The Day the Dam Burst

USGS

What do eastern Washington and northern Mars have in common? Evidence of supercolossal flooding.

by Dietrick E. Thomsen

Geology used to be a provincial science. While physicists and chemists proposed laws of universal validity good for the distant stars and galaxies as well as the earth, geologists confined themselves to our own infinitesimal planetary home. Now geology is branching out. Space probes and manned visits have brought the moon and other planets within reach, and scientists are now beginning to study their geology.

The similarities and differences among the earth and the other terrestrial planets provide geologists with opportunities for interplanetary comparison and the use of one planet's history to illuminate that of another. An illustration of this process is the comparison now being made between a unique feature of the earth's geological history, the so-called Channeled Scablands of eastern Washington state and certain prominent features of Mars, several of the so-called valles.

The Scablands, which occupy about 15,000 square miles of the state, are a region of bare black basaltic rock cut up with channels, rock basins, cascades and cataract ledges. The land shows giant ripple marks, and ragged buttes, and immense gravel bars are present.

Marks on the mountain above Missoula show ancient levels of lake water.

In the early 1920's J. Harlen Bretz, a geologist at the University of Chicago, gave the Scablands their name and suggested that their characteristic features—which look like giant effects of turbulent erosion—resulted from a stupendous flood that occurred about 18,000 or 20,000 years ago. In the time since he made it, Bretz's suggestion has generated much controversy, but now a photo taken by a satellite seems to exhibit the flow patterns he hypothesized and supports his view with such silent eloquence that the U.S. Geological Survey has put out a press release and a pamphlet for the public that takes his explanation for granted.

The flood, usually called the Spokane Flood, was possibly the greatest the earth has ever seen. It did not rise slowly from the rain soaked earth like the Biblical deluge that floated Noah's ark; it was a flashflood of supercolossal proportions. In two days time it drained a no-longer-existing lake that covered 3,000 square miles of what is now Montana and is called Lake Missoula because the site of that town was then 950 feet under its waters.

Before the flood the Scablands were a basin floored with basalt derived from lava flows that occurred in Miocene times between 30 million and 10 million years ago. As time went on the basalt acquired a "frosting" of windblown loess. The basin tilts, running from high in the northeast to low in the southwest at a grade of about 25 feet per mile.

About 100,000 years ago, during one of the glacial epochs, the continental ice sheet extended to a front just north of the Scablands. Tongues of ice extended into valleys south of the main ice front, damming rivers and making glacial lakes. The most important such ice dam blocked the Clark Fork River at about the point where it enters Pend Oreille Lake and made Lake Missoula.

The water rose and rose behind the ice dam until the surface came to 4,150 feet above sea level or a depth of 2,000 feet at the dam, twice the maximum depth of Lake Superior. The lake contained an estimated 500 cubic miles of water or about half the volume of present-day Lake Michigan. Eventually the water reached the top of the ice dam and began to flow over it. Running water erodes ice very quickly, and once the water had cut a sizable channel in the ice, the dam just went.

The water burst out in a cataclysmic surge. The maximum rate of flow is estimated at 9.5 cubic miles per hour

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or 386 million cubic feet per second, ten times the combined flow of all the rivers of the world. (For comparison, the world's biggest river, the Amazon, goes by at a sluggish six million cubic feet a second.) In several stupendous streams the water surged across the Scablands, creating the giant erosion features now seen there—huge ripples, rock pools, dry waterfalls—and collected again at the southwestern outlet of the basin, the Wallula Gap.

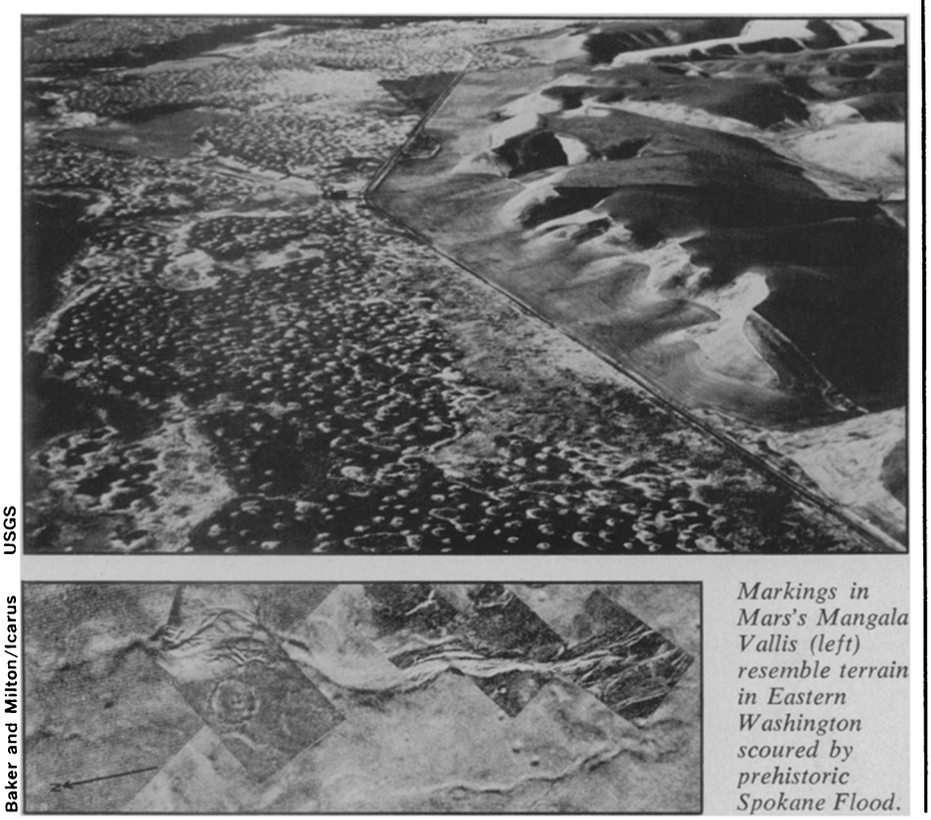
The flood probably came across in a series of surges, and the crest may have lasted at most a day or two at most points. Behind the Wallula Gap the water made a temporary lake that may have lasted two weeks while it rushed through the gap at a rate of 40 cubic miles a day. Down the Columbia River valley it went, backing up the Willamette and making a temporary lake there and finally out to sea.

So far the earliest traces of human presence in the region go back only to 10,130 years ago, some thousands of years after the flood. But this is by no means the earliest date for humans on the North American continent, so it is still possible that human beings, at least any lucky enough to be standing on the safety of a peak in the Bitterroot Mountains, witnessed the spectacle.

Events similar to the Spokane Flood are now proposed to have taken place on Mars. In a forthcoming issue of ICARUS, Victor R. Baker of the University of Texas at Austin and Daniel J. Milton of the U.S. Geological Survey in Menlo Park, Calif., argue for such occurrences in the history of the Martian valles called Kasei, Ares, Tiu, Simud and Mangala. Their reasoning is based on similarities between views of the Martian channels taken by Mariner 9 from orbit around Mars and those of the Channeled Scablands taken by earth orbiters. They admit that some of the Martian features taken alone could be the result of wind erosion, but the ensemble looks strangely like the Scablands.

There is little or no water on Mars now, but that does not necessarily preclude there having been some at one time. Explaining the erosion of the valles by catastrophes such as the Spokane Flood means that one does not have to postulate a Martian atmosphere that yielded rain for thousands or millions of years. The water could have come from the interior of the planet as the earth's originally did and have persisted on the surface for only a short time. The valles in question all run generally north from the equatorial cratered terrain. Whether they were scoured simultaneously by a single outburst and whether flooding in any single channel was a single or repeated event are questions that remain outstanding.

"Scabland erosion takes place in exceedingly deep, swift floodwater acting on closely jointed bedrock," Baker and Milton write. "If the analogy to the Channeled Scablands is correct, floods involving water discharges of millions of cubic meters per second and peak flow velocities of tens of meters per second, but perhaps lasting no more than a few days, have occurred on Mars." □



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Baker and Milton/Icarus

Markings in Mars's Mangala Vallis (left) resemble terrain in Eastern Washington scoured by prehistoric Spokane Flood.

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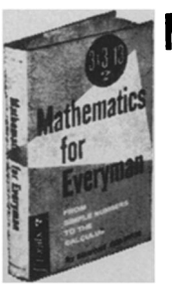

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