Creation of a GIS for the study of the Ason river basin’s Prehistory (Cantabria, Spain)

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Abstract. In this paper we present the initial objectives, development and results of the “Creation of an integral GIS for the Prehistory of the River Asón basin and eastern coast of Cantabria (Spain)” research project, which main aim was to developed a GIS for managing the archaeological information provided by several Palaeolithic sites from the Asón river Basin (Northern Iberia). The GIS was also used to analyse the location of Palaeolithic settlements, in order to define hunter-gatherers’ mobility strategies.

Keywords: Paleolithic, site location, data management, Cantabria.

1. Introduction.

The use of Geographic Information Systems (GIS), Information Technologies and Computer Applications applied to archaeological research have a large development, either as a tool for Heritage management used by the administrations, or as a specific research tool [1]. In the case of the Asón river basin research project, modern fieldworks in the last decades have provided a large data set of archaeological information, coming from several sites along the basin.

However, when a regional approach in intended in order to analyze hunters and gatherers societies’ settlement dynamics it is revealed the difficulty of handling large volumes of information, such as several archaeological sites distributed along a territory, especially when trying to analyze the relationships between different sites or between a site and its territory. In our case, we considered that we needed a very specific tool to address research answers.

To answer those requirements, an integral GIS was developed, using commercial software provided by the University of Cantabria (ArcGIS). The main goal of this project was in consequence to design and develop a GIS structure for archaeological data management and analysis, as well as for the study of Palaeolithic and Mesolithic settlement dynamics and mobility strategies.

2. Framework.

The Asón River basin is located on the Cantabrian region (Northern Iberia), a narrow strip ranging from the Western Pyrenees in the East to the Galicia region in the west. This region is characterized by a steep relieve, result of the proximity of the coast (in the North) to the Cantabrian Cordillera, located about 30 km. on south of modern shoreline. The territory is shaped by sort, perpendicular-to-the-coast rivers, forming self-enclosed river basins, which constitute the main geographical units of this region.

The Asón River Basin participates from these general characteristics, although the lower part of the valley is characterized by a large post-Pleistocene marsh, while river mouth is constituted by the major bay of Santoña.

Regarding the Prehistoric archaeological record of this basin, evidence of human population has been documented from Lower and Middle Paleolithic to Neolithic times. However, the best documented period is the Late Palaeolithic, when up to eight sites are well known, some of them having been excavated or re-excavated in recent years using fine archaeological techniques and multidisciplinary approaches [2, 3](Fig. 1). Among those, El Mirón cave has yielded one the most complete sequences of Cantabrian Prehistory, from Middle Palaeolithic to Neolithic times, although the most intense occupation of the cave was during the Lower Magdalenian [4, 5]; this period has yielded the unique Magdalenian burial documented in the Iberian peninsula to date [6].

Fig. 1 Location of the Asón river basin, and Digital Terrain Model created using GIS.
3. Creation of a GIS.

The specific goals pursued with the creation of an integral GIS for the study of the Asón basin prehistory were: 1. Design of a GIS-based structure; 2. obtaining new information not available and necessary for project development; 3. Integration into the GIS of the information previously available and that obtained in the project; 4. management information process for testing specific hypothesis within the project. To achieve these specific goals, the project was conceived in two phases:

3.1. Design, development and implementation of the GIS.

On this first point, a GIS-based system was designed according to the general research objectives of our long-term research program for the Asón basin, as well as according to our interest in an alternative use of this system as a database. This dual approach determined the full application design, particularly with regard to interrogation procedures and information finding.

The GIS software selected to create this system was ESRI’s ArcGIS, due to its calculation capacities and to the existence of utilization licenses provided by the Cantabria International Institute for Prehistoric Research.

As a first step, a Digital Elevation Model (DEM) was created, in order to obtain a cartographic base for managing the spatial distribution of archaeological sites; this DEM was also the base for creating different maps and for several spatial and territorial analyses. The DEM, in raster format and with a resolution of 25 meters per cell, was created from the digital cartography provided by the Spanish National Geographic Institute; bathymetric cartography, provided by the Oceanographic Institute of the Spanish Armada, was also used to reconstruct the topography of the Pleistocene coastal plain.

On the other hand, a database of archaeological sites from the Asón river basin was created, which included administrative, topographical (coordinates altitude, size, etc.) and archaeological (chronology, type of site, presence of rock art, etc.) information. This database was created in Excel format, since this format is the most accurate when using ArcGIS. Precise location of the archaeological sites was obtained using a GPS. Once the precise location of sites was known and the Digital Elevation Model was created, a vector layer showing the distribution of sites was generated.

For the Mirón cave itself, a total station was used to record the three dimensional position of every significant finding, while digital photogrammetry was used to obtain orto-images of excavation the excavation process [7, 8].

3.2. Generation of new GIS-based information.

In the second phase of the project, the location and distribution of archaeological sites along the Asón basin was analyzed, calculating several variables which allowed to approach sites’ territories and landscapes characteristics. Thanks to this approach, similarities and differences between sites from the same chronology could be highlighted, and in consequence Palaeolithic hunters and gatherers societies’ settlement dynamics and mobility strategies were inferred [9].

The information obtained using GIS-based calculations focus on several properties of the territory and on the interactions between the sites and their landscapes, such as sites’ viewsheds and catchment territories, terrain of slope or sites’ potential insolation [10]. Moreover, a predictive model for Pleistocene forest potential distribution was created for the entire basin [11]. Thanks to this predictive model, the evolution of forest distribution during the Late Glacial was modelled, and the consequences of changes in forest distribution were put on relation with changes in ungulates’ exploitation and mobility strategies.


The development and use of a GIS for the study of Asón river basin prehistory proved to be a critical tool for the analysis of Palaeolithic and Mesolithic hunter and gatherer societies living this area during the Late Pleistocene and the Early Holocene. On the one hand, the use of a GIS allowed managing a large data set of both geographical and spatially referenced alphanumeric data. On the other hand, spatial analyses regarding sites’ location characteristics and terrain properties were conducted thanks to GIS calculation capacities, and in consequence our knowledge of prehistoric human communities’ settlement dynamics and subsistence strategies was significantly improved.

Finally, several cartographic products, such topographical or thematic maps, 3D terrain models, sites distribution graphs or terrain profiles were obtained and used by research team members’ own work.

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References


