Here today …

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In 1999 the Da'an Chi River in Western Taiwan was dammed by the vertical movement of a fault block. As the Da'an Chi River is subject to frequent flood events, the fault block was overtopped, leading to a substantial gorge being cut into the rock. The gorge has been the subject of intense investigation, which has revealed that the entrance to the gorge is being eroded at an unprecedented rate by a previously unobserved process. Such is the rate of erosion that in an estimated 50 years the gorge may well disappear without a trace.

Creation of the gorge

In 1999, an earthquake of magnitude 7.9, named the Jiji earthquake, occurred in Western Taiwan. A large block of rock was raised by 10 m during the earthquake. The fault line cut transversely across the Da'an Chi River, blocking the flow and creating a temporary reservoir.

The Da'an Chi River is subject to frequent and violent flood events. The barrage formed by the fault block was soon overtopped, and between 2004 and 2008 a gorge more than a kilometre long, 25 m wide and 17–20 m deep was cut into the rock. The unusual circumstances of the gorge's creation made it a valuable site for the study of gorge geomorphology. A team of scientists from the GFZ German Research Centre for Geosciences in Potsdam has been making an intensive study of the gorge using GPS measurements, time lapse photography and laser scans. The team leader, Dr Kristen Cook, explained the reason for the academic interest:

> "We have here the world's first real-time observation of the evolution of gorge width by fluvial erosion over the course of several years."[1]

It has been expected that development of the gorge would proceed by erosion of the walls, resulting in a gradual widening of the gorge. This process is indeed occurring, currently at the rate of about 1.5 m/yr. However, it was discovered that a previously unobserved process was eroding the entrance to the gorge at an unprecedented rate.

Downstream sweep erosion

When the Jiji earthquake occurred, the upthrust fault block placed a barrage across a previously existing wide flood plain. The subsequent creation of the gorge resulted in a situation in which flow down the flood plain was suddenly channelled into a narrow gorge. The resulting high flow velocities, coupled with the entrained bed load, causes substantial erosion of the entrance to the gorge. The effect is to reduce the length of the gorge from the upstream toward the downstream end at a rate of 17 m/yr. This erosional phenomenon has been named downstream sweep erosion.

> "We identify a mechanism, which we term downstream sweep erosion, that is rapidly transforming the gorge into a bevelled floodplain through the downstream propagation of a wide erosion front located where the broad upstream channel abruptly transitions into a narrow gorge. We estimate that gorge erosion will remove the uplifted topography in as little as 50 years."[2]

It is known that earthquakes occur in the same area as the Jiji earthquake every 300–500 years. Prior to the Jiji earthquake there was no indication that a gorge had previously existed in that area. Consequently, assuming similar uplifts have occurred in the past, the conclusion is that the existing gorge will be completely eradicated.

Gorge formation

The assumption of the GFZ team is that they are monitoring a scale model of much larger and slower processes.

> "The formation is known in Chinese as the Grand Canyon of the Daan River, and Dr Cook said it shows similarity to its mighty US namesake in Arizona.
>
> "'That's one of the exciting things —we expect the process to be the same, but sped up.'"[1]

The Da'an Chi River gorge was blocked in a very short time by a catastrophic event followed by rapid

Table 1. Observed gorge formation.[3,4,5]

Site	Initiator	Date	Gorge			Formation time
			Length	Width	Depth	
Canyon Lake, TX	Spillway overflow	July 2002	1.6 km (1 mi)	n/a	15 m (50 ft)	3 days
Mount St Helens	Volcanic eruption	May 1980	n/a	n/a	30 m (100 ft)	1 day
Southern Brazil	Rain storm	June 1974	500 m (1600 ft)	15 m (50 ft)	5 m (16 ft)	5 minutes
Walla Walla, WA	Flow diversion	March 1926	450 m (1500 ft)	n/a	35 m (120 ft)	6 days
Imperial Valley, CA	Levee failure	February 1905	69 km (43 mi)	300 m (1000 ft)	15 m (50 ft)	9 months

(presently ongoing) erosion of the barrier by large quantities of fast-flowing water. However, this may not be the process they have in mind for the Grand Canyon. No equivalent erosion event is known to have affected the Grand Canyon, so the comparison is tenuous. Apparently the value of the Da'an Chi Gorge is that an unexpectedly powerful erosional phenomenon is occurring on a timescale that in uniformitarian geological terms, is extremely short.

While the processes surrounding the Da'an Chi Gorge are certainly spectacular, they should not be particularly surprising. A number of erosional events have been observed to take place in a short time, all involving some kind of catastrophic process and large quantities of flowing water. A few notable examples are given in table 1.

There are, in addition, some much larger gorge-forming events which were not observed, but which have left behind enough evidence to show that they did indeed occur. These include:

- formation of the Channelled Scablands, probably in a matter of days, initiated by failure of the ice barrage holding back the vast waters of Lake Missoula[6–8]
- formation of the English Channel in an estimated several months, thought to have been initiated by overtopping of the Weald-Artois chalk ridge, which formerly spanned the Dover Strait, thereby releasing the water dammed between the chalk ridge in the south and glaciers to the north[9,10]
- the Lake Bonneville flood, which was initiated by breaching through a ridge, leading to draining of the lake in 2–12 months, accompanied by formation and/or extension of a number of canyons, the 180-m- (600-ft) deep Snake River Canyon among them.[11,12]

It is evident that vast stretches of time are not necessarily required for the formation of very impressive erosional features. The main requirement is a large volume of water and some event whereby it is suddenly released.

Gorge eradication

The expected eradication of the Da'an Chi River gorge by a previously unobserved process leads one to consider whether a general principle is indicated. It is dubious practice to generalize from a single example, especially one that is not expected to leave any lasting evidence of its existence. However, if there is a general principle, it might be something like:

Figure 1. The Da'an Chi River, showing the gorge that is being eroded at times of flood flow.

Disciplines that have been scientifically studied for decades or even centuries, can encounter previously unobserved and possibly ephemeral processes under novel circumstances.

In considering how such a principle might be applied, it becomes evident that it is of more use to uniformitarians than to creationists. This is because creationists, as a general rule, rely on observed data, moderated by their understanding of the biblical text, to formulate and, if necessary, modify their hypotheses. A prime example of this is the progressive development of a creationist cosmology by Dr Russ Humphries from first proposals,[13] via interaction with other creationist cosmologists,[14] to current thinking.[15]

Conversely, when, as so often happens, observed reality fails to match theoretical expectations, the uniformitarian response can be one of:

- ignore the data (e.g. ^{14}C in diamonds[16])
- defer consideration of the observations pending further research[17]
- explain the data away (e.g. explaining anomalous radiometric dates by 'resetting' of radiometric clocks by recrystallization—or any one of some 400 other documented[18] 'explanations')
- declare whatever is missing to be present but unobservable (e.g. dark matter[19] and paraconformities[20])
- invent a materialistic explanation, "no matter how counter-intuitive, no matter how mystifying to the uninitiated".[21]

The Da'an Chi Gorge phenomenon illustrates yet again that the natural world is replete with instances of processes that do not necessarily conform to the accepted scientific dogma of the day. Progress in science might be better served by open-minded consideration of the observations rather than by a rigid prior commitment to a particular philosophical position.

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