sand dunes? Although uniformitarian scientists have attempted to explain such anomalous features, the lack of any close modern analog shows that they are grasping at straws.

Third, the sand grains that are well-rounded and frosted, claimed as evidence for the desert interpretation, show that the frosting was not by wind abrasion. Scanning electron micrographs show that the frosted surface is actually etched.[8] In other words, the grains have been chemically frosted, probably after deposition by water moving under pressure through the spaces between grains.

Fourth, the direction of transport of the sand is the same as the general transport of practically all the supposed eolian sandstones on the Colorado Plateau.[9] The direction is from the north to the northwest. A further problem is that the transport direction must be maintained for hundreds if not thousands of kilometres, since there is no source for the sand immediately to the north of the Colorado Plateau. Such consistent directions over a supposedly 100-million-year period make little sense. In all that time, why wouldn't a significant change in wind direction, from the south for instance, deposit some dunes with a different orientation?

What really happened?

These unusual dinosaur tracks and their strongly preferred orientation provide more evidence for the 'briefly exposed Flood sediment hypothesis'.[10–12] Tracks, as well as dinosaur eggs, were made by dinosaurs during the Flood while they were still alive, as the waters were rising. They would have perished later on, at least by Day 150, when the entire Earth was covered by water and every lving thing perished (Genesis 7:20–24). Based on many unusual features of dinosaur tracks, eggs and bonebeds, freshly-laid Flood sediments must have become briefly exposed during the first half of the Flood as the waters were rising. Such an exposure can easily be accomplished after heavy sedimentation and a brief drop in 'sea level' (and there are at least four mechanisms that could cause this). Dinosaurs coming ashore onto this 'land' would of course make tracks and lay eggs. Their death *en masse* would produce large bonebeds as found in other parts of the fossil record, graveyards that sometimes contain thousands of dinosaur remains.

References

1. University of Utah, 'A dinosaur dance floor': numerous tracks at Jurassic oasis on Arizona-Utah border, <www.physorg.com/news143692605.html>, 20 October 2008.
2. Oard, M.J., The extinction of the dinosaurs, *Journal of Creation* **11**(2):137–154, 1997.
3. Seiler, W.M. and Chan, M.A., A wet interdune dinosaur trampled surface in the Jurassic Navajo Sandstone, Coyote Buttes, Arizona: rare preservation of multiple track types and tail traces, *Palaios* **23**:700–710, 2008.
4. Uniformitarian thinking assumes that the past can be explained by the sorts of geological environments that we see on the earth today (such as deserts, rivers and volcanoes, and present-day processes such as slow sedimentation and erosion) persisting over millions of years, and denies that the global Flood described in the Bible ever occurred.
5. Austin, S.A., *Grand Canyon: Monument to Catastrophe*, Institute for Creation Research, Santee, CA, pp. 21–56, 75, 1994.
6. Hamilton, W.L., *The Sculpturing of Zion: Guide to the Geology of Zion National Park*, Zion Natural History Association, Springdale, UT, 1992.
7. Hamilton, ref. 6, p. 86.
8. Hamilton, ref. 6, p. 83.
9. Baars, D.L., *The Colorado Plateau: A Geologic History*, University of New Mexico Press, Albuquerque, NM, 2000.
10. Oard, M.J., Polar dinosaurs and the Genesis Flood, *Creation Research Society Quarterly* **32**:47–56, 1995.
11. Oard, ref. 2, pp. 144–147.
12. Oard, M.J., Dinosaur tracks, eggs, and bonebeds; in: Oard, M.J. and Reed J.K. (Eds), Rock Solid Answers: Responses to Popular Objections to Biblical Geology, Master Books, Green Forest, AR, 2009 (in press).

Butterfly brilliance

Jonathan Sarfati

Photonic structures in butterflies

Some butterflies, such as the blue morpho (*Morpho menelaus*) of South America and the male mountain blue don (*Papilio ulysses*) of northern Australia are known for their brilliant iridescent blues. But their spectacular colours are not caused by pigments but by their scales forming a diffraction grating.[1] These are evenly-spaced ridges or grooves that break up white light into all its component colours, but at a given angle, destructive interference cancels out all out except for the required colour, which is bright due to constructive interference. These scales have been called sub-micrometre photonic structures, because they can manipulate light waves. The very deep black on the borders of the butterfly wings is likewise not due to a black pigment but due to photonic structures that trap light.[2,3]

This research has inspired the design of very effective 'Super Black' coatings,[2] and might inspire other sorts of coatings that produce striking colours without the chemical waste in production of pigments and dyes.[4] This is yet another example of *biomimetics*: human technology copying nature—in reality, taking lessons from the Designer of nature.[5]

Dual gratings

Recent research shows that the dorsal wings of *Lamprolenis nitida* have two blazed diffraction gratings interspersed on single scales, which give two main colour signals, red to green and blue to violet.[6] This was a novel discovery, since 'Multiple independent signals from separate photonic structures within the same sub-micrometre device are currently unknown in animals.'[5] The scales form a pattern of cross ribs and flutes that have different periodicities, hence the different signals. In particular:

Photo from <www.sxc.hu>

Figure 1. *Morpho menelaus*. This iridescent blue is caused by scales forming a diffraction grating. The deep black edges are due to photonic structures that trip light.

> 'Observations of individual scales revealed two opposed, periodic and asymmetric structures capable of behaving as blazed gratings: the "cross-ribs" that connect adjacent "longitudinal ridges" and the "flutes" that project laterally from the ridges … The former are plate like, 2 mm wide by 0.5 μm deep and 100 nm thick with a periodicity of 582 ± 12 nm. Each cross-rib is tilted at 30° to the scale surface towards the costal margin of the hindwing. Individual flutes are similarly 100 nm thick; however, their periodicity is 205 ± 5 nm and they are tilted at 45° to the scale surface towards the outer margin of the hindwing.'[5]

The researchers say, 'Multiple signals increase the complexity and specificity of the optical signature, thus enhancing the information conveyed. This could be particularly important during intrasexual encounters, in which iridescent male wing colours are employed as threat displays.' They point out that males would produce strong signals even in the poorly illuminated forests where they live, where sunlight breaks through the canopy only sporadically. And they would help the females find the right species in a species-rich environment.

How did these structures arise?

Making a pleasant change, the researchers didn't propose a just-so evolutionary story to explain the *origin* of these structures; they reported on the *facts*, and proposed plausible functions of their *current* use. Indeed, even single diffraction gratings are hard to explain by a Darwinian series of small steps, each with an advantage over the previous one. *A fortiori*, how much harder is a dual diffraction grating to explain? This is especially so since most butterflies manage perfectly well without one, and the glasswing doesn't even need scales at all,[7] so selection pressure is not clear. Note that Darwin's 'theory of sexual selection'[8] *fails to explain the very thing Darwin concocted it for*—the peacock tail![9]

More biomimetics

The researchers said that advanced human technology could benefit from copying this design:

> 'The double grating of *L. nitida* could provide a solution to a problem with spectrometers, namely that the functional range of their grating is restricted, so that when the spectral limit is reached the grating must be mechanically swapped for another, interrupting measurements. By incorporating two gratings onto a single self-adjusting surface, this problem may be circumvented.'[5]

Since real science works by analogy, it is fair to argue that since our diffractions require intelligent design, *a fortiori*, an even more advanced diffraction grating also shows the *objective* marks of design.

References

1. Vukusic, P. *et al*., Sculpted-multilayer optical effects in two species of *Papilio* butterfly, *Applied Optics* **40**(7):1116–1125, 2001.
2. Butterflies plumb the depths of blackness with a trick of the light, *New Scientist* **181**(2433): 18, 2004.
3. Hopkin, M., Butterflies boast ultrablack wings: Insects use optical trick to get the blackest black out of dark pigments, *Nature science update*, 2004, <www.nature.com/nsu/040126/040126-4.html>.
4. Lerner, E.J., Butterfly blues, *The Industrial Physicist*, Briefs, April 2004.
5. Sarfati, J., Beautiful black and blue butterflies, *Journal of Creation* **19**(1):9–10, 2005; <creation.com/blue>; *By Design*, ch. 3, Creation Book Publishers, 2008.
6. Ingram, A.L. *et al.*, Dual gratings interspersed on a single butterfly scale, *J. Royal Soc. Interface* **5**(28):1387–1390, 6 November 2008 | DOI 10.1098/rsif.2008.0227.
7. Catchpoole, D., Watch a glasswing passing (without flying colours), *Creation* **30**(4):56, 2008.
8. Bergman, J., Problems in sexual selection theory and neo-Darwinism, *J. Creation* **18**(1):112–119, 2004; <creation.com/images/pdfs/tj/j18_1/j18_1_112-119.pdf>.
9. Catchpoole, D., Peacock tail tale failure, <creation.com/tale>, 6 June 2008.