A new mechanism to form free-standing arches questionable

Michael J. Oard

Free-standing arches are the most amazing features. Sometimes an arch is long and high with just a thin strip of rock connected at the top, such as Landscape Arch in Arches National Park, Utah, USA (figure 1). It is the second-longest arch in the world and spans 88 m (290 ft). Arches and natural bridges are similar, but a natural bridge is one in which a flow of water, like a stream, is obviously associated with its origin.[1] There is no obvious stream associated with an arch. Instead arches are commonly found on ridges or the sides of a ridge.

Origin of arches enigmatic

The conventional explanation of how rock arches formed requires long periods of time of slow erosion by physical and chemical weathering. To form an arch, significant amounts of the rock must weather and erode without eroding the arch itself. Geologists estimate that it would have taken 70,000 years of water, frost, and wind opera ting in a dry climate to form the isolated Delicate Arch in Arches National Park.[2] It is important to note free-standing arches are not forming today but are being destroyed, as evidenced by the collapse of Wall Arch in Arches National Park.[3] This presents a challenge for a uniformitarian explanation of their origins:

> "Arch formation cannot be due solely to weathering and erosion, however, because these processes are not restricted to the sites of

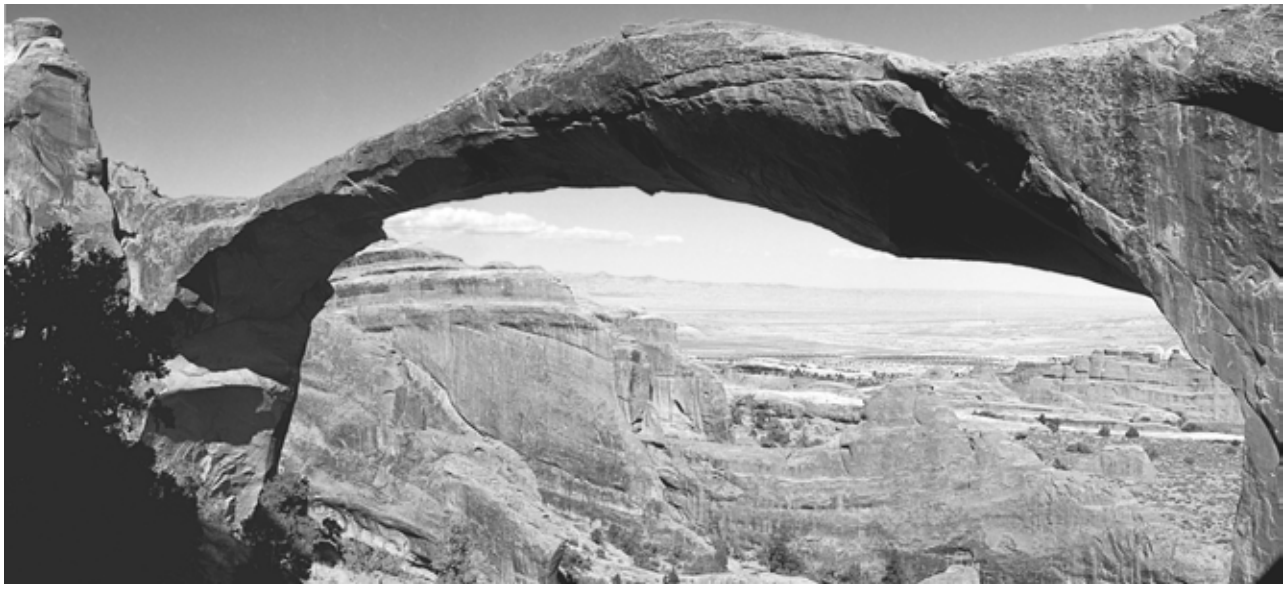

Figure 1. Landscape Arch, Arches National Park, Utah, USA

arches in rock fins.[4] There must be some factor that locally enhances the effects of erosion within a rather small part of a rock fin to produce an arch. How erosion is localized within a rock fin to form an arch is enigmatic."[5]

A new speculative hypothesis

A new hypothesis proposes that arches and other sandstone landforms are formed by differential stress that locks the sand grains during erosion.[6,7] The researchers submerged 10 cm cubes of sand with weights on top. As erosion occurred, differential vertical stress caused the locking of sand grains that resisted further erosion. In nature the eroding agent can be wind or water.

Unfortunately, the experiments really do not apply all that well to natural arches. The researchers used unique sand from a quarry in the Czech Republic that has angular sand grains. It is the angular sand grains that can especially be locked when the vertical stress increases due to differential erosion. Moreover, in order to form an arch, the researchers had to start with a cut at the base of the sandstone block. They assume natural sandstone has a planar discontinuity that would weather faster. So, it appears a little arch had to form first before differential stress would increase its size and preserve it.

These experiments, along with their numerical analyses, are artificial. Arches National Park is a good location to test this new hypothesis. It has over 2,000 arches that are mostly developed in the Entrada Sandstone.[8] The vast majority of the arches in Arches National Park are made of fairly homogenous sandstone that is considered to be lithified desert sand. The sand grains are generally rounded. It is unlikely that spherical sand grains would lock enough to cause differential erosion even under pressure.

A possible Flood mechanism

Large free-standing arches in sandstone are not forming today, but are being destroyed. It does not seem possible that they were formed by present processes. The only possibility appears to be quick formation during a rapid erosion event. The final draining of floodwater during the Recessional Stage of the Flood[9] would cause the rapid erosion. Reconstructing exactly how any one free-standing arch formed may be extremely difficult, or even impossible, but it is possible that turbulent eddies or cavitation first eroded the joints into fins followed by greater erosion at the base of a fin, which rapidly carved an arch

References

1. www.naturalarches.org/archinfo/faq.htm#bridge.
2. Harris, A.G., Tuttle, E. and Tuttle, S.D., *Geology of National Parks*, 5th edn, Kendall/Hunt Publishing, Dubuque, IA, p. 83, 1990.
3. Oard, M.J., Many arches and natural bridges likely from the Flood, *J. Creation* **23**(1):115–118, 2009.
4. A rock fin is a narrow, strip of rock with a vertical wall produced from the weathering and erosion of joints and expansion cracks in the rock.
5. Cruikshank, K.M. and Aydin, A., Role of fracture localization in arch formation, Arches National Park, UT, *GSA Bulletin* **106**:879–891, 1994; p. 879.
6. Bruthans, J., Soukup, J., Vaculikova, J. *et al.*, Sandstone landforms shaped by negative feedback between stress and erosion, *Nature Geoscience* **7**:597–601, 2014.
7. Paola, C., Emergent sculpture, *Nature Geoscience* **7**:552–553, 2014.
8. Arches National Park, www.desertusa.com/arches/du_arc_desc.html, accessed 4 July 2016.
9. Walker, T., A biblical geological model; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 581–592, 1994.