Sauropods in Argentina kept their eggs warm near geothermal vents

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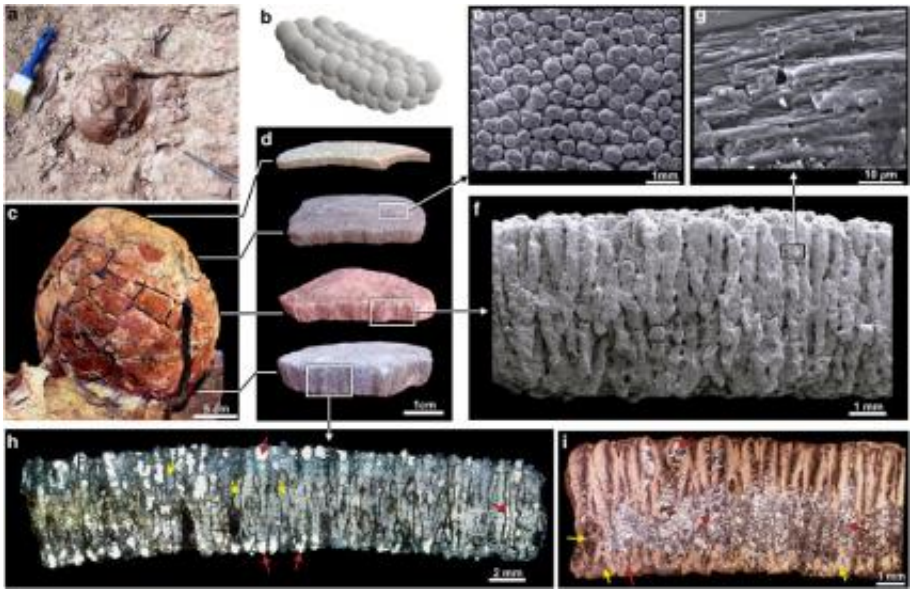

(a) A 21 cm egg exposed at SGP. (b) Spatial arrangement of a complete egg clutch implying dug-out holes as 'nests'. (c) A complete egg with typical fractured eggshell. (d) Typical variation of the eggshell thickness in a single egg; (e) SEM image of outer surface of eggshells with nodes and pore apertures. (f) SEM image of radial view of eggshells. Note the spongy appearance, an adaptation to extremely wet environments. (g) Rombohedric acicular calcite crystals with vesicles. (h, i) Transmitted light microscopic views of radial section of an eggshell. Yellow arrows point to the microspar diagenetic calcite, the red arrows to the diagenetic chalcedonic crystals. Image: Nature, doi:10.1038/ncomms1031.

(PhysOrg.com) -- Researchers working in Argentina have found

100-million-year-old neosauropod nesting sites in which clutches of eggs were kept warm by geothermal vents.

Paleontologists from the US and Argentina found the nesting grounds in the Sanagasta Valley in La Rioja Province in northwest Argentina. The nesting sites are the first to show definitively that some neosauropod dinosaurs had specific nesting grounds they returned to year after year, as many migratory birds do today.

The researchers working in the field last summer were Gerald Grellet-Tinner from the Field Museum in Chicago, US, and doctoral student Lucas Fiorelli, from the Regional Research Center for Scientific Investigation and Technology Transfer (CRILAR) in La Rioja, Argentina. They discovered about 80 clutches of eggs at Sanagasta, all within three meters of hydrothermal vents. The nests usually contained from 3 to 12 eggs, but some spread wide, with up to 35 eggs stacked in two rows over an area of up to 1.8 square meters. The stacking indicates the clutches were buried in dug-out holes rather than on the surface.

The site is the first Cretaceous site where neosauropod dinosaurs have been shown to have used the soil moisture and thermoradiance to incubate their eggs. It lies within the Sanagasta Geologic Park, an area of 300,000 square meters characterized by hydrothermal mega structures of alkaline fountain geysers, hydrothermal pipes, druses and vents.

The eggs measured up to 21 centimeters in diameter, and had variable shell thickness ranging from 1.29 to 7.94 millimeters, which implies the shells became thinner during the incubation period. The thick shells of newly laid eggs may have been gradually leached away by the acidic environment near the geothermic vents, making the shells thinner at the end of incubation and easier for the babies to break through. Most of the eggs were in fragments that intricately fit together.

A geochemical analysis of the fossilized eggs yielded an estimation of the incubation period of one to two months at temperatures of 60-100°C. The researchers said the elements found in the sediments and eggshells matched those present around 134-110 million years ago in a period known as the Gondwanic hydrothermic cycle, an era characterized by geothermal venting.

So far the researchers have not discovered any fossilized bones or embryos, which would enable them to identify the egg-layers conclusively. The most common herbivorous animals in South America in the Cretaceous period were the sauropods.

The endangered megapode turkey (*Megapodius prichardii*) in Tonga has a similar nesting behavior today, laying its eggs in burrows volcanically heated burrows.

The paper is available online in the *Nature Communications* journal.

More information: A new Argentinean nesting site showing neosauropod dinosaur reproduction in a Cretaceous hydrothermal environment, *Nature Communications*, Volume: 1 ,Article number: 32, DOI: doi:10.1038/ncomms1031