.=1 mile), and a general statement of safe areas and buildings and what was being monitored.

April 3—Map of Turnagain slide, plus line indicating hazardous areas back of bluff (1 in.=500 ft).



Some Anchorage property owners found it hard to believe that this could happen again. (Photo by Dolores D. Roguszka of Anchorage)

April 5—Television program, with City Manager Oldland, Robert Miller and Ernest Dobrovolsky of the USGS, and I to explain what had happened, and what was being done.

During the first two weeks, geologists were also called on by Civil Defense to investigate 'steam coming out of the ground,' frost boils, ground rising, new cracks appearing in houses, and so on.

Daily for the first week and then on alternative days, the progress of the group was reported to an Earthquake Coordinating Committee, established by Gov. William A. Egan, in which all agencies exchanged information to avoid duplication of effort. Julius Moor, a mining geologist temporarily with the State Housing Authority, kept a diary of daily events upon which I drew heavily in writing this article.

Also, the Group was greatly helped by Miller and Dobrovolsky, who had written a report on the surficial geology of Anchorage and vicinity (USGS Bull. 1093, issued in 1959), and who had flown to Anchorage soon after the earthquake.

The preliminary report was available for limited distribution April 15. It consisted of 38 text pages, 8 figures, 12 plates, and 6 photographs, plus a set of city planning maps, reproduced just for the city and the State Housing Authority, showing all cracks and fissures. In its final form—41 pages, 12 figures and 17 plates—it was released May 8. Excerpts:

The following report and evaluation were prepared under emergency conditions for immediate planning use in area rehabilitation. Because of the time limitations . . . a full engineering assessment of the subsurface stability . . . must be left to future investigation.

However, based on universally accepted geological principles, on the knowledge of the subsurface geology of the area, on surface investigation made immediately after the earthquake, on a testing program limited by the urgency of this report, areas of instability have been outlined.

The purpose of this report is to outline ground conditions existing immediately after the earthquake which should guide a detailed geological and soils engineering study of the affected areas, to be conducted immediately to determine appropriate land use.

The following recommendations . . . were made as an aid to, and at the request of Anchorage City officials and authorities of Alaska State Housing Authority. Geologists, realizing that the frequency of aftershocks was high and that a major aftershock was a very strong possibility, suggested that the lives of fellow citizens were more important than monetary value placed on their property. It is to the credit of the City Council that it acted on these recommendations.

. . . While all of the critical subsurface data are not yet interpreted, enough information has been collected and interpreted by the Group to establish that unstable conditions exist locally and that additional information will only refine this evaluation in critical areas. 'Unstable' is used to classify areas that have undergone movement, weakening, and deformation, and which will be subject to additional movement in the future.

The unstable area, as delineated, is now subject to continual slumping and differential settling along the many fissures (of which only those visible in the preliminary survey are shown on the map) and will be continually weakened by ground-water activity along the fissures. Building or residential rehabilitation should not be attempted and the present residences should be relocated.

On the basis of present information, the West Turnagain area, although locally not heavily fissured, is considered to be in the same unstable category as the adjacent Turnagain area. If future subsurface information and geological evaluation indicates that different subsurface conditions do exist, only then should the West Turnagain area be considered stable.

Conditions are favorable for future major movement of all these slide blocks, and settling and slumping will undoubtedly continue. For these reasons, we recommend that the City consider evacuation of all persons residing within the outlined unstable areas until more detailed studies may be made.

Any rehabilitation program should be directly oriented toward these geologic facts: (1) major earthquakes will occur in the Anchorage area in the future. (2) Geologic conditions are favorable for earthquake-triggered slides similar to the Turnagain slide. (3) Badly fissured areas are now zones of weakness and if not rehabilitated properly could in the future become another Turnagain disaster area.

After the report was read to the City Council, the Anchorage *Daily News* of April 14 reported:

'City councilmen decided to make sure that residents were notified of the report recommendations and then leave it up to individuals to decide whether or not they want to move out. They also decided not to grant permits for construction or repairs in the areas until further study is completed, although occupants of structurally safe buildings will be permitted to remain in them. . . . The council decided to continue service to the areas by emergency utility installations but not to construct permanent installations until the soil study is completed.'

One developer, quoted in the Anchorage *Daily Times*, said 'We lost enough in the earthquake but these experts, these geologists, in pronouncing the death knell of earthquake, have done equal damage. If there was anything precarious or unsettled after that first world's [sic] biggest earthquake, the second one a week later would have shaken down any questionable piece of property. . . .' Another resident quoted in the *Times* said he did not 'like to hear geologists make positive statements, as it forces other experts to withhold their views.'

And in the weeks that followed, an editorial writer of the Anchorage *Times* came out against not only geologists, but all scientists and long-haired professionals in general.

Some of this, of course, was expected. And many of the citizens were naturally alarmed. For this reason it was necessary for them not only to see the report, but to be able to interpret it. The *Daily News* reprinted parts of the report, and supported it in its editorials.

During the compilation of the data, a strict silence was imposed on the working members, for no one knew the entire picture. It was not considered wise to let any individuals make statements they would not have made with access to all the data.

But when the preliminary report was made, it behooved members who had worked with the group to inform the affected citizenry. Those no longer working on the report did so.

On April 20, Bill Bedford and Gerry Ganopole, who had worked with the Evaluation Group, appeared with George Moerlein, mining geologist, a state representative and a councilman on a radio program to discuss landslides triggered by earthquakes. On April 21, Bedford and Ganopole appeared on television to explain the report. The same night, the Alaska Geological Society held a meeting for all its members, where the report was explained by members of the Group.

After that, many geologists in the community took copies of the report and explained it in detail to small groups, such as their neighbors, and to larger groups such as the Lions, the Turnagain Homeowners, and the Citizens Council for Civic Improvement. Bill Bedford spoke several times before the City Council.

On April 17, the State Housing Authority completed an application for an urban-renewal project for downtown Anchorage. As of May 21, the first phase of Urban Renewal had been completed for both Turnagain and Downtown.

Nearly 40 persons were working on the project the first two weeks—this, of course, does not include contracted work. Drilling and laboratory testing was done by Arctic Alaska Testing Laboratories; aerial photography was by Air Photo Tech Inc of Anchorage. Monitoring of building movement and street measurements were by Tryck, Nyman and Hayes, Dickinson-Oswald, and the city.

But the direction and interpretation of the data, all mapping and photogeologic work, and drafting and assembling of the report were done by volunteer geologists and draftsmen. State, federal and city agencies donated the time and equipment of their personnel, as did many oil companies and private individuals. To ensure continuity and completion, three private geologists—Ganopole, Moor and I—were put on the State Housing Authority's payroll temporarily. Moor and I stayed with it to the completion of the final report, as did four employees of the Alaska Department of Highways and one from the State Division of Lands.

The final report completed the initial subsurface work including laboratory analyses of holes completed, and all data available by April 30. Additional detailed mapping was done in several areas, to complete that started in the first two weeks. No conclusions reached in the first two weeks were changed.

As can be seen, geological reports are not always enthusiastically received.

No one likes to be told his house and business are on landslide areas, but if they are, how much better it is to know it. The earthquake-triggered landslides brought home to many people the need for factual geologic data. The Group provided this.

And on May 19, Task Force 9—a Presidential Field Committee for earthquake reconstruction—issuing its first report, included all the areas that the Engineering Geology Evaluation Group called hazardous, and enlarged the boundaries, calling them high-risk areas.

What will happen now? The citizens and home owners are informed. Many residents of the landslide areas are geologists, some of whom worked with the group. City officials are informed. And everyone is waiting for the final results of the soil studies contracted by the Corps of Engineers for the city. Will it be economically feasible to stabilize any of these slopes? Should the areas be turned into recreational areas only?

Time will tell—it is most difficult for home owners—but geologists have done their part as citizens to see that everyone has been made aware of the hazard of building on landslides and similar weakened and unstable areas. Let us hope that they can continue to guide the city, and to help see that disasters do not recur.

# My Pet Rock

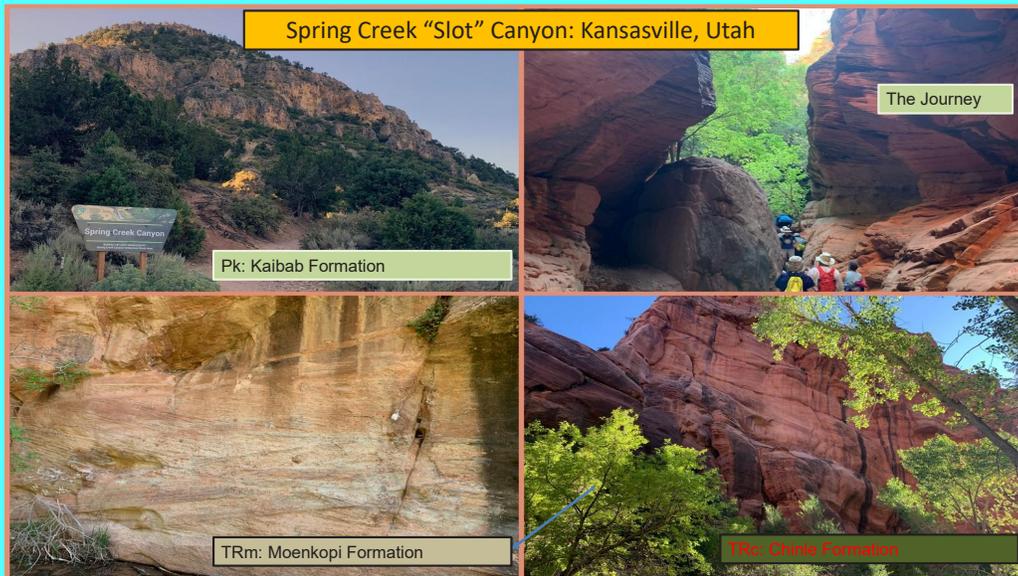
Steve Carhart

## Spring Creek Canyon –South West Comments from Geology Hobbyist – Steve Carhart

- A day trip up and back into Spring Creek C. Want to make it a little harder to find, so no map coordinates. These South-West beauties needs to be harder to access.
  - Hike. Gentle climb until hit what was obvious boulders from flash floods.
    - Some scrambling after first boulder field. Total hike about 8KM
    - Canyon at narrowing about 1-2M width at places.
    - Lots of Butt sliding. Cliff walls greater than 30M.
    - Small stream that you cross several times. I am sure that this stream carries rocks from younger formations to the older Kaibab. Can't use river wash as a formation indicator.
  - Geology. Beautiful slot canyon that crosses four (by the state geology map) formations. Kaibab, Moenkopi, Chinli. I list another, but not sure I ever saw it.
    - Formations were easily observed with help of the very large "Geology of" books. Note to self. Make your summary report earlier, leave books home, bring something flat to write and draw on.
    - Tolerate all types of questions and asked only because I had the book. And not being an expert I had to make up stuff.
      - Will we see any Dinosaur bones?
      - Did they eat Cottonwood Trees?
  - Enjoy the journey. I did!



My Pet Rocks: Fossils found in Kaibab Limestone:  
Burrows, Brachipods



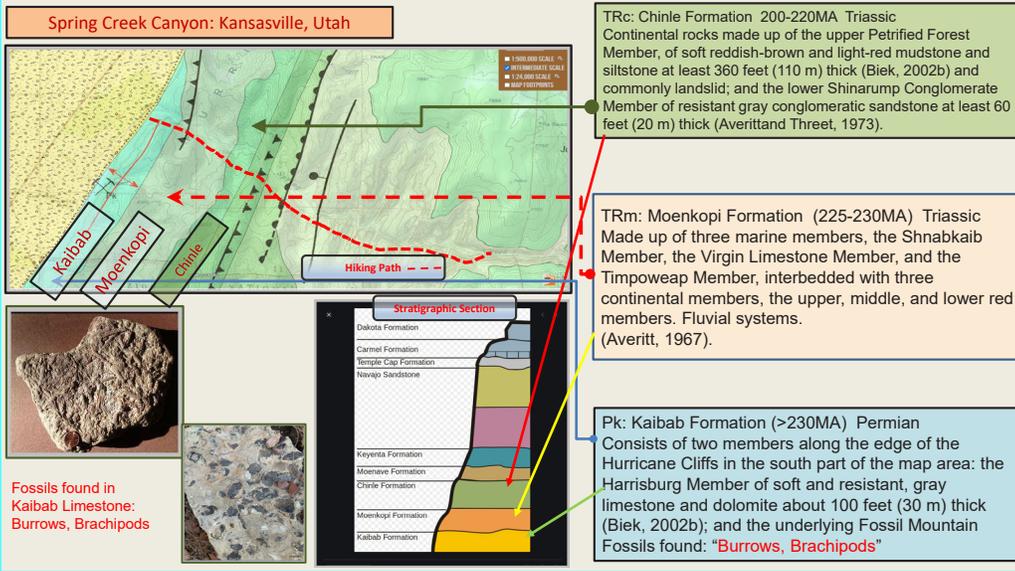
Spring Creek "Slot" Canyon: Kansasville, Utah

Pk: Kaibab Formation

The Journey

TRm: Moenkopi Formation

TRc: Chinle Formation





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The Alaska Geological Society, Inc.  
P.O. Box 101288

Anchorage AK 99510

On the web at: <http://www.alaskageology.org>

The Alaska Geological Society is an organization which seeks to promote interest in and understanding of Geology and the related Earth Sciences, and to provide a common organization for those individuals interested in geology and the related earth sciences.

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Kenneth P. Helmold (Editor)

Alaska Geological Society, Inc.

P. O. Box 101288

Anchorage, AK 99510

e-mail: [ken.helmold@alaska.gov](mailto:ken.helmold@alaska.gov)

907-269-8673 (office)

## MEMBERSHIP INFORMATION

AGS annual memberships expire November 1. The annual membership fee is \$25/year (\$5 for students). You may download a membership application from the AGS website and return it at a luncheon meeting, or mail it to the address above.

Contact membership coordinator Kirk Sherwood with changes or updates (e-mail: [membership@alaskageology.org](mailto:membership@alaskageology.org); phone: 907-334-5337)

All AGS publications are now available for on-line purchase on our website. Check to see the complete catalogue:

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Director 2020-2022	Steve Wright	907-854-2362	<a href="mailto:AlaskaGeo@aol.com">AlaskaGeo@aol.com</a>	Consultant
Director 2020-2022	Sean Regan	907-474-5386	<a href="mailto:sregan5@alaska.edu">sregan5@alaska.edu</a>	UAF
Director 2020-2022	Matt Frankforter	907-717-6898	<a href="mailto:mfmattkate@gmail.com">mfmattkate@gmail.com</a>	
AAPG Delegate	Andy Dewhurst	907-265-6229	<a href="mailto:andrew.dewhurst@conocophillips.com">andrew.dewhurst@conocophillips.com</a>	ConocoPhillips
PSAAPG AGS Representative	Andy Dewhurst	907-265-6229	<a href="mailto:andrew.dewhurst@conocophillips.com">andrew.dewhurst@conocophillips.com</a>	ConocoPhillips
Advertising	Steve Carhart	907-565-9087	<a href="mailto:Steve_Carhart@hotmail.com">Steve_Carhart@hotmail.com</a>	
Education/Science Fair				
Field Trips	Marwan Wartes	907-451-5056	<a href="mailto:marwan.wartes@alaska.gov">marwan.wartes@alaska.gov</a>	AK DGGS
Bylaws	Sue Karl	907-441-8010	<a href="mailto:smkarl107@gmail.com">smkarl107@gmail.com</a>	USGS
Memberships	Kirk Sherwood	907-240-2546	<a href="mailto:membership@alaskageology.org">membership@alaskageology.org</a>	
Newsletter Editor	Ken Helmold	907-269-8673	<a href="mailto:ken.helmold@alaska.gov">ken.helmold@alaska.gov</a>	AK DOG
Publications	Alexandra Busk	907-696-0079	<a href="mailto:alexandra.busk@alaska.gov">alexandra.busk@alaska.gov</a>	AK DGGS
Scholarship	Sue Karl	907-441-8010	<a href="mailto:smkarl107@gmail.com">smkarl107@gmail.com</a>	USGS
Website	Heather Beat	907-443-3842	<a href="mailto:Heather.a.beat@gmail.com">Heather.a.beat@gmail.com</a>	Glacier Oil & Gas
Fundraising				