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## **POST-MORTEM TREPANATIONS IN A BURIALS IN LATE BRONZE AGE AND IRON AGE FROM ARMENIAN PLATEAU**

**Abstract:** According to the classification of trepanations used by modern palaeopathologists, one group includes ritual operations. In prehistoric Europe trepanations post-mortem was accomplished to create amulets from the bones of human skulls, while in Central Asia post-mortem operations were connected within funerary traditions, including embalming and mummification. Craniological materials in this study are dated to the end of the Late Bronze Age and Early Iron Age, and originated from the Sevan Lake (Armenia). From 4 series, numbering 88 skulls, 9 trepanned skulls were recognized in which this procedure was performed on crania before the soft tissue had disappeared. Lesions, classified according to location and size, revealed five basic types.

**Keywords:** Armenian Plateau, burial rites, post-mortem trepanation

### **Introduction**

The Armenian Highland (also known as the Armenian Upland, the Armenian Plateau, or simply Armenia), is the centermost and highest of three land-locked plateaus that together form the northwestern sector of the Middle East. The Armenian Plateau was in early history a crossroads, linking the worlds of East and West. At the end of the fourth millennium and beginning of the third millennium, there was an important agriculturalist culture in the Armenian plateau called the Kura-Araxes culture. Metal goods and pottery were produced and widely distributed, having been found in the Dagestan, Chechnya, Volga, Dnieper and Don-Donets systems in the north, in Syria and Palestine in the south, and to the west in Anatolia (Krupnov 1966; Gadzhiev 1966; Nechitailo 1991; Pustovalov 2002; Trifonov 1991; Badalyan and

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Avetisyan 2007; Sagona and Abramishvili 2008). The Craniological data allowed identification of alien Mediterranean characteristics influencing various ethnic Eurasian samples and revealed evidence of a migratory stream from the Caucasus, Near East and Central Asia (Dubova 2009, 2010; Khokhlov and Mimokhod 2008; Khudaverdyan 2011a, 2011b). The Odontological and Craniological data, exhibit close affinities with the Armenian Plateau samples (Kura-Araxes culture), and with the samples from Ukraine and Moldova (Tripolye culture) (Alekseeva and Krus 1999; Khudaverdyan 2011a, 2011b, 2013, 2014a). Hence, it is possible to outline the cultural and ethnic communication in antiquity and the known role of the Armenian Plateau (Kura-Araxes culture) as the intermediary between ancient area of distribution of Tripolye cultures and the east countries (Lang 2005; Martiroyan and Mnacakanyan 1973; Passek 1949).

The Armenian Plateau and Georgian samples (Kura-Araxes culture), and the Catacomb culture samples from Kalmykia, Ukraine, Dnieper exhibit very close affinities to one another. The contacts continued until the late Bronze Age. The Armenia samples and the steppe Bronze Age sample from Volga (Albashevo, Fatyanovo, Balanovo, Timber Grave cultures) exhibit close affinities. The presence of these Mediterranean components was marked by Shevchenko (1984, 1986), Khokhlov (2000) and Dubova (2009) in carriers of Timber Grave cultures of the forest-steppe Volga region, and also by Yusupov (1989) in the Southern Ural Mountains.

The Kingdom of Urartu flourished in the Caucasus and eastern Asia Minor between the 9th century BC and 585 BC in the Armenian Plateau. Urartu was a remarkably developed culture that had extensive contacts with the major empires of the Ancient world stretching between the Mediterranean and India, and rivaled them for trade, military and cultural hegemony. With VIII century BC in the Armenian Plateau the interaction of different ethno-cultural units-Iranianspeaking nomadic (Scythians, Sarmatians, Sauromatians, Saka) and local. Finds of tumuli in the Caucasus show the permanent presence of Scythians in these parts (Piotrovskii 1959). The samples from Urartu, is identified as possessing closer affinities to the samples from the Volgo-Uralja (Sauromatians) and Moldova (Scythians) (Khudaverdyan 2012).

Trephination (both derived from the Greek word *trypanon*, meaning "to bore") is perhaps the oldest form of neurosurgery. Trepanation may be defined as the removal of a disk of bone from the skull. Many famous scientists such as P. Broca (1876) in France, D. Anuchin (1895) in Russia, and J. Matiegka (1928) in the Czech Republic, who developed different branches of study within physical anthropology, did not avoid including the provocative theme of trepanation in their research. Subsequently, with the differentiation of sciences, palaeopathology has entered the sphere of research on human

trepanation (Ruffer 1918). Most theories that have been advanced about the purpose of trepanation can be grouped into 3 categories: therapeutic, symbolic and cultural. Throughout this paper I will be mainly analyzing ritual post-mortem trepanation at burials from Armenian Plateau (Noraduz, Sarukhan, Karmir and Arszvakar). This better understanding of a single aspect of human practice can also lead to a better understanding of the culture of that society and perhaps also the world at that time.

Trephination-like holes were made on corpses in order to obtain bony fragments with magic properties, called roundels, or for charms or amulets (Crump 1901). Many cultural explanations are proposed for skull remains that show no evidence of disease, injury, or any other sort of paleopathological changes. Anthropologists and archaeologists have suggested that perhaps these individuals were trepanned for magico-ritual, religious, and ritualistic reasons (Broca 1876; Aufderheide and Rodriguez-Martin 1998). R. Mallin and T. Rathburn (1976) discuss the case from the Iranian Iron Age II period (1100-800 BC) of an 11 to 12 year-old boy, whose skull shows no evidence of depressed fractures, injury or disease. Is no biological evidence of the reason to trepan this individual, and given the fact that this individual is quite young, it is possibly part of a ritual or religious ceremony. M. Ruffer (1918) and K. Oakley et al. (1959), for example, describe cranial bones being used as powerful religious objects that have curative powers in Medieval Europe. Ruffer briefly states that people thought powdered cranial bones had curative powers and that this belief continued up through the Middle Ages. S. Parker et al. (1986) describe a skull from Medieval England with three unhealed holes, probably made postmortem, that were likely used to suspend the skull. They argue that this was probably a ritual act (Parker et al. 1986). W. Hindsdale and F. Greenman (1936) hypothesize that many cases of trepanned skulls found in prehistoric Michigan were postmortem trepanations, and that the holes were used to suspend the skulls in a ritual or decorative manner.

In prehistoric Europe, the majority of cases were performed in order to obtain amuletic material from human skull bones. In Gallic times (260-273 AD) bone roundels (or roundels) were worn as ornaments or amulets (Ruffer 1918). There is even some evidence of roundels being perforated so that they could be worn on a string or chain around the neck (Oakley et al. 1959). In central and eastern Europe, ritual or 'symbolic' postmortem trepanations are associated with some cultures such as the Hungarians (Marcsik et al. 2002).

In Central Asia, however, the postmortem operations were performed in connection with the funerary traditions of embalming and mummification. K. Goroshenko (1899), the first investigator of the anthropological materials from the Minusinsk Basin, reported to the Empire Archaeological Commission on the nature of the artificial damage to the human remains found in late Tagar mounds. He described large perforations in the parietal bones,

and classified this manipulation as an after-death event in which the brain was evacuated in connection with some variant of the death mask ritual. Goroshenko also noted that some "trepanned" skulls were coated with clay that, in turn, were covered with gypsum. It is possible that the skulls had lost their soft tissue at the time the gypsum masks were created.

### **Materials and Methods**

Craniological materials from the Sevan Lake in Armenia, to the end of the Late Bronze Age and Iron Age, were studied. The sites were excavated in 1979-1989. The archaeological context, such as location of the site, and time period of the burial were recorded. Unfortunately, in all cases only the skulls were preserved. Skulls from Noraduz, Sarukhan, Karmir and Arszvakar are a part of collection gathered by Anna Palikyan

Sex determination was carried out using cranial morphological markers (glabella, mastoid process, supra-orbital ridge, nuchal crest, parietal eminence, orbit, palate, occipital condyle, external occipital protuberance, styloid process, fronto-nasal junction, mandible, mental protuberance, and teeth) (Buikstra and Ubelaker 1994). Age categories were estimated based largely on methods using the dental wear, and cranial suture closure (Aleksiev and Debets 1964; Buikstra and Ubelaker 1994; Meindl et al. 1985). For subadults, dental development and eruption were used (Buikstra and Ubelaker 1994; Ubelaker 1989; Moorrees et al. 1963a, b).

Among 100 skulls in 4 series, 9 post-mortem trepanned skulls were identified. All skulls kept in the Palaeoanthropology Repository of the Institute Archaeological and Ethnology, Armenia.

The common methods for trepanation are scraping, grooving, boring-and-cutting and rectangular intersecting incisions (Lisowski 1967). The classification of trepanations currently in use today includes: (a) real or surgical trepanation (*trepanatio ante mortem*), defined as any opening of the skull on a living person; (b) ritual trepanation (*trepanatio post mortem sive post huma*), any posthumous opening with the aim of obtaining a part of the skull vault to be use as an amulet or other use (Broca 1876); (c) symbolic trepanation, an operation on the skull roof of a living person that does not affect the inner compact layer of the bone (Bartucz 1950; Nemeskery et al. 1960). Using the current system of classification of trepanation procedures, a group of undoubtedly ritual postmortem operations may be described.

Historical sciences have recorded valuable information pertaining to the ancient cults of various parts of a body. Of primary importance are cults of the skull related to ancestors cults, distribution of postmortem masks, embalming and mummification traditions, manipulations of the defeated enemy,

neutralization of buried spirits, decapitation, and scalping (Khudaverdyan 2014b). The goal of this study is to provide a more detailed description of the post-mortem operations on skulls from Late Bronze Age and Iron Age Armenia burials, and to find the nearest analogies to these types of lesions.

### Results and Discussion

The principal results, the technique involved in the trepanation was to cut the fresh skulls using sharp, flat bladed instruments. Traces of healing or inflammatory reactions were not present. The margins were sharp and there were no indications of vital reaction. The outer margins of the openings were larger than the inner ones; this finding indicates a differentiation of the damage from traumatic lesions. In the case of an injury caused by a battle weapon, the exit area of the weapon seen inside the skull is larger than the external hole. This indicates that trepanations appear in the opposite manner (Berryman and Jones 1996). The difference in size between the perforations of external and the inner compact skull layers was not so clear. The original unchanged structure of the spongy substance is visible; any trace of bone callus development is not apparent.

The lesions were classified according to their location:

Type 1. Skulls with triangular perforations on the parietal bones (Figures 1-2).

Type 2. Skulls with square perforations on the temporal (Figure 3) and frontal bones (Figure 4).

Type 3. The skull have single perforations in the occipital region (Figure 5).

Type 4. The skulls demonstrate both large perforations in the base skull (Figure 6).

The procedure to have been common among males and child.

Moreover, the artificial apertures were more varied in form and location than was previously suspected.

**Type 1.** The skull to be discussed was found in Arszvakar, in a cemetery dated to the IX-VIII BC. Burial no. 5 is that of a male, aged between 60 and 65 years old, with an incomplete skull. On the skull, of which only the calvarium is preserved, two cases of trepanation (one medical and one ritual) were recorded. The post-mortem perforation was localized on the right parietal bone, 10mm of the sagittal suture (Figure 1). A triangular bone fragment was removed from the skull: a fragment of has the following dimensions: 15.5mm×20mm×18.8mm. Used a knife to perform rectilinear trepanations (by making perpendicular cuts in the skull). The skull had been cut with great skill through the outer table only, the external diameter of the hole being greater than the internal (15.5mm×16mm×17mm). Possibly, such triangular

skull fragment was removed for bone amulets. Thus, this procedure was performed after persons' death for magical reasons.

The surgical trepanation is oval, measures 29 mm×14 mm, and is located of the right parietal bone. Bone fragments recovered. Traces of healing and inflammatory reactions were present. The traits of surgical intervention are still visible. The operation was probably performed in the hope of curing intracranial disease or extradural haematoma, persistent migraine or paralysis. But it is more likely that it was a surgical clearing-out for the removal of splinters of bone from a head injury brought about by combat, hunting or farming. The low level of healing indicates that the man did not die immediately after the injury and the operation, but only survived for a short time.

Further evidence of trephination. A triangular fragment of left parietal bone were removed from a male skull (40-45 years) (Karachamb, burial 2). In the trepanation of a skull of a male from Karashamb the scraping seems to have been carried out very crudely (Figure 2). A fragment of the following dimensions: 13.8mm×12mm×9.9mm. The external diameter of the hole being greater than the internal (6 mm×9.9mm×5.5mm). It is apparent that the trepanners were not especially careful and had no fear of destroying the dura mater or the brain itself. The original unchanged structure of the spongy substance is visible; any trace of bone callus development is not apparent. Therefore, it can be concluded that the procedures took place after death.

A compressive trauma is present on the right parietal bone of a male from Karashamb. The lesion has an circular form with diameters of 39mm–33mm, in the center of which has a recess (8mm×8mm). Because the fracture occurred several years before death, the margins of the traumatic injury are smoothed and the initial compressed bone region has been reduced and replaced by normal bone. The paleopathologies noted include porotic hyperostosis and cribra orbitalia. Porotic hyperostosis is a descriptive expression for any porous enlargement of bone tissue that finally results in a porotic external surface of the skull vault that is usually also thickened (Lallo et al. 1977; Stuart-MacAdam 1997; Aufderheide and Rodriguez-Martin 1998; Ortner 2003). Porotic hyperostosis and cribra orbitalia can be caused by different conditions such as anemia, scurvy, rickets, osteomyelitis, periostitis, inflammatory processes of the scalp (Larsen 1997; Ortner 2003).

**Type 2.** Another skull, which is an example of post-mortem examination, was dug out from a cemetery in Karmir (burial 7) dated to IX-VIII BC. It belonged to an male aged approximately 50-55 years. Was removed part of temporal bone using a metal saw (perhaps a kind of chisel) and a hammer. A square bone fragment was removed from the skull and has the following dimensions: 9mm×10?mm (Figure 3). Also a square bone fragment was

removed and from the child skull from Noraduz (Figure 4). The square perforations skulls example present from Dashkesen region (Azerbaijan) was post-mortem (Kirichenko 2007). Probably the, common spiritual beliefs and religions were characteristic for the populations at the Bronze Age and Iron Age. The location of the trepanations and, probably the techniques used in opening the skulls, however, appear to be similar to those used in Armenia. It seems probable that the populations that practiced such rites may have had common genetic origins. These kinds of ritual intervention are not uncommon, and sometimes had the purpose of obtaining rondelles or bone powder for use in healing potions or as magical amulets (Lisowski 1967; Facchini et al. 2003).

**Type 3.** The present study reports the occurrence of post-mortem trepanation in Karashamb site (IX BC, excavations 1985; male skull, burial 1, 20-30 years, Figure 5a). Trephination, achieved using a drilling technique, created a hole noted on the occipital bone. The width of the trephination hole, which is circular in shape, is 13.8 mm by 13.3 mm. No sign of specific trauma was found near the hole nor elsewhere on the skull. It is rather difficult to pin-point the reason why the operation was performed. The primary direction of the research led us to think that the person had died after the surgery or was performed on the dead individual. However, there was no sign of infection, which proved that the person survived the procedure and then died later, due to post-operative complications. There is evidence of cut marks present at skull (Figure 5b). There are many possible explanations for the presence of cut marks on human bones, although surgery, surgical bleeding or other medical operations cannot be ruled out. Often traces are not random, but are clearly structured (symmetrically on the parietal bones), again suggesting their symbolism. These are the so-called cultical trepanations. The object of the latter is unknown, ritual-medical reasons are as possible as religious causes or higher social status.

Some groups apparently practiced post-mortem removal of circular pieces of skull (Ruffer 1918; Parry 1931; Stewart 1958). T. Parry (1931) asserts that Neolithic man performed trephination "as a religious rite ridding an affected individual of some demon or demons". He also indicates (Parry 1931, 1388-1389) that amulets were made from the trephined skulls of deceased individuals, which included healed edges of the trephination.

**Type 4.** On the four skulls from Noraduz site were found post-mortem trepanned (Figure 6). The skulls have large single perforations in the base of the skull. The large areas of destruction, it is apparent that the operations would have been fatal if the patient were alive; therefore, it can be concluded that the procedures took place after death. In Armenia post-mortem operations, perhaps, were connected within funerary traditions, including embalming and mummification.

### **Symbolic signs on the skulls**

Ancient populations Armenian were a deeply spiritual and they communicated their history, thoughts, ideas and dreams from generation to generation through Symbols and Signs such as the symbol. When symbols were first used it was to concentrate man's mind on the Infinite. The symbols which were used in the religious teachings of early man are popularly known as the Sacred Symbols. The three original symbols which I have referred to are: the ovale (or circle), the triangle and the square.

As is well known, one of the sacred meanings associated with the symbolism of the triangle is the fiery aspiration of the human soul towards higher unity. The triangle is the geometric image of the ternary and the myriad concepts of an archetypal trinity which crowns the mystical endeavour (birth - life - death, life - death - rebirth /rebirth/). It is used to depict such personalized entities as Father, Son and Holy Ghost in the Christian system, as well as the Egyptian Osiris-Isis-Horus and the Graeco-Roman Zeus-Poseidon-Hades. Bones of the dead were often used for magical or therapeutic purposes. The triangle with its apex downward symbolized the element of water, and typified the material world, or the three enemies of the soul: the world, the flesh, and the Devil, and the cardinal sins, envy, hatred and malice. The triangle with its apex upwards stands for the elements of fire and spirit, composed of the three virtues (love, truth, and wisdom).

The square is used as a basis for many symbols. The simple shape of the square sign was easy to extract from the bones. The four-sided symbols point to the four compass directions of north, east, south and west, the four sections can indicate the four great primary forces, or the Sacred Four, emanating from the Creator and representing the individual elements of Air, Fire, Water and Earth. There are other magical symbols and signs which can be connected to four-sided symbols such as the four seasons of winter, spring, summer and fall, the four ages of man that symbolize birth, growth, maturity and death. The use of the four sided square symbol is sometimes extended to include the four cosmic elements of the sun, moon, planets and stars.

The oval or circle is a picture of the Sun and was the symbol of the Infinite One. According to legend, the Sun was selected for this symbol because it was the most powerful object that came within the sight and understanding of man at that time. The circle having no beginning and no ending also symbolized:--everlasting, without end.

### **Conclusions**

The anthropological researches that came out during archaeological excavations from Bronze Age and Iron Age have given information about

the ritual practices in the very important geographic area of Armenia. There is little certain data regarding trepanations from Armenia. However, recent studies have revealed that this area represents one of the most active centers of cultural transformation in the medical and ritual field. Moreover, the artificial apertures were more varied in form and location. There were 6 cases total; 5 were male and child. Often traces are not random, but are clearly structured, again suggesting their symbolism. Traces of healing are not detected. Post-mortem trepanations, undoubtedly, be interpreted as a ritual. They were not related to possible Bronze Age and Iron Age surgical practices but were possible keepsakes or trophies made posthumously. The attempt to confer mystical powers on trepanation has also been described in some cases (Carod-Artal and Vázquez-Cabrera 2004; Campillo 2007). While ritualistic procedures seem to be more common in certain cultural contexts such as Eastern Europe (Marcsik et al. 2002), they have been sporadically found in other regions in the same archaeological contexts than supposed therapeutic trepanations (Facchini et al. 2003; Roberts and McKinley 2003). The triangular, square and oval cranial amulets, i.e. produced with fragments of human cranium. They were worn or displayed as pendants- possibly to draw strength or protection from the world of the deceased or perhaps simply to commemorate past members of the community. It is clear that these people were allocated a special group. Unfortunately, in our study, there are no cultural or archaeological evidence which can cast light on the motives behind the trepanation.

In this paper, we would like to present these new, unusual cases of ritualistic trephination. I have no intention of giving a chronological account of development of medicine and neurosurgery in Armenia. I will do the same in the other article.

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## Post-mortem trepanations...

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Table 1. Number of individuals from Armenian sites studied in this paper.

Site	Sex	Age categories							Total
		0-10	11-19	20-29	30-39	40-49	50-59	60+	
<b>Noraduz</b>	male		1	2	3	4	3	4	17
Iron Age	female		2	2	1		2	1	8
11 <sup>th</sup> -6 <sup>th</sup> c. BCE	undet.	8	1		1				10
<b>Karmir</b>	male			2	1				3
Middle/Late Transitional	female					1	1	1	3
<b>Karashamb</b>	male			7	3	6	1	2	19
Late Bronze Age	female			2	2	1		2	7
14 <sup>th</sup> -12 <sup>th</sup> c. BCE	undet.	6							6
<b>Arszvakar</b>	male				1	6	1	2	10
Middle/Late Transitional	female			1			2	1	4
11 <sup>th</sup> -8 <sup>th</sup> c. BCE	undet.					1			1
<b>Total</b>		14	4	16	12	19	10	13	88



Figure 1. Cranial trepanation from Arszvakar, burial no. 5, male (60-65 years)



Figure 2. Cranial trepanation from Karashamb, burial no. 2, male (40-45 years)

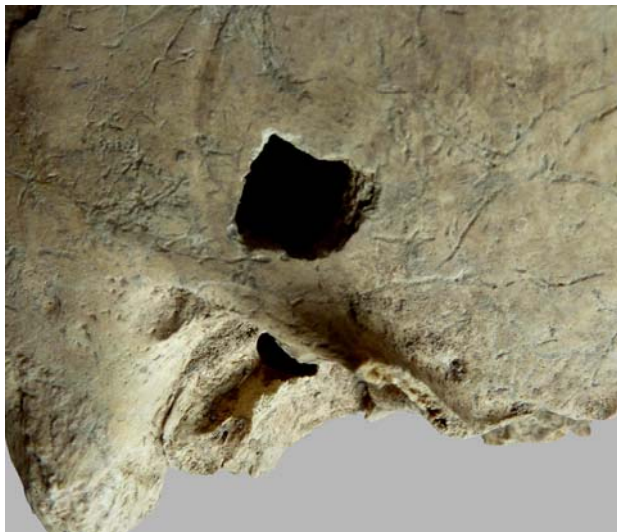


Figure 3. Cranial trepanation from Karmir, burial no. 7, male (50-55 years)

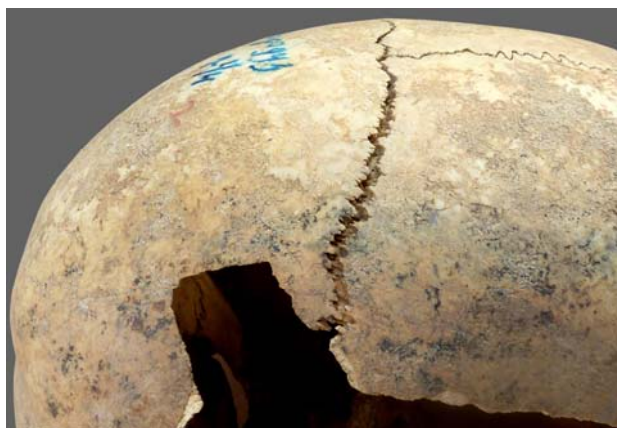


Figure 4. Cranial trepanation from Noraduz, burial no. 7, child II (6-9 years)



Figure 5a. Cranial trepanation from Karashamb, burial no. 1, male (20-30 years)



Figure 5b. Cut marks from Karashamb, burial no. 1, male (20-30 years)



Figure 6. Cranial trepanation from Noraduz, burial 13, male (35-40 years

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### **POST-MORTEM TREPANACIJA NA PRIMERU SAHRANA IZ KASNOG BRONZANOG DOBA I GVOZDENOG DOBA SA JERMENSKE VISORAVNI**

Prema klasifikaciji trepanacija koju koriste savremeni paleopatolozi, jedna grupa uključuje ritualne operacije. U preistorijskoj Evropi trepanacije nakon smrti su vršene u cilju pravljenja amajlija od kostiju ljudske lobanje, dok su u Centralnoj Aziji post-mortem operacije bile u vezi sa običajima sahranjivanja, uključujući tu i balsamovanje i mumifikaciju. Kraniološki materijali u ovoj studiji datovani su na kraj kasnog bronzanog doba i rano gvozdeno doba, i potiču sa jezera Sevan (Jermenija). Od 4 serije u kojima je ukupno bilo 88 lobanja, identifikovano je 9 lobanja koje su bile trepanirane pre nego što je meko tkivo nestalo. Lezije, razvrstane prema mestu i veličini, otkrile su 5 osnovnih tipova.

**Ključne reči:** Jermenska visoravan, običaji o sahranjivanju, post-mortem trepanacija