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Mario Parise
Carla Galeazzi, Roberto Bixio, Carlo Germani

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SPELEOLOGY IN ARTIFICIAL CAVITIES AND ARCHAEOASTRONOMY: THE CAVE OF CASNEA IN BRIAGLIA (CUNEO, ITALY)

Fabrizio Milla
Via F.lli Calandra 35, Murello (CN) - Associazione Mus Muris (Torino)
Tel. (+39)3381163110 - fabrizio.fabus@libero.it

Abstract
In the 1970s a local researcher claimed that a small artificial cave in the hills of Briaglia, near the town of Mondovi in the province of Cuneo (NW Italy), was an extremely ancient site attributable to prehistoric megalithic peoples. Between 2012 and 2013, the cave was at the centre of a multidisciplinary project of recovery and investigation to ascertain its origin and nature. Speleologists, archaeologists, archaeoastronomers and other specialists have worked together to gather information on this cave. The research showed the astronomical alignment of the cave at the winter solstice, whilst the archaeoastronomical calculations suggested an age of the cavern that expands the research boundaries.
Keywords: artificial cave, archaeoastronomy.

Riassunto
Una piccola grotta artificiale sulle colline di Briaglia, un paese vicino alla città di Mondovì in provincia di Cuneo, nel 1970 fu oggetto di indagini da parte di un appassionato ricercatore locale. Secondo questo studio l'ipogeo doveva essere un antichissimo luogo di culto attribuibile a popoli preistorici di tradizione megalitica. Tra il 2012 e il 2013 speleologi, archeologi, archeoastronomi e altri specialisti hanno lavorato insieme ad un progetto multidisciplinare di recupero e di indagine per accertare l'origine e la natura di questa grotta. La ricerca ha dimostrato un allineamento astronomico al solstizio d'inverno avvalorando, in assenza di reperti archeologici, l'origine cultuale del sito. I calcoli archeoastronomici hanno inoltre suggerito un'epoca di costruzione molto antica che amplia gli orizzonti della storia locale.
Parole chiave: *cavità artificiali, archeoastronomia.*

Introduction

Brigaglia is a small village, near the town of Mondovì, in the province of Cuneo (Piedmont region, NW Italy). The landscape is hilly, mainly covered by woods and pastures at maximum elevation of 546 m a.s.l. To the W it faces the open planes, with a wide view opening onto the Alpine mountain chain further characterised by the unique profile of the Monviso Mount, while to the E the slopes descend towards the valley of the Tanaro River. Archaeological research in the area has turned up proof of Roman and prehistoric settlements in the area (Botta & Collida', 1990) (Fig.1).
Professor Ettore Janigro D'Aquino was an independent researcher fond of history and archaeology. Born in Casale Monferrato, during the 1970s he led an in-depth research that spanned the hills of Brigaglia, where he spotted numerous artificial hypogea and many stones that he ascribed to a prehistoric megalithic cultureThese also include several menhirs, cromlechs (stones circle) and oddly shaped stones (Barbadoro & Nattero, 2007; Brun 2000). Though research was conducted with strong endeavour, the academic world has failed to acknowledge the professor's claims, due to the lack of what was considered a solid method of study. D'Aquino died in 2005 and both the artefacts and the data collected have almost entirely gone lost.

The research

In 2011 a team of cultural voluntary associations including cavers, archaeologists, geologists, archaeoastronomers and other specialists, started a complete and articulate project with the purpose of progressing Briaglia's research and, with the municipal administration, endorsing the historical and cultural aspects of the village.
The project, named "World of Stone", consists of:
1) Acquirement of every available document or material;
2) Territory investigations;
3) Interviews to local residents;
4) Census of every known hypogea;
5) Archaeological, geological and other investigations in several locations;
6) Presentation of the results and staging of a permanent exhibit.
The investigations and research have been focused on the hypogeum known as "Casnea Dolmen".

The Casnea grotto

Downstream of the town (valletta del Rio Frocco), on the E-facing slope, cultivated with vineyards and grasslands, stands an artificial hypogeum known in the 1970s as "Casnea Dolmen", located at only a few meters from the bottom of the valley. The site is considered an ancient place of worship or burial site (Cordier, 2004). Researchers found the entrance obstructed, and the access was only possible through a hole that opened up in the ground following the collapse of a small portion of the hypogeum vault (Figs. 2 and 3).
An excavator cleared the entrance and dug out an access corridor to the site.
Cleaning the location revealed a dry stone threshold with vaulted columns preceded by the ruins of two stone low walls that decorated the external corridor (Fig. 4).

Fig.1: Menhir in Briaglia.
Fig.1: Menhir a Briaglia.

The cavity was excavated in marls and sandstones of the Lower Miocene (Langhian) with a clear clayey component (Pane, 2013). It is composed by a 1 meter wide and 15 meter long corridor with a barrel vault; near the entrance, along the right wall at ground level, stands a spring water well that measures 7 meters in depth with a diameter of 1 meter (Figs. 5 and 6). In October 2013, an underwater speleology investigation. The walls are abundantly concretioned and the bottom is full of oozy sediment for a non-measurable width. No evidence of anthropogenic nature was found in what was possible to collect from the bottom (Fig. 7).
A square room measuring 3x3 m opens to the right at the middle of the corridor whilst a similar room is also found at the final part of the corridor, on the opposite side. The latter of these walls houses large rectangular stone blocks that sit on ground along the length of two walls. A curious cup mark on the end wall of the corridor, at about 1 meter from the ground, to collect the water dripping from the wall and off a stalactite. Two recesses can be found along the corridor to the left. The whole hypogeum is covered by thick concretions, particularly active in the room at the end of the structure.
The walking ground lies beneath approximately 5 cm of sediment, which has been removed and sieved: several terracotta potsherds were found, along with additional minor findings which were submitted to the

Fig. 3: view from inside before work.
Fig. 3: vista dall'interno dell'ipogeo prima dei lavori.

Turin Archaeological Superintendence for studies and dating.
Various animal bones found were C14 dated, though these traced back only to relatively recent times.
The walking ground is made of rock and no man-made pavement could be seen.
The well water seasonally overflows, flooding the hypogeum; therefore, the structure has been reworked by building a drainage system, rebuilding the vault and restoring the collapsed area.

The Archaeoastronomical investigation

The works in the hypogeum and the construction of an external access corridor (*dromos*) has made it possible to confirm its E-W direction. The observations carried out at the site reveal that the hypogeum could present some constructive traits of "astronomical" nature linked to the cycle of the sun, particularly to sunrise of the winter solstice. Ruling out plain randomness, it seems that the layout of the cave is linked to a "preventive" horizon observation by the builders, which translates into an application of spherical astronomy. Diurnal spherical astronomy is linked to the daily or seasonal "apparent path" of the sun (apparent as the Earth spins on its own axis and revolves around the sun at the same

Fig. 2: the lawn by the entrance to the hypogeum before work.
Fig. 2: il prato con l'accesso all'ipogeo prima dei lavori di recupero.

Fig. 4: access of the hypogeum after work.
Fig. 4: l'accesso all'ipogeo dopo i lavori di recupero.

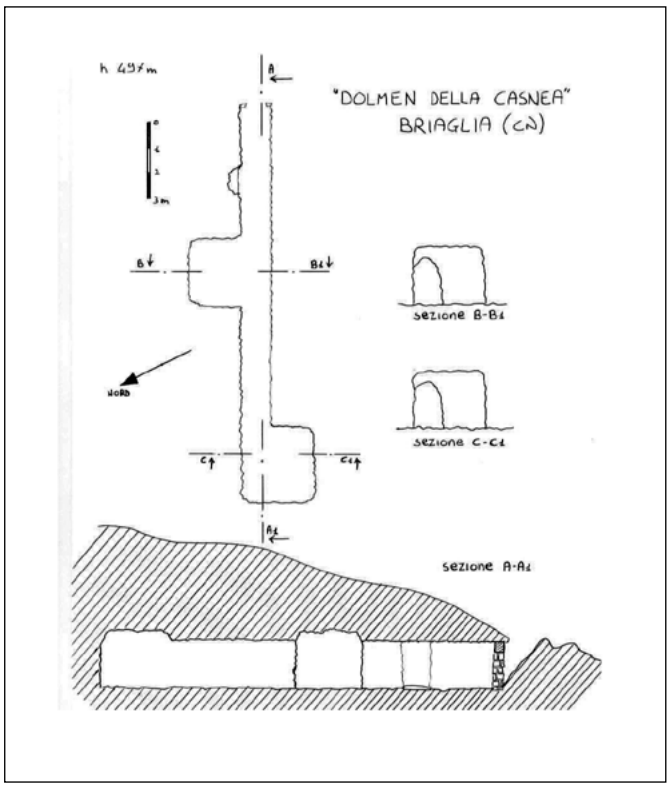

Fig. 5: plan and section (drawing F. Milla).
Fig. 5: pianta e sezioni (elaborazione grafica F. Milla).

time) (Gaspani, 2009). In winter 2012, the location was subject of extensive archaeoastronomical investigation by the expert Piero Barale, member of the Italian Astronomical Society (Fig. 8). Archaeoastronomy is a branch of archaeology which investigates astronomical knowledge, acquired through specific methods of this discipline, by the pre-historical, classical, late ancient and medieval populations. The knowledge gained seeks to unveil how these peoples interpreted celestial phenomena, how they put it to use and what role the celestial sphere held in their cultures. It is a scientific discipline which combines astronomy with both archaeology and anthropology, making it possible in various parts of the world to verify the knowledge ancient peoples and cultures had about celestial phenomena, and the way these were assimilated and interpreted to cults and traditions through artefacts, buildings and formations (Barale, 2003) (Fig. 9).
The observation of the phenomena linked to the

Fig. 6: Casnea grotto.
Fig. 6: la grotta della Casnea.

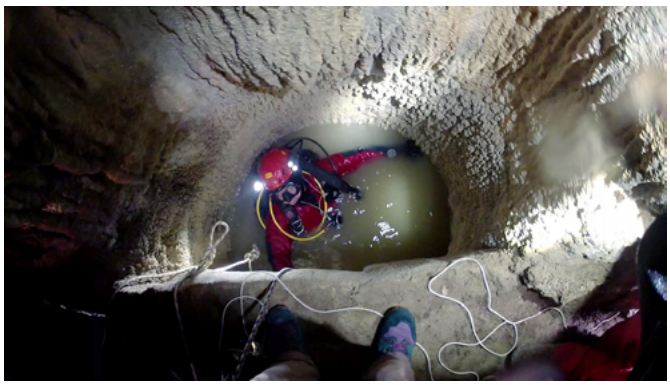

Fig. 7: cave diving survey in the well.
Fig. 7: indagine speleosubacquea del pozzo.

sun, in relation to its positions in the sky, is what allowed ancient communities to schedule all of their activities, both over short terms (days) and long terms (seasons). Nowadays this is possible thanks to technical instruments such as the azimuth compass, the surveyors' cross and the theodolite.
A survey station was set up on 21 December 2012, and the clear day made it possible to record the entire sunrise as to provide documentary evidence of the alignment of the Casnea hypogeum to the rising sun of the winter solstice. The luminous phenomenon in the cavity begins at 8.30 in the morning when the sun rises above the horizon and penetrates the hypogeum with its rays in a tangent orientation. The stone threshold shapes the light into a luminous brush that, as the star

Fig. 8: archaeoastronomical survey.
Fig. 8: studio archeoastronomico.

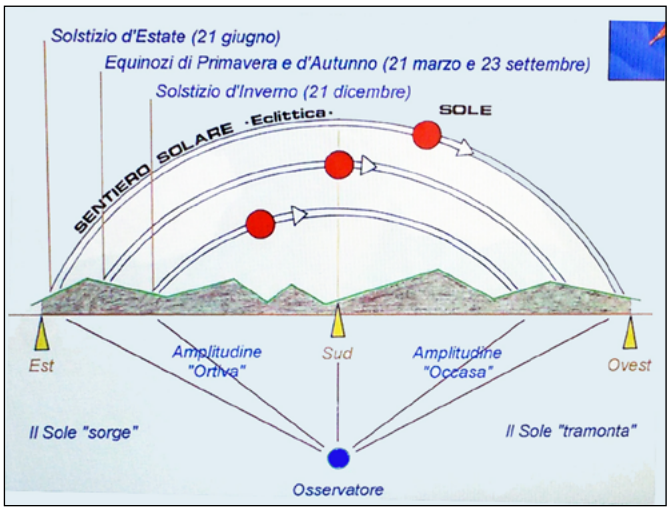

Fig. 9: graphic representation of the apparent motion of the sun (Barale P., 2013).
Fig. 9: rappresentazione grafica del moto apparente del sole (Barale P., 2013).

rises, moves from the sud wall of the corridor towards its centre, until it perfectly overlies its course with an orange light beam. At the peak of the phenomenon, the beam rises up the end wall until it touches the cup mark with an intense light accompanied by a perceivable rise in temperature. Then the light regresses from the grotto, sliding along the nord wall, which completely fades, approximately 2 hours after it first entered the structure (Figs. 10 and 11).

Conclusions

Considering the lack of past archaeological evidence able to determine the period in which the Casnea hypogeum was first settled, the archaeoastronomical investigation brought about several new data. The Institute for Spatial Astrophysics and Planetary Science of Rome states that this kind of alignment might be random in a 1/1000 case; further, many archaeological

Fig. 10: the solar phenomenon in Casnea grotto January 6, 2015 (photo F. Milla).
Fig. 10: il fenomeno solare nella Grotta della Casnea il 6 gennaio 2015 (foto F. Milla).

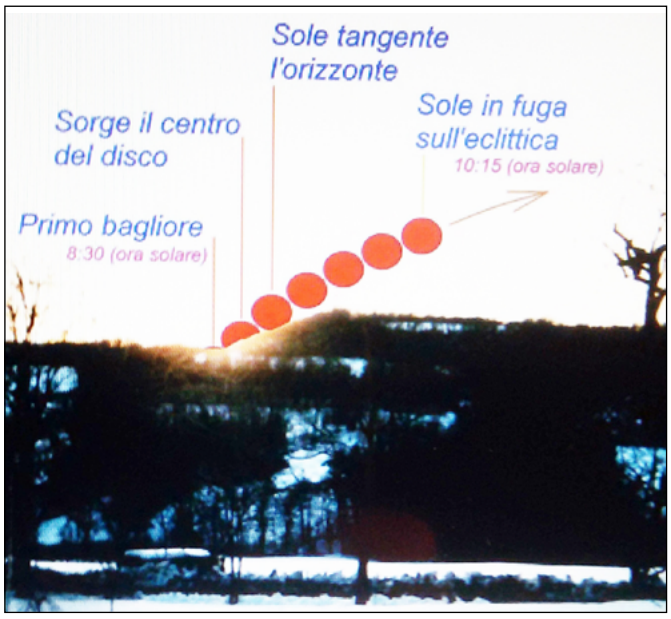

Fig. 11: winter solstice horizon in front of Dolmen of Casnea (Barale P., 2013).
Fig. 11: orizzonte al solstizio d'inverno di fronte al Dolmen della Casnea (Barale P., 2013).

sites, well known and acknowledged (e.g. Newgrange in Ireland) also exist, in which spectacular sunlight phenomena occur, similar to that observed at Briaglia. Interesting conclusions can be reached if we validate the thesis that the hypogeum was realized with a complicated solar alignment. Furthermore, on the basis of the surveys conducted and given the fact that the obliquity of the ecliptic (the angle comprised between the apparent path of the sun and the equator of the Earth) shifts by a known graduation in a given set of years, which makes it possible to determine the position of the rising sun on the horizon in the past, it is possible to venture a date for the construction. A series of calculations led to the conclusion that the constructive origin may date back to 8,000 B.C. (Barale, 2013).

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