

- Eyre, J. 1989. *The Ease Gill System: Forty Years of Exploration*, London: BCRA (Speleo History Series 1)
- Railton, C.L. 1953. *The Ogof Ffynnon Ddu System*, London: Cave Research Group: (CRG Publication No. 6)
- Shaw, T.R. 1992. *History of Cave Science: The Exploration and Study of Limestone Caves, to 1900*, 2nd edition, Broadway, New South Wales: Sydney Speleological Society

- Tratman, E.K. (editor) 1969. *The Caves of North-west Clare, Ireland*, Newton Abbot, Devon: David & Charles

Further Reading

- Cullingford, C.H.D. (editor) 1953. *British Caving: An Introduction to Speleology*, London: Routledge and Kegan Paul

BURIALS IN CAVES

Caves accessible to humans have been used from the Paleolithic to the present. They provide a variety of burial conditions, such as graves in the ground, body exposure on the floor, coffins exposed in selected places, storage of bones or pieces of bone in jars, and cremation urns. Habits have varied through time, and also according to the particular people, social status of the deceased person, position in the family, age, and cause of death.

In Mousterian times, and perhaps before, *Homo sapiens neanderthalensis* buried their dead in caves and rock shelters such as Tabun Cave, Israel, dated to about 180 000 years ago. The first discovery of a Neanderthal grave was in 1908 at La Chapelle-aux-Saints Cave, Corrèze, France. In La Ferrassie, Dordogne, France, eight bodies were placed into man-made graves, given specific positions and covered with protective flagstones, artefacts, and earth mounds. Clearly, Neanderthal Man was conscious of death and life, as shown by his rituals. In Shanidar Cave, Iraq, the covering was pine branches and flowers (see Shanidar Cave, Iraq: Archaeology), and in Teshik-Tash Cave, Uzbekistan, a boy's body was circled with ibex horns. Archaic *Homo sapiens sapiens* were also given offerings, as in Qafzeh, Palestine, that indicate belief in a life after death. The reality of Mousterian burials has been questioned by a number of authors, such as Gargett (1999). Though their comments bring an interesting insight into the necessary fossilization processes, deliberate burial could be confirmed in most of the cases.

Dordogne caves have provided evidence of burials for nearly every prehistoric period. Some caves were repeatedly used, as for instance, Rouffignac (Neolithic, Bronze, and Iron Ages), or Déroc Caves (Late Neolithic and Chalcolithic).

Burial habits evolved, from mainly collective exposure on the floor during the Neolithic, with up to a hundred bodies in a single cave; partial (accidental, sometimes ritual) burning of bones; graves in the cave floor (Mousterian, Bronze Age); ash deposits near gallery walls after cremation (appearing during Late Bronze II Age); bone storage after flesh removal (Late Bronze Age); body exposure on wooden platforms, as in La Fontanguillère (Bronze Age) and Foissac Caves (Lot, France, Chalcolithic Age); or apparently little use (during Iron Age before Tene III, perhaps because of widespread cremation). In some caves, body remains lie on flowstones or clayey ground subsequently covered with calcite, for instance Early Iron Age remains at Palabres Cave (Lot, France). Some people occasionally hid themselves in caves, but were smoked in with wood fires at the entrance and so died.

The cave environment and noticeable cave features were taken into consideration, probably in relation to belief or specific interest. Late Bronze ashes from cremation in Rouffignac Cave entrance were placed only in galleries with Magdalenian wall paintings. Wooden platforms in La Fontanguillère and Foissac

Caves were located above a permanent stream, perhaps in relation with a water cult or to signify a route to the realm of the dead. At different periods variable artefacts, pottery, and offerings were placed besides bodies.

Comparable habits existed elsewhere in the world. In Vietnam, for instance, a few caves and rock shelters were possibly used for burial during Lower Neolithic Hoabinhian II–III and three caves, Pho Binh Gia, Khéo-Phay, and Lang Cuom, revealed skulls of people of the Bacsonian culture. In the latter, skulls were rubbed with red ochre; 80 to 100 individuals were present—probably a secondary burial. Children's skulls were used as funeral urns or trophies. Many caves with Upper Neolithic remains are very rich in burial-related attributes.

In Laos, Mesolithic—and perhaps older—human remains were found in Tham Pong. A Lower Neolithic burial was uncovered in that cave (an adult on its back) and in Tham Hang South, where six bodies, including three lying on their back on an ash blanket, were placed parallel to the cave wall. Upper Neolithic burial possibly existed in Tham Hang. Burial in karst fissures of Khammouan karst, sometimes associated with pottery, lasted up to 400 to 300 BC. These burials are similar to some modern burials as in Sagada (see below) and suggest a possible use of coffins. Undated, relatively young coffins are also found in the area.

Hardwood coffins are common in nearly 100 caves of the Mae Hong Son and Kanchanaburi areas of Thailand (200 BC–800 AD) (see also Asia, Southeast: Archaeological Caves). Many of these caves have a difficult access and the coffins themselves are stored in inaccessible locations, such as on ridges or ledges, some even being placed horizontally on pole systems. The coffin shapes vary and their length may exceed 2 m. Associated items include glass beads, ceramics, and metal objects.

Caves in the Southeast Asian islands, such as Borneo (Malaysia, Indonesia) and Palawan (Philippines), offer similarities with the mainland and make the link with modern times. Borneo's Niah Cave delivered a 38 000 years old *Homo sapiens* skull, tree trunk Neolithic coffins dated 2460 ± 70 years BP, 1000-year-old boat-shaped coffins, together with many other burials. More coffins are found in several areas of Borneo, as in Sabah State, the upper reaches of Mahakam River, and recent ones in Mulu karst (e.g. Cave of the Winds).

Palawan caves in the Tabon area have demonstrated Man's presence for at least 45 000 years, including the Tabon Man (22–24 000 years BP) and long time burial habits. In the Early Neolithic, a flexed male body in Duyong Cave was placed face down in a grave, with associated earrings and tools (2680 ± 250 BC). From c. 1500–1000 BC in the Late Neolithic, to the 14th century AD, jars offered primary and secondary burial, though skulls were sometimes buried separately.

Jars, covers, vessels, and other items are sometimes very numerous: there being up to 200 in the single-chambered Tabon Cave (200–500 BC)—with glass beads, as in Thailand, and lime containers, probably for betel chewing; more than 500 such items in Tadyaw Cave, with iron tools of the advanced Metal Age (100 BC to 300 AD); more than 78 in Manunggul Cave, many of Late Neolithic (890–710 BC) and Early Metal Age (190 BC), including pottery covers showing a ship of the dead and one trunk-shaped pottery coffin 73 × 34 cm large for secondary burial. Bone painting with haematite occurred during the Neolithic and Early Metal Age (from c. 1500 to 1000 BC, to c. 190 BC) and gradually disappeared before the 13th century AD.

In rare narrow caves, bodies were put into maceration on the ground, probably wrapped in a mat. Skull burial, supine position (primary burial), and bone bundles (up to seven persons) were also observed.

All sites were chosen for their beauty or magnificent scenery. Jars were often placed in the daylight, or sometimes in dark chambers decorated with beautiful stalagmites. Nearly all burial caves in the Tabon area face the sea at various elevations (115 m in a sheer cliff at Manunggul), as do burial caves in the Palawan El Nido area and in southern Luzon. Jars are usually placed along walls, occasionally protected by stones, leaving space for new jars or ritual gatherings (cult-of-the-dead), or in the centre and at the rear of the cave.

Also in Palawan, two bodies and funeral attributes were placed one century ago in a cave of Balagbag Cliffs. In Lungun Cave, a 1.15 m long hardwood log coffin (700–1000 AD) closed with pegs, was placed high above a small stream; iron tools and some pottery were found inside. A beautifully carved, 2.24 m long, wooden boat-coffin was found on a cliff ledge (13th or 14th century).

Wooden coffins are found in several mountain areas of Southeast Asia, especially in Luzon, Philippines, and Sulawesi, Indonesia. In Kabayan, northern Luzon, more than 20 caves are packed with hollowed tree trunks containing mummies in a foetal position, that are up to 400–500 years old. Bodies were rubbed with a medicinal plant decoction and smoked during long funeral rites. Carved coffins, such as a water buffalo-shaped coffin made of fine wood, were reserved for elite people. Skulls and bones are stored in some caves.

In Sagada, northern Luzon, cave and cliff burial is still occasionally performed. More than 50 sites exist, mainly on the karst fringe close to villages. Coffins are exposed on the cave floor, ledges (high above a cave stream in Matangkib Cave), horizontal poles, or placed in fissures, because locals believe that the souls of deceased adults are able to move and must be left free to do so. Selecting a future coffin location takes into account kinship, deceased person's quality and social role, and the availability of suitable locations. Infants, children, and women who died in childbirth are buried outside.

Coffins are traditionally made up of hollowed pine logs with a lid, and closed by vine ties or pegs. Occasionally, lids were carved (lizard, a symbol of felicity), pegs as well: they were reserved for highly appreciated persons. Normally no offering is placed in coffins. Bodies are commonly given a foetal position. Recent coffins are often nailed wooden planks and bear bodies laying on their back. Normally no offering is placed in coffins. A few burial jars have been discovered.

There can be no long time between death and body transfer to the burial site. The rituals to bring the corpses to the caves are by tradition rather strict. No sharp noise must occur during the body transfer to the coffin already placed in the cave, which explains why selected caves or cliffs are not distant from the village. Once all required sacrifices are completed, the deceased person is considered as definitely departed to another world.

In Tanah Torajah, Sulawesi, log coffins are placed in caves (or man-dug underground chambers) after long ceremonies, with numerous sacrifices. Selected caves are located at ground level or at various elevations on karst slopes. Some are accessible by long bamboo ladders used for one burial only. Rituals during coffin carriage to the burial site are less strict than in Sagada and loud noise is common. Coffin shaking and irregular loops are made, so the soul cannot remember the way back to the village. Then the coffin is quickly carried to its final place. The dead has now attained the status of an ancestor and a statue of him is placed near the burial place, facing the realm of the alive. Children cannot access this status and so are usually buried in hollowed trees. Recent to present burial caves are also known in Papua New Guinea, in Lifou Island, and nearby New Caledonia, in Tahiti and Marquesas Islands, Easter Island, and Patagonia (Alakaluf Indians).

In the United States, cave burials have been found for example in western Kentucky. In Salts Cave, the flexed mummy of a 9 year old boy (dated at 10 BC to 30 AD ± 160 years) was found high upon a ledge, desiccated by the dry, cool atmosphere. In Short Cave, mummies of a baby, an adult sitting in a stone grave with offerings, and a flexed or sitting adolescent, were all dressed with deerskins. In Mammoth Cave, a flexed female body was buried in an oval grave lined with burned grass or fibre matting. Burnt bones were uncovered separately. Short and Salts Caves revealed primary burials of people defleshed for this purpose. Ashes mixed with animal and human bones were found in crevices near the entrance (and also inside Salts Cave). Bones from foetuses to adult individuals were very abundant, with marks of defleshing (questionably burial rituals or cannibalism), and many were partly burnt—probably accidentally. Some ornaments and tools, and many fabrics were present. The remains are likely to belong to several Indian or close populations.

In eastern Kentucky, Ash Cave was used for primary interments of female adults and children; it also contains layers of ashes and vegetal remains with many fabrics. In Tennessee and Missouri, primary and secondary burials have been uncovered in caves. Burnt bones, stone slab graves, and pottery were found in Miller's Cave, Missouri.

Burial caves are known in South and Central America, for instance, in Maya areas of Central America. In Brazil, 8–10 000 year old remains of the Lagoa Santa Man were found in Sumidouro and other caves in Minas Gerais, and 40 000 year old human remains in rock shelters of Piauí State.

Africa also has burial caves, e.g. of Dogon people in Bandiagara Cliffs of southern Mali.

Cave burials exist because favourable natural sites, adequate beliefs, and necessity are present at the same time. It is remarkable that this habit has lasted since Paleolithic times and that similarities are found in different locations and cultures. Although a variety of ritual uses of caves do still occur, burials are gradually disappearing under the pressure of Christianity and westernization of indigenous cultures.

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See also Asia, Southeast: Archaeological Caves; Human Occupation of Caves; Religious Sites

Further Reading

- Chevillot, C. 1990. L'occupation du milieu souterrain en Périgord durant la Protohistoire [Occupation of underground realm in Périgord during Protohistory]. In *Les Cahiers de Commarque, 2è colloque sur le Patrimoine troglodytique*, Les Eyzies-de-Tayac
- De Leon, L. 1976. The mummies of Benguet. *Philippine Panorama*, August 8: 52–54
- Fox, R.B. 1970. *Tabon Caves: Archaeological Explorations and Excavations on Palawan Island, Philippines*, Manila: National Museum
- Gargett, R.H. 1999. Middle Paleolithic burial is not a dead issue: The view from Qafzeh, Saint-Césaire, Kebara, Amud and Dederiyeh. *Journal of Human Evolution*, 37: 27–90
- Mouret, C. 2000. Grottes et falaises sépulcrales de Luzon et Sulawesi [Burial caves and cliffs of Luzon and Sulawesi]. In *Actes de la 10ème Rencontre d'Octobre*, Paris: Speleo-Club de Paris
- Robbins, L.M. 1974. Prehistoric people of the Mammoth Cave area. In *Archeology of the Mammoth Cave Area*, edited by P.J. Watson, New York: Academic Press

BURREN GLACIOKARST, IRELAND

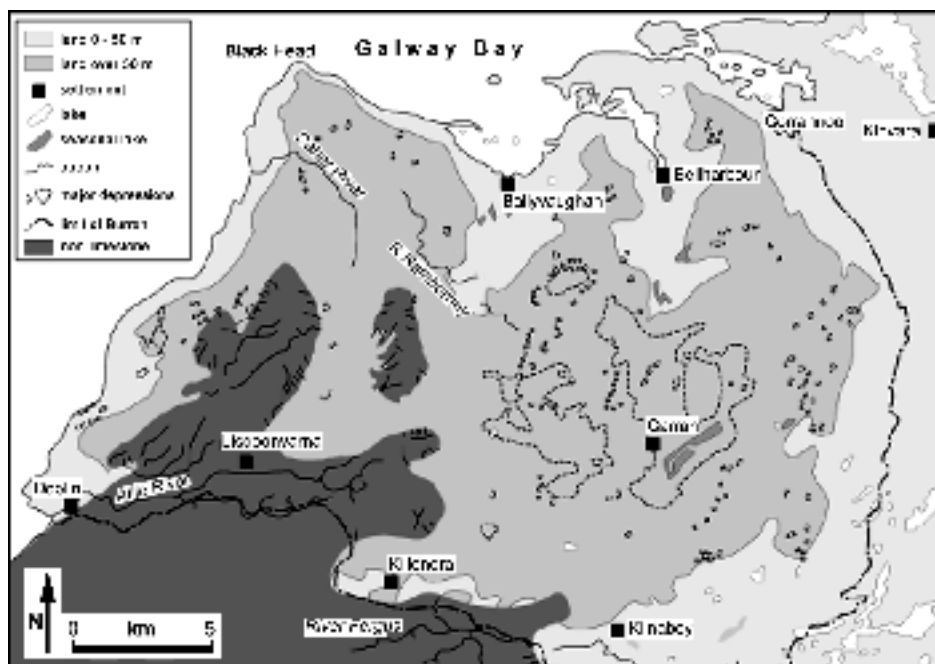
The Burren plateau of northwest County Clare is the finest example of a karstic terrain in Ireland. The landforms of the Burren have been strongly influenced by glacial and periglacial processes, as well as by purely solutional, karstic processes, and in this respect the landscape resembles that of the Yorkshire Dales karst in England, with extensive areas of limestone pavement.

The Burren is bounded to the west and north by the Atlantic Ocean and Galway Bay, respectively. The southern boundary is where the limestone passes beneath younger shale and sandstone of Namurian age. This corresponds to a line from Corofin to Kilfenora to Lisdoonvarna to the coast at Doolin. The eastern limit of the Burren is the foot of the scarp at an altitude of approximately 60 m, which extends from Corranroo Bay in the north to Kilnaboy in the southeast (Figure 1). The area defined above is some 360 km² in extent and forms a gently inclined plateau at 200–300 m above sea level in the north and 100–150 m above sea level in the south, bounded by steep scarps on all but the southern flank. Only isolated summit areas exceed

an altitude of 300 m and the highest point is the shale-capped Slieve Elva at 344 m. To the west of the Burren, the three Aran islands are, in many respects, an extension of the main Burren.

The Burren karst is developed in Carboniferous limestones, with some 500 m of limestone succession exposed. Differing characteristics of the limestones are reflected in landforms and in hydrology throughout the Burren. For example, the Maumcaha Unit, 70 m in thickness, with few joints or bedding planes, is overlain by a 140 m thick strongly bedded sequence of limestones (the Aillwee unit), and underlain by a similar sequence, some 150 m thick. The massive unit forms steep, uniform slopes or cliffs, whilst the bedded units form tiers of stepped terraces, particularly on the northern flank of the Burren overlooking Galway Bay

The uppermost stage of the limestone is the Brigantian Slievenaglasla Formation, characterized by more coarse-grained rocks than the main Burren Limestone, and incorporating numerous nodules or sheets of chert between the limestone beds. The chert seems to function in a similar manner to the shale



Burren GlacioKarst: Figure 1. Major depression and seasonal lakes within the Burren Karst, Ireland.