

Palaeontology research and its application as cultural tourism in Aragon (Spain)

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Resumen

El grupo de investigación Aragosaurus-IUCA de la Universidad de Zaragoza desarrolla su labor sobre vertebrados fósiles, entre los que destacan dinosaurios y grandes vertebrados del Pleistoceno de Aragón (España). Estos fósiles son muy atractivos para el gran público, por lo que ha existido un gran interés por parte de los lugares donde se han encontrado para rentabilizarlos turísticamente. Se relatan tres actuaciones distintas en las que el grupo ha participado aportando información científica para la puesta en valor en las localidades donde se han encontrado los fósiles: Últimos dinosaurios de Europa en Arén (Huesca), El oso de las Cavernas de Tella (Huesca) y los centros satélites de Dinópolis (Teruel). En cada actuación de puesta en valor se ha destacado la singularidad de los fósiles de cada localidad.

Palabras Clave: VERTEBRADOS FÓSILES, ARAGÓN, DIVULGACIÓN, TURISMO

Abstract

The focus of the work undertaken by the research group Aragosaurus-IUCA of the University of Zaragoza is on fossil vertebrates, including in particular dinosaurs and large vertebrates from the Pleistocene of Aragon (Spain). These fossils are very attractive for the general public, and the localities where they have been found have thus shown great interest in exploiting them for the purposes of tourism. An account is given of three distinct projects in which the group has taken part, providing scientific information to draw attention to the localities where the fossils were found: the “Last Dinosaurs of Europe” at Arén (Huesca), the “Tella Cave Bear” (Huesca), and the Satellite Centres of Dinópolis (Teruel). In each case the uniqueness of the fossils from the locality in question has been highlighted.

Key Words: FOSSIL VERTEBRATES, ARAGON, POPULARIZATION, TOURISM

1. Introduction

The research group Aragosaurus-IUCA of the University of Zaragoza (Spain) was formed in the early 1990s (<http://www.aragosaurus.com>). From the outset its main lines of research have been the vertebrates of the Mesozoic and the Pleistocene, including the two aspects with the greatest media repercussions, namely dinosaurs and everything associated with human evolution. The group has constantly grown over the course of these two decades, making it possible to take on various projects within the administrative region of Aragon. One of the consequences of our research is the great interest aroused by the fossils we recover and the information we obtain from them. The discoveries of new dinosaurs, for example, tend to have considerable media repercussions both in the localities where the findings are made and in the local and national press.

Small Aragonese villages such as Arén, Peñarroya de Tastavins and Tella have made front-page headlines thanks to the discoveries of fossils there. An immediate consequence of this media impact has been the interest shown by local councils in turning the findings to account socially and in terms of tourism. In other words, it has been necessary to promote projects that would make it possible to visit the sites and create permanent exhibitions and museums where the fossils could be put on display. Our group has always believed that the existence of such synergies is positive, because in the long run they will also foment medium and long-term research.

To be consistent in applying these ideas, we have thus carried out – and continue to do so – a great deal of consultancy work for the opening of new museums and the preparation of open-air sites (CANUDO et al. 2010). This work has been backed up by the numerous talks we have given throughout Aragon.



Fig. 1. Inauguration of the Museum of Arén by the President of Aragon (2007)

2. The Last Dinosaurs of Europe – Museum of Arén

The village of Arén is located in the region of La Ribagorza, in the north-easternmost part of the province of Huesca. The municipality borders on Catalonia, from which it is separated by the River Noguera. It can be reached either from the west from Barbastro via Benabarre or from the south via Lleida. Since July 1982, the centre of Arén has formed part of the Spanish system of heritage listing (as a “historic-artistic grouping”). Our group has been working at the dinosaur sites of Arén (Blasi 1-5) since 1995. With crucial help provided by the Council of Arén, the Regional Government of Aragon and the County Council of Huesca, excavation campaigns were carried out through until 2002.

The fossils from the sites at Arén were found in consolidated layers, and extraction of the bony remains called for the use of machinery (such as grinders, jackhammers, percussion hammers etc.). With this machinery large blocks of rock were extracted, within which the fossil bones were contained. Hundreds of dinosaur bones were recovered, among the most remarkable of which were the hadrosaurids, amounting to around 80% of all the fossils recovered. At present these hadrosaurid remains are the subject of the PhD thesis by one of the members of the group (CRUZADO-CABALLERO et al. 2010). One striking feature was that the caudal vertebrae were found in anatomical connection, i.e. in the same arrangement they were in during the animal’s lifetime. The rest of the fossils from the site were excavated from within an area of some 200 square metres. In addition to the dinosaur remains, the findings include a number of crocodile teeth, turtle shell plates, amphibians and fish.

Most of the dinosaur remains from Blasi 3 belong to the two dinosaurs *Arenysaurus* and *Blasisaurus* which we recently defined at the sites at Arén (PEREDA-SUBERBIOLA et al. 2009; CRUZADO-CABALLERO et al. 2010). These are two of the last species of dinosaurs that inhabited what is today known as Europe at the end of the Cretaceous, just prior to the Cretaceous-Tertiary boundary extinction. These two species are included in the hadrosaurids (the popular duck-billed dinosaurs), which were the most diverse and abundant plant-eating dinosaurs in the Upper Cretaceous of Laurasia (North America, Europe and Asia). *Arenysaurus* and *Blasisaurus* form part of the group of lambeosaurine hadrosaurids. They are unique dinosaurs in the fossil record, because they display singular hollow structures in the head due to the modification of the nasals. Most of the cranium of *Arenysaurus* is known except for the nasals, so we cannot be certain what form this structure would have taken. But thanks to the evidence provided by the cranium it is clear that the structure was present in *Arenysaurus* and possibly also in *Blasisaurus*. Let’s hope that new findings will allow this to be confirmed.

Saturday 7 July 2007 saw the inauguration of the museum of the Last Dinosaurs of Europe, presided over by the president of the Autonomous Region of Aragon (Fig. 1). The museum is housed in a three-storey building (the former town hall) in the village centre. At the entrance to the first storey is the reception area, from which – following a trail of ichnites marked on the floor – we come to a reconstruction of *Arenysaurus* (Fig. 2). This model was created before the scientific research was completed, so it could be improved: indeed, it should display the aforementioned structure on the head that is characteristic of the

lambeosaurines. Following *Arenysaurus* we come to a small projection room where the history of the dinosaurs of Arén is told, and the process of excavating, preparing and studying the fossils is described. The second floor consists of two rooms, in the first of which there is a spectacular reconstruction of the landscape around Arén as it would have been 65 million years ago. This reconstruction further incorporates real bones from the sites we have excavated.



Fig. 2. Life-size reconstruction of a hadrosaurid dinosaur in the Museum of Arén

The second room is reached via a walkway that allows the reconstruction of *Arenysaurus* to be viewed from above. This room focuses on the extinction event and features a model of the great meteorite. Explanations are provided for the causes of the various extinction events that have taken place on Earth in the course of its history. What is original about this exposition is that it relates these extinctions with the one now being caused by human activity. Although these extinctions are far removed in time, there are certain parallels that should give us food for thought as regards our own role on Earth.

The third storey is also divided into two rooms. The first room displays some of the fossils that have been recovered from the sites at Arén (a left mandible, a vertebra from the neck, a pubis, a rib, a phalanx bone, etc.). Among the most remarkable exhibits are the twenty vertebrae in anatomical connection and various femora. The bones are in a splendid state of preservation, and many visitors question whether they really are fossil bones.

This room also contains an audiovisual display recounting the development of research into the dinosaurs of Arén. There is also a 3-D reconstruction of how life might have been for *Arenysaurus*. The room further contains some of the items that would have been necessary to look after a dinosaur if it had been a pet – though of course its needs would have been somewhat on the big side, e.g. a rather stronger chain than usual, a little more food and other such things... The final room in the museum on the one hand recreates a palaeontologist’s office and on the other hand incorporates a model showing the excavation techniques used at the Blasi sites. The magnificent views from this storey are not to be missed.

The sites with fossil bones that can be visited at Arén are known as the Blasi sites. The preparation of the path and the sites was the work of the Zaragoza company Paleoymás. Opposite the

museum door is an information panel showing the two routes that can be taken, the route leading to the Blasi sites and the dinosaur track route. The routes start next to the main village square, the Plaza Mayor, where arrows with dinosaur heads indicate the direction to be taken.

The path leading to the Blasi sites is well signposted with arrows and information panels, making it easy to follow. The first part of the path is wide and runs through an oak wood where there are panels explaining the botany and geology of the area. On reaching a chain that closes the path to motor vehicles, we must take a well-marked track that follows a small gully until cutting across it at a point where the riverbed is cemented. The path then strays from the gully somewhat, and it becomes necessary to pay careful attention to the green posts marking the route. After passing a small structure that resembles a dolmen (though it is not one), we cross the gully once again and keep on walking, without losing the green signposts from view. At this point the path climbs steeply until it reaches a height where it again becomes clearly marked, continuing straight on as far as the large white, sloping surface of the layer where the site Blasi 1 is located. From here there is a magnificent view of the sandstones of Blasi 1, which formed where there had once been a beach where the bodies of dinosaurs and other animals were buried. The palaeodunes can be discerned on the surface of the stratum with the help of an information panel.



Fig. 3. Blasi 3 site prepared for visits. The fencing is to protect the site.

A few metres further on, the path descends rapidly as far as some grey rocks situated above Blasi 1. On reaching these rocks, a wooden structure comes into view at a certain distance, enclosing most of the site of Blasi 3 (Fig. 3). On the rock surface there are three groups of replicas of dinosaur bones. These replicas were made in accordance with the original arrangement of the best specimens found. One of the groups consists of articulated caudal vertebrae (i.e. from the tail); the second shows bones from the hip of a juvenile individual; the third presents us with various cervical vertebrae (i.e. from the neck) and a femur. At this point there are a number of information panels providing texts and diagrams on the characteristics of these bones and how they were excavated. From Blasi 3 there is a narrow path leading down to Blasi 1. Many of the dinosaur fossils recovered from the white sandstone of Blasi 1 have not been extracted from the rock, and with a little luck they can be seen. Moreover, there is a replica of a mandible from *Blasisaurus* that was found at the site and can be viewed in the museum.

2. Museum of Tella

Tella is a small locality in the Pyrenees of Huesca, situated within the area of influence of Ordesa National Park. The unusual feature about Tella is that it is located high up a mountain, unlike most of the villages in the Pyrenees of Huesca, which tend to be situated in valley bottoms. As a result, Tella is one of those fantastic, little-known places far removed from the traditional Pyrenean routes. It has considerable charms in its own right, such as the dolmen and the route of the four hermitages. In addition to these tourist attractions, a few years ago it acquired the Cave Bear Museum and the guided tour to the site of the Bear Cave.



Fig. 4. The Tella Cave Bear Museum (Huesca): palaeontologists digging

The site was initially discovered by the Speleological Group of Badalona. In September 1976 this group undertook a complete exploration of Cave A-5, which enabled them to carry out a topographical survey and precisely locate the palaeontological site. In 1994, our research group took charge of the activities at the site. Two excavation campaigns were undertaken in 1995 and 1996, in the course of which several thousand fossil bones were recovered. This was of great significance because the fossils from Tella belong to the only mountain cave bears described in Spain, which could also be the last populations of their species in the Pyrenees (de TORRES et al. 2004). The Tella cave bear is represented by bones from the entire skeleton. Particularly notable is the great abundance of infant and neonatal individuals, which indicates that the first accumulation was the result of the death of the male and female bears during the hibernation period.

The cave where the fossils were found is currently open to visitors. Visits are guided, subject to advance booking in the locality of Tella itself. The cave has been prepared for visitors with artificial lights and construction of a pathway. In order to change as little as possible, many of the natural features have been maintained; as a result visitors are required, for example, to wear a caving helmet so as not to bang their head on the ceiling. At the end of the cave is the site, where the excavation grid has been maintained. With the help of the guide, it is possible to make out bones that have not been extracted, allowing visitors to see them in situ. The guide even allows visitors to touch some of the fossils found isolated and loose in

the cave. The visit is unique within Aragon and is the perfect complement to a trip to the museum.



Fig. 5. Reconstruction of the Tella Cave Bear

Inaugurated in 2007, the Cave Bear Museum is housed in the Casa del Molino (Mill House) at the entrance to Tella (CANUDO & CUENCA-BESCÓS 2006). At its entrance visitors are greeted by the reconstructed skeleton of a large male. It is in an upright posture, giving an idea of its enormous size. The visit begins with a number of information panels explaining the formation of the caves. A little further on, we encounter a reconstruction of a palaeontologist on the cave floor, digging (Fig. 4). Next to the model is a television screening an audiovisual presentation of the Tella fossils being excavated, prepared and studied.

At the end of the first passage is the reconstruction of a laboratory where fossils are prepared. If the chests are opened, visitors find replicas of the bones and information on how the fossils are dated. The following exhibit that can be visited is the life-size reconstruction of a female cave bear and her offspring, entering the cave to hibernate there (Fig. 5). Particularly noteworthy is the robustness of the bear and the cranium that is markedly different from the bears that currently inhabit the Pyrenees. Following this, we find a large panel describing the history of the major climate changes that have taken place on Earth in the last few thousand years and how these changes may have affected the vertebrate faunas. There is also a selection of fossils on display including crania, mandibles, long bones, hand bones and vertebrae. On closer inspection, some of them can be seen to have clear tooth marks, interpreted as bite marks made by bears (RABAL-GARCÉS et al. 2011).

3. Dinópolis Satellite Centres

One of the greatest satisfactions of recent years has been the eruption of Dinópolis onto the Spanish palaeontological panorama, clearly bringing to light how research may also show social and economic profitability. Our group has not been directly responsible for the design and implementation of the exhibitions at the Dinópolis centres, but our research has provided sustenance and support. A good example is the centre at Castellote called the “Stone Forest”: in the early 1990s we started to research into the fossil trunks at El Barranquillo, the site of the stone forest in question. Great importance is likewise

attached to the exhibition of the gobiconodontid mammal from Vallipón, which includes an audiovisual display of its reconstruction. Similar participation occurred at the Galve centre (Legendark), with its exhibition of a large-sized copy of the tooth from *Lavocatia*, a mammal we defined in the 1990s.

The excavation of the dinosaur from Peñarroya de Tastavins was our first project from the Mesozoic to have major media repercussions. In the winter and spring of 1995 and 1996 we recovered *Tastavinsaurus*, Spain’s most complete sauropod dinosaur (CANUDO et al. 2008). The excavation and subsequent preparation of the fossils required a great effort, for we lacked the infrastructure necessary for fossils of such large dimensions. Accordingly, the local council set up an area in the locality itself where the fossils could be prepared. All this aroused great interest in the dinosaur within the locality itself.

Tastavinsaurus is of dual interest as an item both of cultural heritage and scientific research. It owes its cultural significance to the fact that when it was discovered it was the best and most complete sauropod fossil ever recovered in Spain. As for its scientific import, one might cite the great quantity of palaeoenvironmental and palaeobiological information it harbours. Certain injuries to the vertebrae of the tail indicated to us that the sauropod adopted a tripod position, using its tail as a third point of support and raising its forelimbs.

We do not know why it adopted this position, which produced major lesions to where it propped its tail. Another scientific discovery we made was that many of the bones had marine invertebrates attached to them. The conclusion was plain: the carcass of the dinosaur had been on the seabed, where it had been used by the invertebrates as a point of attachment.

The media repercussions of the discovery of *Tastavinsaurus* in the press gave a decisive boost to the Dinópolis project. The regional government realized the pulling power dinosaurs could exert in the province of Teruel. The result was the creation of Inhospitak, which focused on the dinosaur and on its discovery, preparation and the scientific research associated with it. As well as being able to see the original bones, a life-size reconstruction of *Tastavinsaurus* is on display, the first such model to be made of a Spanish sauropod dinosaur. Its most remarkable feature is the bipedal position in which it is shown, reaching a great height and creating a spectacular impression.



Fig. 5. Reconstruction of the excavation of *Tastavinsaurus* at Inhospitak

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