Megafloods downsized

A fresh look at the Channeled Scablands of North America shows that the ancient floods that scarred that landscape were smaller than is commonly assumed. This result could revise estimates of similar floods on Mars. See Letter p.229

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The enormous canyons of the Channeled Scablands in the northwestern United States, many of which contain no rivers, puzzled geologists for decades. The gradual realization that these canyons were carved thousands of years ago by huge floods spawned by melting glaciers challenged the idea that Earth’s surface is shaped by gradual, steady erosion. However, on page 229, Larsen and Lamb1 show that at least one of the canyons was formed by a succession of much smaller floods, a finding that has implications for flood-carved canyons on Mars.

When the geologist J Harlen Bretz proposed in the 1920s that the Channeled Scablands were created by a catastrophic flood2, his ideas were attacked relentlessly by geologists who subscribed to the mainstream view that erosion is slow and steady, and who wanted to distance their profession from the notion of a biblical deluge. Bretz did not identify the source of the flooding until the 1940s, when his colleague Joseph Pardee found evidence3 that ancient Lake Missoula, which formed at the margin of the melting Cordilleran ice sheet roughly 15,000 years ago, had drained catastrophically to the west. This discovery led to the gradual acceptance of Bretz’s flood hypothesis, which was later supported by studies that considered the mechanics of large flows through canyons4. Subsequent analyses of sediments deposited throughout the region showed that the Channeled Scablands had experienced not one but many floods5.

Although the flood origin of the Channeled Scablands is no longer disputed, the sizes of the individual floods remain uncertain. It has become common practice to place an upper bound on the flow rate of the floods by assuming that they filled the present-day canyons to the brim. Estimated flood magnitudes based on this assumption6 range up to 60 cubic kilometres per hour — nearly 100 times the average flow rate of the Amazon River today7. But these estimates might be much too large. Glaciologists have argued that it is difficult for ice sheets to store enough water to produce such enormous floods8. The brimful-flood model also requires the unlikely scenario that each flood passing through the canyons was larger than the one that preceded it, because the canyon deepens as each successive flood erodes the bedrock (Fig. 1a).

Larsen and Lamb wade into this debate and present evidence that a series of consistently sized, moderate floods eroded the canyons of the Channeled Scablands. In this scenario, the first flood filled the shallow, newly formed canyons to the brim, but subsequent floods only partly filled the deepening canyons (Fig. 1b). They studied Moses Coulee (Fig. 2), a canyon in which a series of bench-shaped terraces preserves the remnants of former canyon floors that were abandoned by the flood water as the canyon was progressively eroded.

Using previous estimates of the forces required to erode blocks of rock from the canyon floor, and a computational model of flood flow through the canyon, the authors constrained the minimum flow rate corresponding to each remnant canyon floor. Their calculated flow rates are consistent with the presence of gravel bars that the most recent floods deposited in the canyon. Brimful floods would have instead suspended the gravel (and even larger boulders) high in the flow, preventing deposition. Larsen and Lamb conclude that Moses Coulee was eroded by repeated floods of no more than 2 km$^3$ h$^{-1}$. This flow rate is by no means small — it is more than three times that of the Amazon River — but it is much smaller than the maximum of 10 km$^3$ h$^{-1}$ that is implied by the brimful model for Moses Coulee.

Floods as large as those discussed by Larsen and Lamb have not been observed in recorded history. This makes it difficult to test some of the authors’ assumptions, such as the estimated...
Measuring our narrow strip of life

In line with previous research, a demographic analysis corroborates the presence of a limit to human lifespan, indicating that increases in life expectancy are likely to slow down or stop over the coming years. See Letter p.257

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The British author Annie Besant once wrote: “out of the darkness of the womb, into the darkness of the grave, man passes across his narrow strip of life.” The ration of time allocated to humans is of profound personal and scientific interest. On page 257, Dong et al. turn to the demographic literature to analyse whether there is a limit to human lifespan — and find evidence to suggest that there is.

Before discussing the study at hand, we should define some relevant terms. Lifespan describes how long an individual lives. Life expectancy is a population-based estimate of expected duration of life for individuals at any age, based on a statistical ‘life table’. And maximum lifespan is the age reached by the longest-lived member of a species.

Human life expectancy has risen fairly steadily and rapidly over the past 150 years in most countries. In 1990, colleagues and I predicted that this increase would slow over time, and this has proved to be the case. Maximum lifespan also seems to have risen steadily, but this too might have reached an upper asymptote — no one is known to have lived longer than Jeanne Calment, who died in 1997 at the age of 122. Thus, the debate about life’s limits is ongoing.

Some scientists speculate that fixed limits to...