New dinosaur discovery in Myanmar includes feathers

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A new article published in *Current Biology* on December 5 provides details of a study that scientists made of a nearly 100-million-year-old dinosaur tail, which was discovered preserved in a chunk of amber. Due to the amber, more than bones survived the long encasement—also contained therein were muscle, ligaments, skin, and feathers—sparking a great amount of interest in the scientific community and the general public. This is the first time that non-avian feathered remains preserved in amber have been described, and it allows scientists to better understand the evolutionary pathway of feathers and modern birds.

The amber sample itself was recovered from a mine in the Hukawng Valley in Kachin, northern Myanmar. This region is well known for having an abundance of amber that contains a variety of plant and animal remains from the mid-Cretaceous period (approximately 99 million years ago). This particular sample is the size of a tennis ball and also contains an ant as well as plant debris that was alive at the same time the dinosaur tail was deposited into the amber. The tail fragment itself measures about 1.4 inches and is covered in chestnut-brown feathers with a pale-white underside.

X-ray analysis shows that the fragment is made up of eight vertebrae that likely served as the middle or end of a long thin tail that may have featured upwards of 25 individual vertebrae. The vertebrae suggest that the source of the tail is a juvenile *coelurosaur*, a type pf Jurassic dinosaur that is considered intermediate between dinosaurs and birds. Coelurosauria includes *maniraptorans*, the only dinosaur group alive today. Maniraptora are characterized by downy feathers with elongated quills, and they are also the only dinosaur group known to include flying members.

One of the interesting facets of the research is the analysis of barbs located on the stems of the feathers—something that can only be seen at the microscopic level. The authors of the paper explain that the spatial arrangement of the barbs allowed them to confirm hypotheses about the evolutionary development of feathers and how they reached their present morphology. This is important because the morphology of the barbs is what allows modern birds to fly.

They conclude that while the feather arrangement is similar to what we see in birds today, the dinosaur in question was likely incapable of flight based on the contours and the way the barbs fuse. This means, however, that the feathers may have evolved due to ornamentality, so it may be hypothesized moving forward that feathers evolved for other purposes such as signaling or temperature regulation before they were adapted for flight. Of course, with a sample size of one, it is difficult to say with certainty whether this was typical of coelurosauria or whether this individual specimen is an exception.

This is not the first time that feathers dating from this time period have been found in amber, and biologists have already reported evidence going back over 20 years that dinosaurs had feathers, based on fossil impressions. However, scientists had difficulty in interpreting feather morphology due to compression in sedimentary rocks. Another road block was the fact that none of the feathers discovered were attached to or even associated with actual skeletal remains.

Just as interesting as the results of the latest study are the circumstances that led to the recovery of the amber in question. This sample was one of many that was collected at an amber market in Myitkyina, the capital of Kachin, where amber is used in both jewelry and carvings. In fact, the piece of amber containing the tail

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had already been cut and shaped by the time the researchers found it at the bazaar.

While the modification meant that the tail was less intact than it could have been, one positive aspect was that a cross-section was cut through the tail that allowed for chemical analysis. This means that the authors were able to detect small amounts of iron that came from the creature's blood, which will allow scientists to identify more information about coelurosauria.

Research in this region has been hampered by an ongoing civil war between the Myanmar government and the Kachin Independence Army, which controls the Hukawng Valley. If this conflict ends, it could lead to researchers gaining greater access to the vast caches of amber that likely contain data that will unravel even more of the mysteries surrounding the mid-Cretaceous period. The lead author suggested that they may even find a complete dinosaur at some point in the future.

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