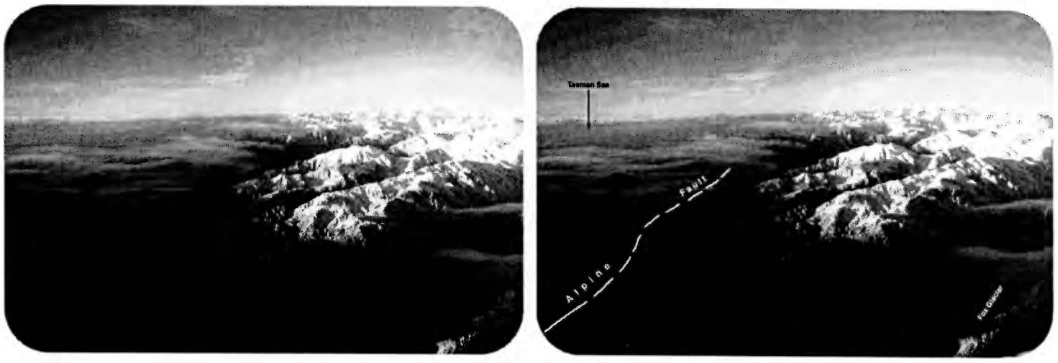
A STEREO PICTURE GUIDE TO WRENCH FAULTS

by
Hugh Dresser
1997



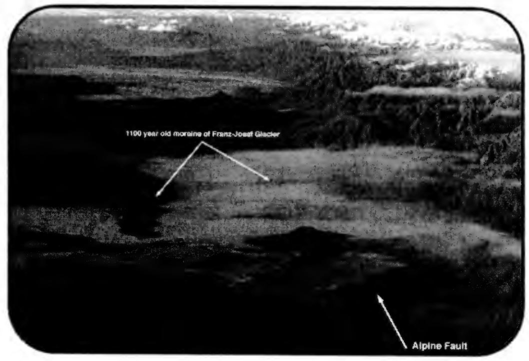
You are looking toward the northeast along the Alpine Fault on the South Island of New Zealand. The straight outcrop of the fault indicates that it dips steeply at the surface. Geophysical evidence indicates that it dips about 40 degrees toward the southeast in the subsurface and that it is a zone of high heat flow. To the north the thin, dense Pacific plate dives under New Zealand's North Island along the leading edge of the Indian-Australian plate. Here on the South Island, the Pacific plate rotates counterclockwise as it forces Meszoic greywacke up and southwestward along the Alpine Fault To the south of South Island, the Indian-Australian plate is forced below the Pacific plate and may force the rocks along the northwestern side of the Alpine fault to slide toward the northeast. The resulting horizontal offset along the Alpine Fault amounts to about 500 km (300 miles).

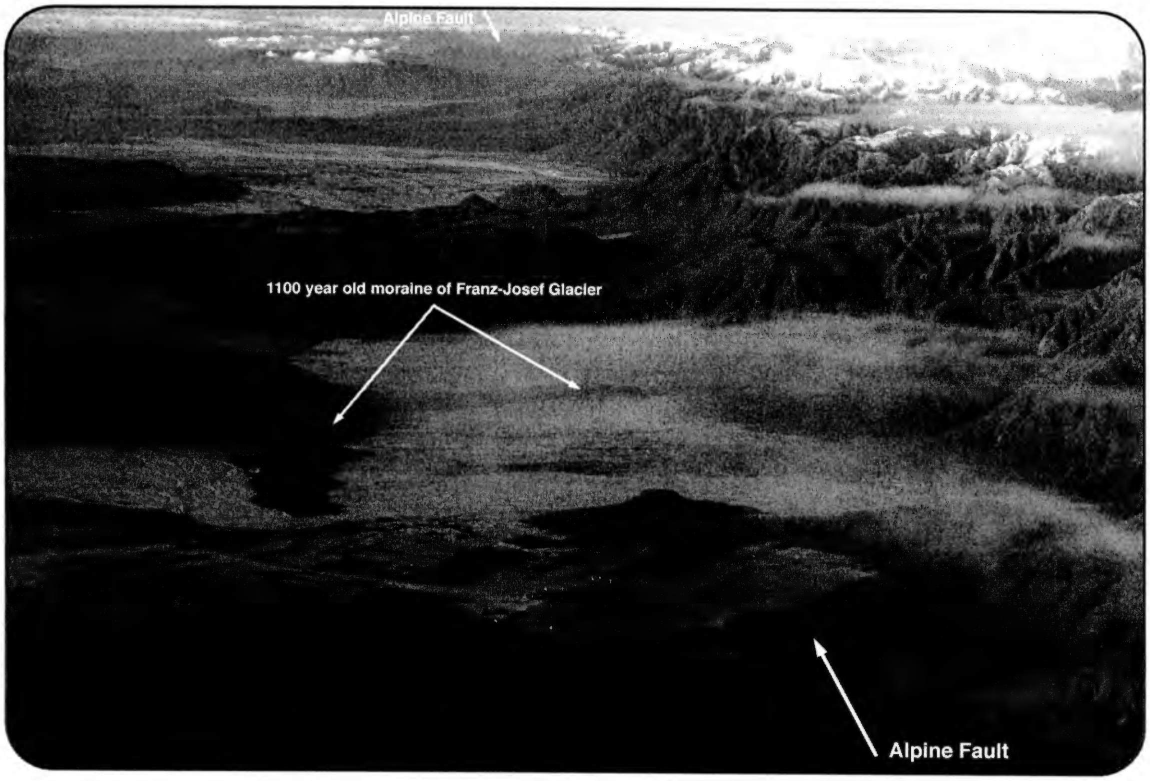
Viewing Stereo Images

The two small pictures at the top of each page are a stereo pair. To see the image in three dimensions, you need to look at the right image with the right eye and the left image with the left eye. To do this, pick out some prominent feature in the pictures and stare beyond the pictures. The two prominent features, one from each picture, should float together in the center. This center image will be in three dimensions. At first it may not be in focus. You are accustomed to associate convergence of your eyes with focus. If you continue to stare at the center image, your mind will ultimately relent and focus on the center image while your gaze remains parallel, each eye looking at its respective image.

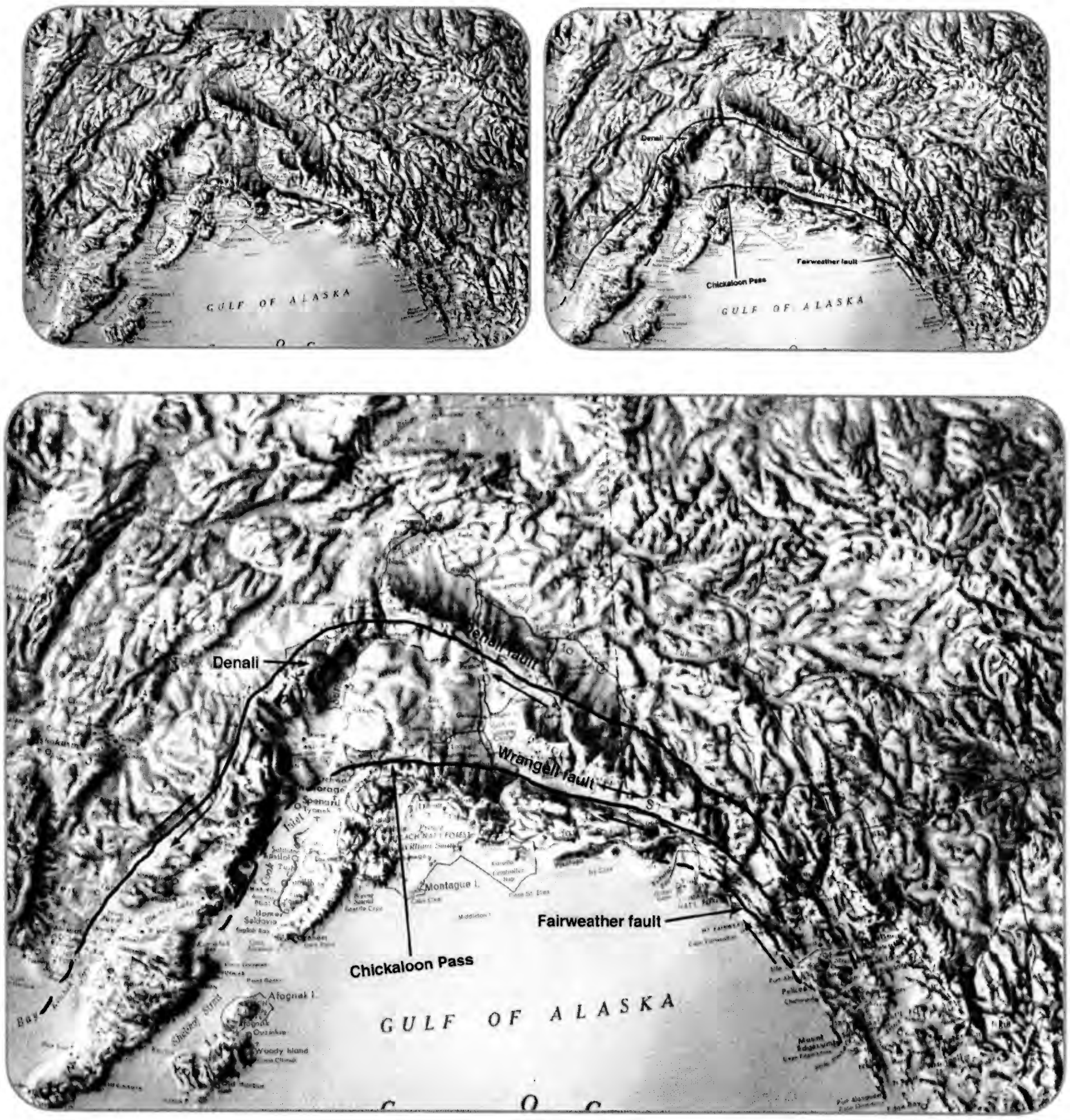
A simple exercise may help prepare you for this unaccustomed way of viewing. With your hands at arm's length in front of your eyes, touch your two index fingers together as you look beyond them. You should see a sausage image between your two index fingers. Your eyes are parallel, the right one looking at the right finger, the left one at the left finger. The two images have floated apart, the right one to the left and the left one to the right to form the sausage. The feeling in your eyes is the one you should try to imitate when looking at the stereo images. Some will master the technique instantly. It will take longer for others. If you don't succeed at first, keep trying at odd times. Try sometime when you are really tired and tend to see double images anyway when you stare at objects. If I could learn to do it, anyone with two good eyes can. I worked at it off and on for over two years before I suddenly learned the knack.

Your eyes are just a few inches apart. With that small separation, you can see in three dimensions for about 1100 feet. Most of these images were taken from a small airplane flying at a velocity of about 100 mph. The interval between the two images varied from one second to several seconds, giving an effective eye base of between 100 and several hundred feet. With this eyebase, you can see in three dimensions for miles. These pictures produce spectacular three dimensional views not easily obtainable in any other way.



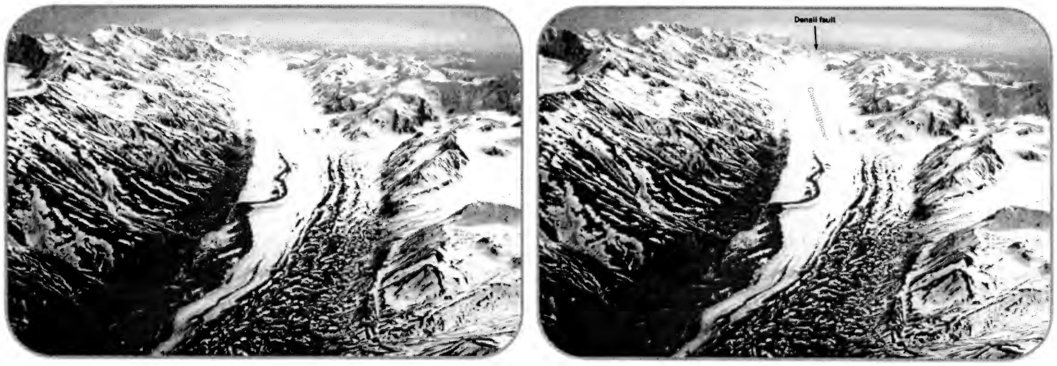


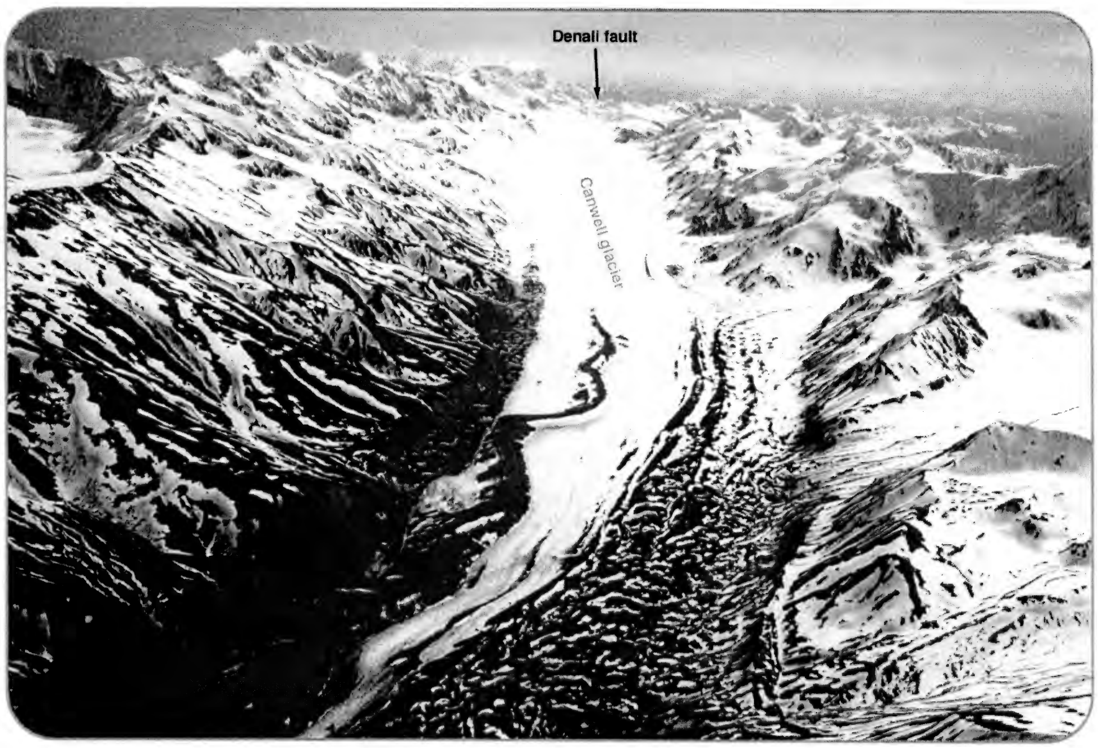
You are looking toward the northeast along the Alpine Fault on the South Island of New Zealand. Rocks along the northwestern side of the fault are offset toward the northeast by about 500 km (300 miles). During the last 10 to 15 million years, the New Zealand Alps have been thrust upward and toward the southwest along the fault, which dips about 40 degrees toward the southeast in the subsurface. Eleven hundred years ago, during a cold period, the Franz-Josef Glacier spread out across the fault at the foot of the Alps to deposit the arcuate terminal moraine visible below the thin clouds.



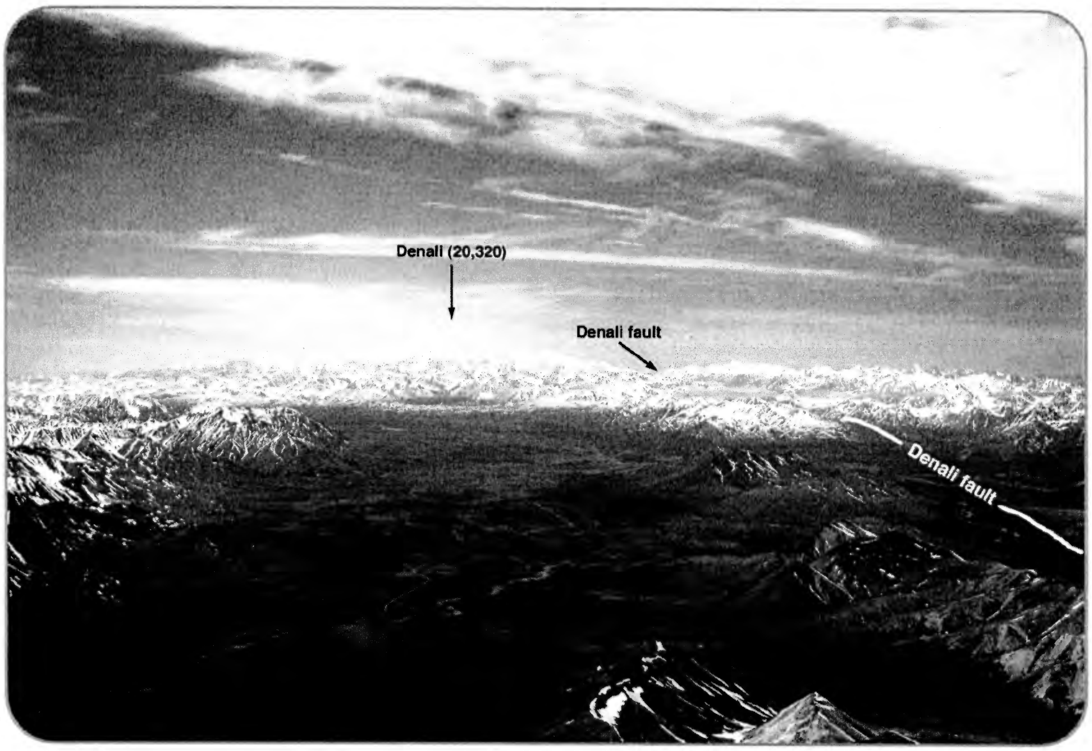
Wrench faults in south-central Alaska

You are looking toward the northwest along the Shakwak Trench, the surface expression of the Denali fault in Canada's Yukon Territory. Kluane Lake is dammed by glacial deposits out of view to the left. Major rivers, the Donjek and the White, drain the east slopes of the St. Elias Mountains and flow directly across the Shakwak Trench as they head northeastward to join the Yukon River. No rivers flow along the trench. The Denali fault separates the North American terrain to the east from a microplate terrain to the west. The accreted microplate terrain is now rotating northwestward along the fault.

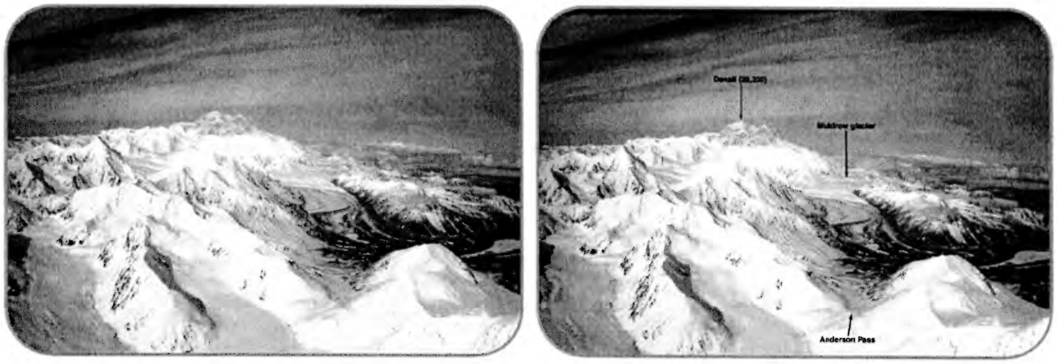


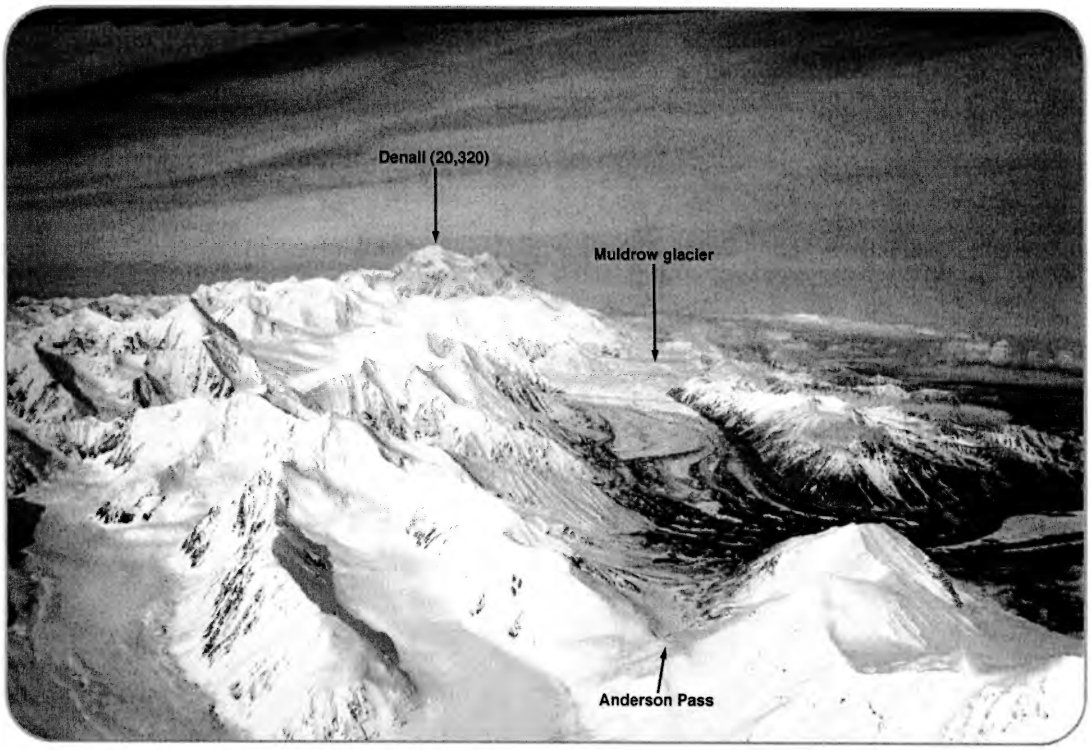


You are looking southeastward from above Pass Isabel at the eastern extension of the Alaska Range. The Canwell glacier carved its bed into the shattered rocks along the Denali fault. The south side of the fault rotates toward you along the fault.

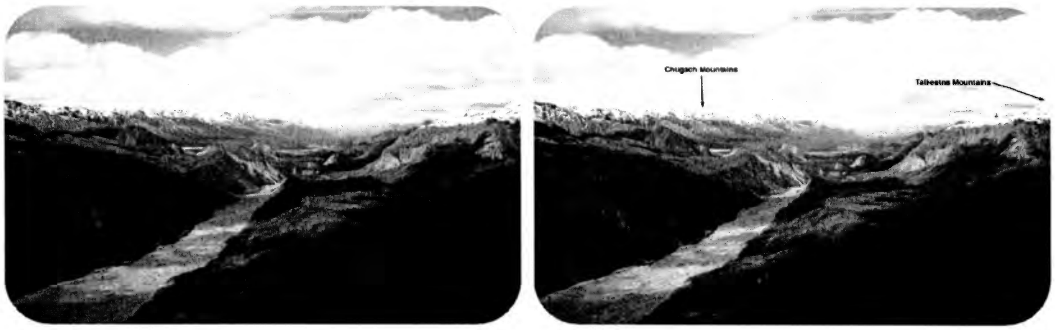


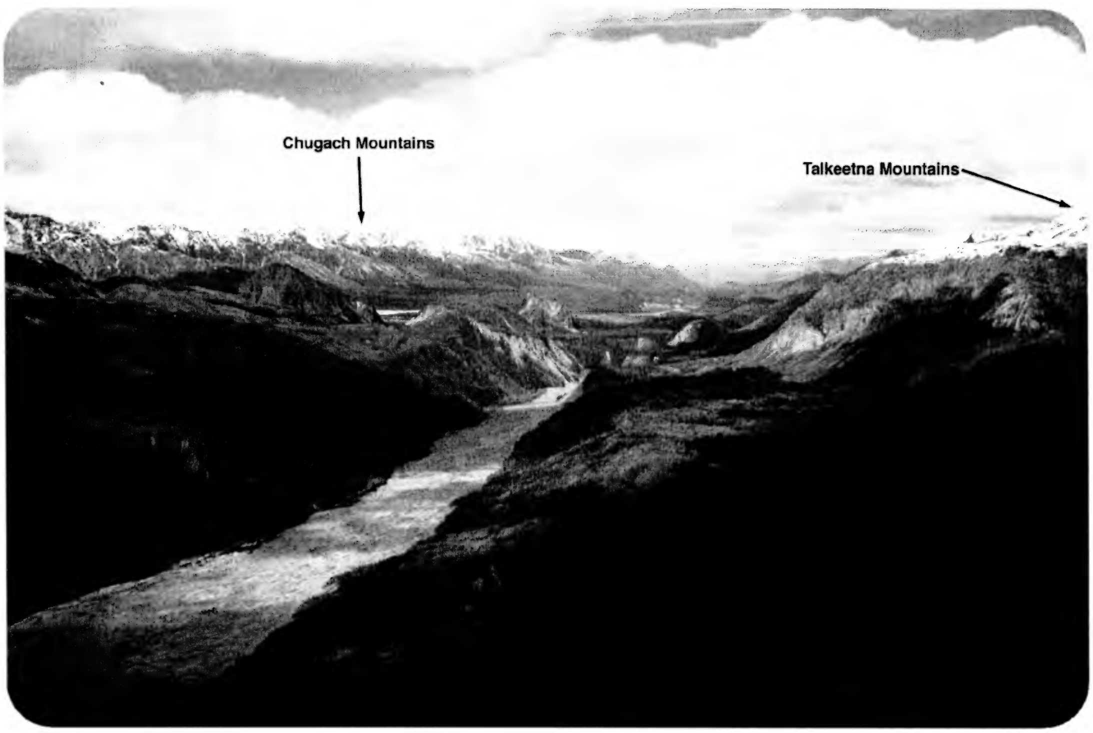
You are looking southwestward at Denali (Mt. McKinley) in the Alaska Range. The Denali fault curves around the back side of Denali to head down toward Bristol Bay. Denali has been elevated as the microplate on the left side of the fault, rotating and sliding away from you, collides with the plate on the right side where the fault curves from a west northwest trend behind you to a south southwest trend behind Denali.





You are looking south southwest along the west side of Denali (Mt. McKinley). The Denali fault extends through Anderson Pass and under the Muldrow glacier.





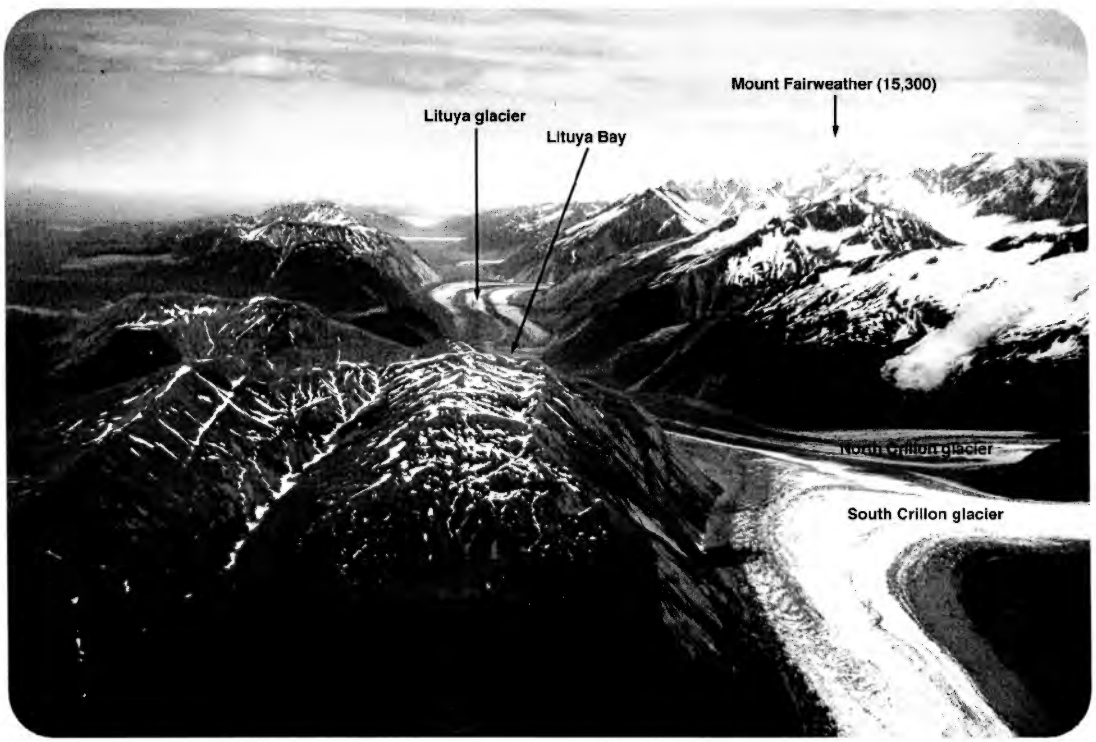
You are looking westward at Chickaloon Pass (Wrangell fault) between the Chugach Mountain melange and the Talkeetna Mountains.

You are looking northeast at Lituya Bay, a “T”-shaped bay. The crossbar of the “T” is in the distance along the Fairweather fault. At 10:16pm on July 9th, 1958 the near side of the Fairweather fault lurched 21 feet northwest and rose 35 feet. The earthquake shook loose about 40 million cubic yards of rock 3000 feet above the bay. The rockfall trimmed 1800 feet off the end of the Lituya glacier and displaced the water in the “T”, generating a wave that rose 1740 feet on the SW side of the “T”. The wave snapped off trees along the sides of the bay and washed two fishing boats in the bay over the terminal moraine into the Pacific Ocean. One washed back into the bay. The other foundered, but the man and his wife were rescued two hours later from their dinghy. A third fishing boat, perhaps securely anchored, vanished.

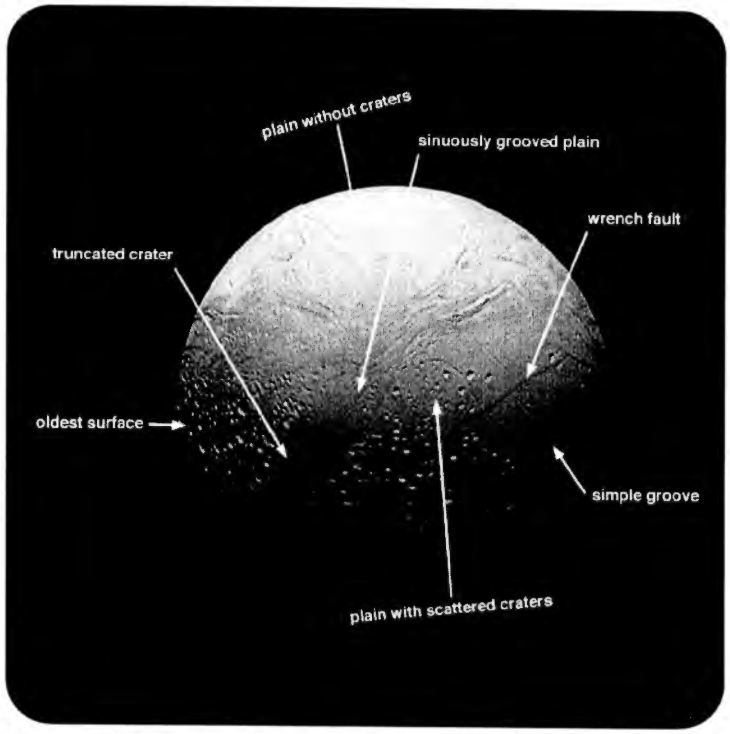
<u>Don Miller of the USGS found evidence of earlier large waves in Lituya Bay:</u>

1853 or 54 = wave height 395 feet. No earthquake known. It may have been generated by a rockfall from the south side of the bay.
1874 = wave height of 80 feet. No earthquake known.
1899 = wave height of 200 feet, probably caused by the Yakutat Bay earthquake.
October 26, 1936 = wave height of 490 feet. No earthquake known.

The mountains of the Fairweather Range rise 10 to 12 thousand feet above the bay

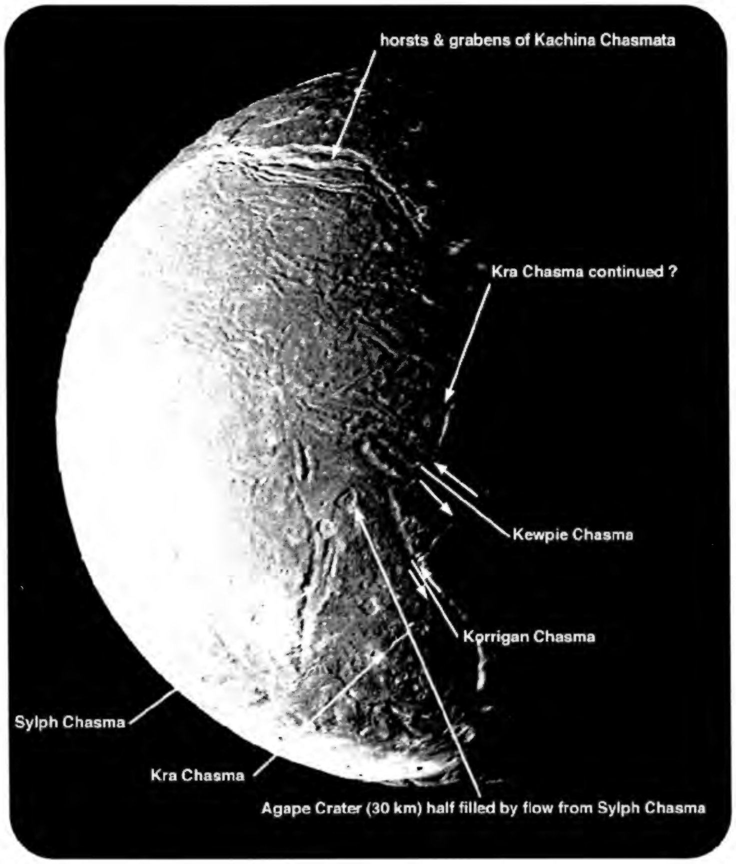


You are looking toward the northwest along the depression excavated by glaciers on the Fairweather fault, southeastern Alaska. On July 9th in 1958 at 10:16 pm the southwest side of the fault slid 21 feet northwest and 35 feet up. The earthquake shook loose 40 million cubic yards of rock 3000 feet above the bay on its northeastern side. This rockslide trimmed 1800 feet off the end of Lituya glacier and displaced the water of the bay into a wave that rose 1740 feet on the southwestern side of the bay, snapping off all the trees along both sides of the bay as it sloshed out into the Pacific Ocean.

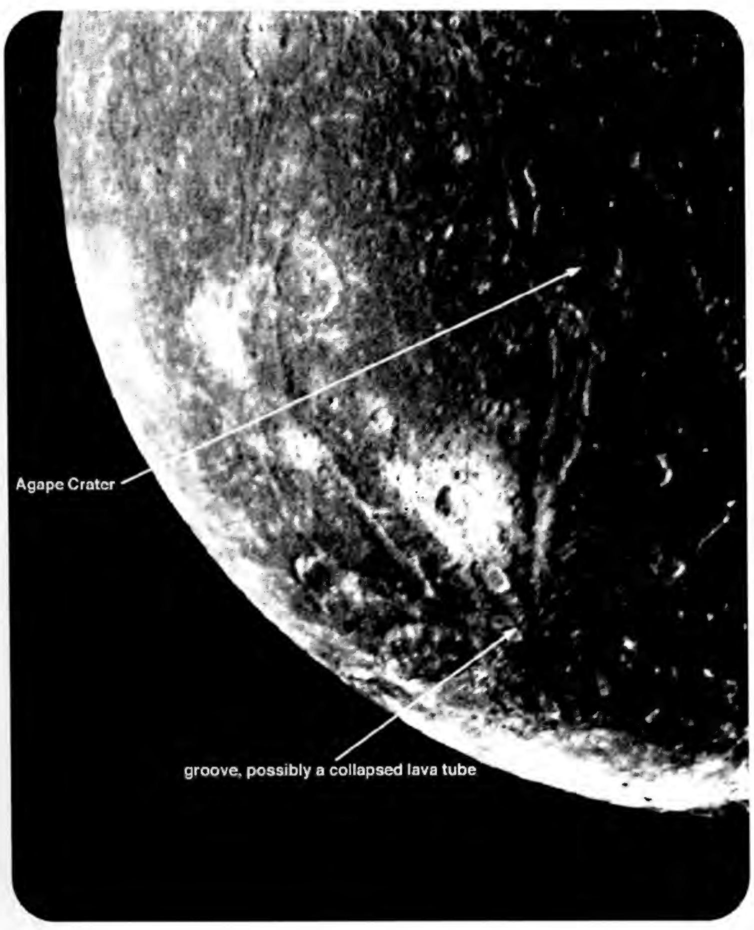


Enceladus, a satellite of Saturn, has a diameter of 500 km and a spg of 1.2. It is the most reflective satellite in the solar system, perhaps covered by fresh frost from volcanic eruptions that produced the youngest terrain, the plain without craters. Its oldest terrain is moderately cratered with flattened craters and is cut by a smooth terrain that contains sinuous grooves and a few sharp craters. A wrench fault displaces simple grooves. The energy for resurfacing may come from tidal flexing.

This enhanced image of Enceladus accentuates the impact and structural features of the satellite.



Ariel, a satellite of Uranus, has a diameter of 1160 km and a spg of 1.66. It has three terrains, a cratered terrain, a ridged terrain, and plains. The cratered terrain is the oldest, but its crater density indicates that it has been resurfaced after the initial heavy bombardment. The ridged terrain consists of grabens and horsts. The grabens are filled with smooth plains-forming material. Korrigan and Kewpie Chasmas appear to have been formed by wrench faulting.



Evidence for ice volcanism on Ariel is provided by Agape Crater, half of which has been filled by smooth plains material that flowed intro the end of Sylph Chasma. Smooth plains material also appears to have flowed into the end of Korrigan Chasma. Sinuous rilles and grooves that run down the centers of some of the chasmas may be collapsed ice-lava tubes.