# About the structure and relative chronology of the complex of artificial caves in Chhoser, Upper Mustang, Nepal

## Sulla struttura e sulla cronologia relativa del complesso delle grotte artificiali di Chhoser, Alto Mustang, Nepal

*Igor Grek [1], Nataliya Moldavskaya [1], Mykhailo Shyrokov [1]*

**Abstract**

A large complex of artificial caves was examined by the authors in Chhoser site, in the Upper Mustang, in Nepal. In this article, on the basis of maps, the structure and relative chronology of such anthropogenic cavities are analyzed. Observations show a change in the functional purpose of individual rock-cut rooms and the evolution of the hypogeal settlement as a whole. The authors associate such changes in the construction of the rock-cut complex with the collective use of cavities and a change in the historical and political situation. The similarity of large complexes of artificial caves of the Upper Mustang with some types of rock-cut complexes of Cappadocia is noted. The results are important for understanding the general patterns of development of rock-cut architecture, and can probably be used to analyze similar monuments.

*Keywords: Chhoser Caves, Upper Mustang, rock-cut architecture, cavities, artificial caves, structure of hypogeal complexes, rock-cut shelters.*

**Riassunto**

Un ampio complesso di cavità artificiali, tra le 30 visitate dagli autori a quote comprese tra 3500 e 4000 m, è stato indagato nel sito di Chhoser, nell'Alto Mustang, in Nepal, non distante dall'Annapurna, una delle nove vette dell'Himalaya oltre gli 8000 m. In questo articolo, sulla base dei rilievi, vengono analizzate la struttura e la cronologia relativa di tali cavità antropogeniche, fornendo una datazione del periodo di maggior frequentazione tra X e XV secolo. Le osservazioni mostrano un cambiamento nella funzione dei singoli vani rupestri e la loro evoluzione in un unico insediamento ipogeo a piani sovrapposti, basato su un sistema interconnesso di camere, di corridoi e di pozzi che viene descritto in dettaglio. Gli autori associano tali modifiche stutturali del complesso rupestre ad un uso collettivo delle cavità ed un cambiamento della situazione storica e politica del paese. Viene fatta notare la similitudine tra gli estesi complessi di grotte artificiali dell'Alto Mustang ed alcuni tipi di insediamenti rupestri della Cappadocia, nonché di alcune caratteristiche morfologiche e ambientali del paesaggio in cui sono stati scavati. I risultati vengono considerati importanti per comprendere il modello generale di sviluppo dell'architettura rupestre, che probabilmente potrebbe essere utilizzato per procedere all'analisi di strutture similari.

*Parole chiave: Grotte di Chhoser, Alto Mustang, architettura rupestre, cavità, grotte artificiali, struttura di complessi ipogei, rifugi rupestri.*

## Introduction

Mustang is a territory in northern Nepal, in the upper reaches of the Kali Gandaki River, which is now quite well-known due to the numerous tourist routes passing through this region, the most famous of which is the track around Annapurna (figs 1a and 1b). At this point, the river cuts the chain of the Himalayan Mountains, forming the world's deepest and incredibly picturesque gorge.

Geographically, the Mustang is divided into Lower Mustang, located at heights of 2500-3000 meters and Upper Mustang with heights of 3500-4000 metres, both surrounded by peaks of over 6000 m. The climate is dry and farming is possible only on irrigated lands (fig. 2).

[1] Speleoclub "Poisk", Odessa (Ukraine)

Reference author: Igor Grek ,65072 Odessa, Ukrain ,Rabina str.47 ap.112 - grekigor@mail.ru


Fig. 1a – Position of rock-cut sites in Nepal, documented in present article, in relation to those located in Tibet (drawing courtesy R. Bixio).

*Fig. 1a – Posizione dei siti rupestri in Nepal, documentati nel presente articolo, in relazione a quelli individuati in Tibet (grafica g.c. R. Bixio).*

The Kali Gandaki Valley is a natural trading route through which for many centuries salt from Tibet was delivered to the northern provinces of India. Control of this trade route determined the strategic position of Mustang.

Buddhism with its writings came to Mustang in the 8th century AD. But, the earlier Bon religion has long held a strong position in the Mustang.

In the Middle Ages, this territory became the scene of a struggle. In the 14th century, an independent state appeared here - the Kingdom of Lo. The last dynasty ruled the kingdom from 1380 until recently. In 1790, the Kingdom of Lo fell into a vassal dependence on Nepal, while maintaining the ruling dynasty and autonomy. In modern times, due to changes in trade routes, the value of the Mustang reduced, and it remained in oblivion until the end of the twentieth century (Simons & Schön, 1998).

## Artificial caves in Mustang

In the second half of the twentieth century Mustang again became famous thanks to the book of the French traveler and ethnographer M. Pessel (Pessel, 1978). He also draws attention to the numerous complexes of artificial caves (or anthropogenic cavities) in rock outcrops in this region. Literally, he writes: "On the opposite side, I noticed a lot of black holes. What could it be? It turned out that the caves were open by people. But how did people get there? Who could live there? And when? The riddle greatly aroused my imagination. But no one could answer my questions. Some said that it was the "dwelling of eagles", others that in ancient times the monks lived there. Unfortunately, Kali Gandaki caves could only be eyed hungrily. Without a solid group and without complex equipment we could not even think of getting there. I will add that this riddle haunts me to this day".

In 1990-1995, archaeological research was carried out by German archaeologists (Simons & Schön, 1998, Schön, 2001) in three rock-cut complexes and adjacent terraced settlements, in the Lower Mustang, in the Dzong Valley (points 2-3) and in the vicinity of the village of Chokhopani (point 4, fig. 1b). Researchers have identified five different periods of the creation of cavities. During the first three periods, hypogeal rooms were created and used only for burial. Tombs were carved in the cliff facade directly above the settlements.

Typology of the tombs of the first period (1200-450 BC) was described as follows: "very small, highly eroded funerary caves, up to 4 sq. m. The deceased were buried in niches or in cauldron-shaped pits carved into the rock. The second period (450 BC-100 AD) is characterized with burials on wooden coffin beds decorated with carvings and paintings[1] (Simons & Schön, 1998). Burial chambers of the third period (100 AD - 900 AD) are also very small in size, but well preserved unlike the same premises of the first period. Absolute chronological marks were made based on radiocarbon data.

Later, during the fourth and fifth periods (900-1600 AD), multi-storey cavity systems were created. The beginning of this period is marked by the first evidence of Tibetan cultural influence. Such systems consist of galleries, passages and chambers spread along rock outcrops. Separate levels of such systems are connected by vertical shafts. The stratigraphic sequence of mud traces on the floor of the rooms shows periods of desolation and reuse. The middle of the 13th century included a period of particularly high construction activity, both in rock-cut systems and in adjacent settlements. The same period is characterized with walls made of adobe bricks in order to close openings that appeared on the facade of the rock due to collapse and dividing walls inside the chambers. Rock-cut systems are also intensively used to store food. In conclusion, the researchers note that some cavities were used at a later time (Schön, 2001). Even today, sheep farmers use accessible parts of the carved rooms as a shelter from the weather, and hermits use parts located high in the rocks of the cavity for meditation.

In 2008, Parkash Darnal (2008) published a short exploration report on hypogeal complexes in the Upper

[1] This period also differs with other types of ceramics and other funerary furnishings.

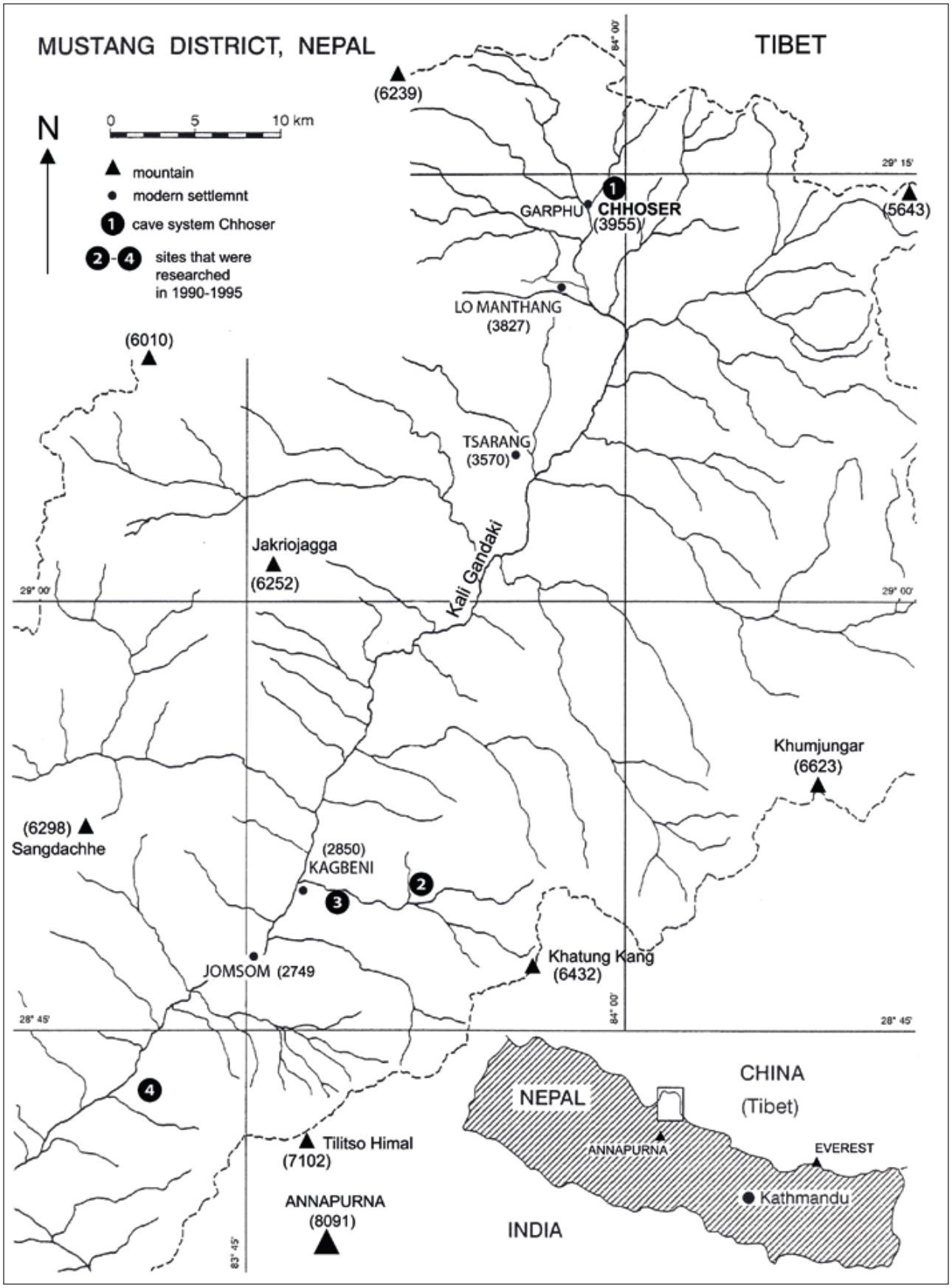



Fig. 1b – Nepal and Mustang maps (drawn by W. Schön, 2001. Modified by N. Moldavskaya).

*Fig. 1b – Mappe del Nepal e del Mustang (tratte da W. Schön, 2001. Modificate da N. Moldavskaya).*

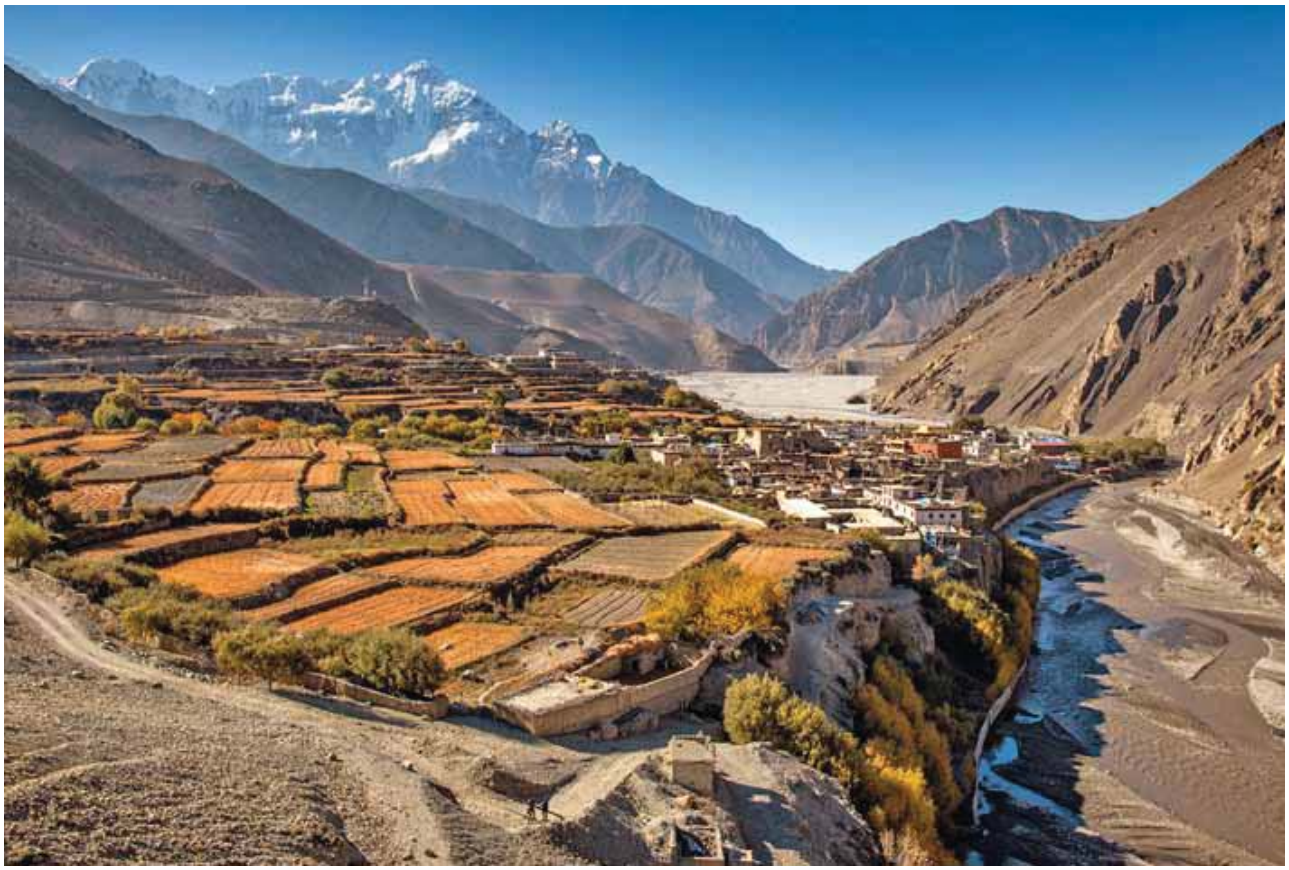


Fig. 2 – Modern settlements and irrigated fields in a Mustang valley (photo N. Moldavskaya).
*Fig. 2 – Moderno insediamento e campi irrigati in una valle del Mustang (foto N. Moldavskaya).*

Fig. 3 – A system of small anthropogenic cavities located close to each other, in the vicinity of Ghami (photo I. Grek).
*Fig. 3 – Sistema di piccole cavità antropogeniche tra loro attigue, nei pressi di Ghami (foto I. Grek).*

Mustang. The report provides a brief description of the fourteen rock-cut sites, mostly containing frescoes or *chortens* (places of worship) and emphasizes the importance of exploring artificial caves in the region.
Later we see a bright National Geographic film [https://www.youtube.com/watch?v=K95Siz7XiVY] which tells about the work of the team of cave researchers in 2007-2010 in the Upper Mustang. However, according to the laws of the genre, these films talk more about dramatic ascents on sheer cliffs, about findings made in caves, and about the difficult relationships of researchers with local peoples. As a result, we have little information about the construction of rock-cut complexes and the purpose of different rooms.
The authors visited Upper Mustang in November 2019 and examined about 30 rock-cut sites. Some of the results of our research were published (Grek *et al.*, 2019).
According to our observations, the presence of artificial caves is primarily associated with the presence of rocky tuff outcrops in the slopes of the valleys. Therefore, such cavities appear a little south of Jomsom, and spread to the north, where tuff rocks come to the surface. At present, we do not know the northern, eastern, or western borders of the distribution area of artificial cave complexes in this region[2].
A serious problem for researchers is the inaccessibility of underground cavities, as well as the fact that many rock-cut complexes were severely destroyed. Obviously, the complexes of artificial caves cut down in rock outcrops at a considerable height bear primarily a defensive function[3]. This is eloquently evidenced by the simultaneous existence of land settlements, and only the periodic use of rock-cut settlements noted by researchers (Simons & Schön, 1998). Researchers in Cappadocia refer to such complexes of artificial caves, protected by defensive devices (usually millstone-door, vertical and horizontal traps, loopholes), defining them just underground shelters and/or redoubt[4] (Bixio & De Pascale, 2015).

There are small multi-level cavities in Mustang, intended, probably, for one family. This is evidenced by the preserved structure of family ownership of such units[5]. This also confirms the separate location of such individual structures at a short distance from each other. For example, in Ghami and in Drakmar (fig. 3). But, there are rock-cut complexes of another type, larger in size. An example of such a large system of cavities is Chhoser Cave[6]. Below we consider the structure of this interesting and well-preserved settlement.

## Description of the artificial cave complex and some considerations about its relative chronology

The hypogeal settlement[7] is carved in the southern facade of the cliff located on the left bank of the stream, which crosses the village of Garphu further downstream.Currently, this six-story complex is used as an excursion facility, and is equipped with stairs for movement between levels. The plan and section of the Chhoser Cave are shown in figure 4 (figure 5 shows the facade of the artificial cave complex.).

### Sixth and fifth levels.

The fifth, upper, level of the rock-cut settlement is formed by three groups of rooms: eastern, central and western. Three shafts, K1, K3 and K4, lead to each group from the fourth level. The premises of the eastern part of the fifth level are grouped around corridor 2, which is illuminated by a window overlooking the rock facade. The rooms 4,5 and 6[8], which have no windows and open into the corridor 2 by doorways, in our opinion, were used as storage. Room 3, which also opens onto the corridor 2 with a doorway, was probably used as a living room. It was equipped with a toilet, a window and an oven. There is a gap in the outer wall of this room, which was restored by mud brick masonry on clay. In the southwestern corner of the room there are 3 notches under a large round vessel. Shaft K1 also comes into corridor 2 from level 4, through which the eastern group of caves of this level was carved.
Shaft K2 (1.8 m) goes up from corridor 2, leading to a single room of the sixth level, a tiny room 1. This is a rounded chamber with a diameter of 1.5 meters, 1 m high, with a vaulted roof. The purpose of this room remains unknown[9].

[2] There is every reason to believe that the area of distribution of artificial cave complexes in this region is quite wide. For example, we can mention a recent article of Italian cavers (Bixio A. & Bixio R., 2019) on the rock-cut structures visited by the well-known orientalist Giuseppe Tucci (who surveyed also Mustang area in 1952) and his colleague Ghresi, in the Sutlej river basin, on an extension of about 150 km as the crow flies, located on the edges of the Tibet plateau, in the northwestern sector of the same Himalayan chain that crosses Mustang region (see fig. 1a). The article speak of the Italian expedition of 1933 (described in Tucci & Ghersi, 1934), during which at least 13 sites excavated by man in the cliffs were documented. They consist of dwellings ("wall" or "terraced" rock-cut villages) or worship spaces, passages or water works and, maybe, war works. They are located at altitudes between 3400 and 4700 m a.s.l., surrounded by peaks between 6400 and 7800 m. Therefore, these sites were excavated in an environment orographic characters similar to the Mustang.
[3] It is important to note that such rock-cut complexes not only served to protect the population, but also to protect the crop, which probably could also be the target of raids. Thus, such cavities combined the function of shelter and storage.
[4] In the North Mustang, vertical shafts and steep sections of rock outcrops were most often used as defensive devices.
[5] The locals in Drakmar told us this.
[6] On Google maps, this place is marked as Garphu Cave, and in some web sites is also called Jhong Cave.
[7] Local residents did not live in this cave settlement permanently. These cavities carved in tuff were used only in case of military danger.
[8] The purpose of the small tunnel 6a leaving room 6 to the east and ending in a dead end is unknown.
[9] This room is too small to be a refuge. The dimensions of this room

The central part of the fifth level is represented by a single room 7. It is connected to the eastern part by a junction point A. Shaft K3, the mouth of which has traces of a notch for a ceiling beams goes into the middle of room 7. In the eastern and northern parts of the room 7 stone beds preserved. (fig. 6). A window and a toilet hole were cut in the front wall of the room.

A 1 m wide passage connects the central part of the complex, consisting of room 7, with the western part, through corridor 8. In the floor of this passage the mouth of the K4 shaft opens, 2.2 meters deep. Another connection between the central and western parts of the fifth level is a small hole between rooms 7 and 10. Corridor 8 opens with a window to the facade and goes deep into the cliffs perpendicular to the cliff. Premises 9, 9a, 10, 11, 12, and 13 are open with doorways into corridor 8. The doorway of room 9a is currently blocked, and the partition between rooms 9 and 9a has been cut down. We believe that all of these premises were used as storage. Some rooms have niches for oil lamps.

The fifth level, obviously, initially consisted of three separate parts. This is evidenced by the three separate shafts K1, K3 and K4 rising to the premises of the fifth level from the fourth, by the junction point A, between rooms 3 and 7, as well as by the undercut in the floor of room 7 showing the initial shape of this room. The presence of two toilets in nearby rooms 3 and 7 also confirms the assumption that different parts of this level initially existed separately.

## Fourth level.

The configuration of the rock-cut rooms of the fourth level is determined by the gallery 14 which extend along the facade of the cliff. Traces of tools preserved on the walls show well the direction of the excavation of this gallery, from west to east. Premises 25, 26 and 27, in our opinion, were intended for storing supplies. Room 25 was originally divided into two. In its floor there is a small sinking into the lower (third) level. It is clearly seen that the western part of this gallery is much wider than the eastern one and opens with windows on the facade. In addition, a well-preserved (fig. 7) toilet opens onto the facade near the mouth of the K7 shaft[10].

This suggests that the western part of the gallery up to shaft K4 initially played the role of a living room. This living room was probably the highest point of refuge existing in the western part of the complex. The reconstruction of the changes on this site is highlighted in red in figure 4. We believe that the shaft K4 and the premises of the western part of the fifth level are never as compared to the eastern and central parts of the complex.

The central part of this level is represented by a short corridor 23, in the roof of which the K3 well goes up, and in the eastern niche the K6 well goes down. (This niche connects to room 16 with a small hole, junction point B). In the same corridor room 24 opens with a window on the facade. Room 22, in our opinion, was intended for storing supplies and opens at the northern end of corridor 23 with a door. Previously, room 22 was divided into two, 22 and 22a.

In the eastern part of this level, doors to storage rooms 17, 18 and 19 and living room (16 with windows opening onto the facade) open to corridor 15 perpendicular to the rock facade. Rooms 20 and 21, in our opinion, were cut down later, when the eastern part of the corridor connected different originally separate parts of this level. In rooms 22, 25, 19 and 17, the remains of adobe brick partitions were preserved.

## Third level.

Three shafts connect the fourth level with three separate groups of cavities, forming the third level. So the K5 shaft, at the mouth of which a notch under the lid has been preserved, leads to corridor 44. The doorways of three rooms go out to this corridor corresponding to the storages 41, 42, 43, which form the eastern group of third-level rooms.

Shaft K6 leads to the inexpressive corridor 39, which has a window opening onto the facade. The doorways of two rooms 38 of the large storage room, and 40 of the most likely residential premises go out into this corridor. These rooms 38.39, 40 form the central group of cavities of the third level. Room 38 is connected with room 31 of the western group of cavities by a small hole (Junction point C, fig. 4).

The western part of the third level is grouped around the corridor 28 of the rock mass extending inland perpendicular to the rock facade. The doorways of storage rooms 29, 32, 33, 34, 35.36, as well as the living room 31 with a window overlooking the facade, open into it. The southern end of the corridor opens onto the facade with a doorway with the notch under a massive wooden door. In room 29, the remains of the cut containers whose purpose is unknown are preserved. In the floor of this room is also the square hatch of the K8 shaft. You may notice that this shaft is in the shape of a bell and was originally a pit for storing supplies or water. Later, the bottom of the pit was broken and a connection of the third level with the second level arose, becoming the K8 shaft[11]. The purpose of the tunnel 37

do not allow to protect the shaft K2. Moreover, the location of shaft K2, directly above shaft K1, is too noticeable. It is interesting to note that the size and shape of this room, and its location above the shaft, exactly copies the same room in one of the shelters in Ak-koy, in Cappadocia (Bobrowskyy & and Grek, 2019). Perhaps the work on creating the sixth-level premises was incomplete.

[10] At first glance, the location of the toilet near the mouth of the K7 shaft may seem unsuccessful. We believe that the toilet was used only when the shaft was closed, that is, only during the siege. A surviving example of such a lavatory overlapping a communication shaft we can see in shaft K9. Such a configuration of this site indicates that the hypogeal complex was not intended for permanent residence.

[11] At the same time, a light window was made in the front wall to illuminate this shaft.

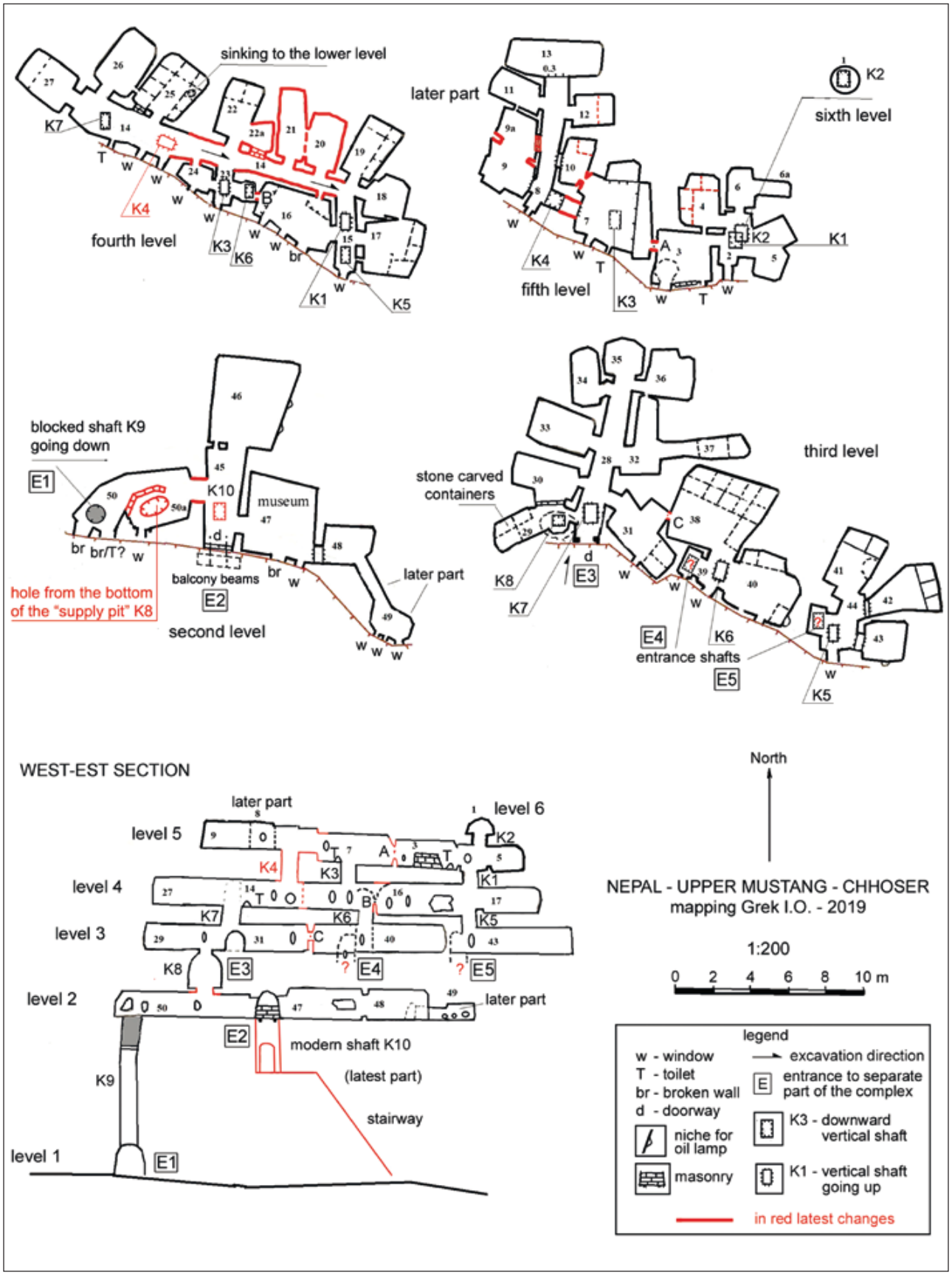
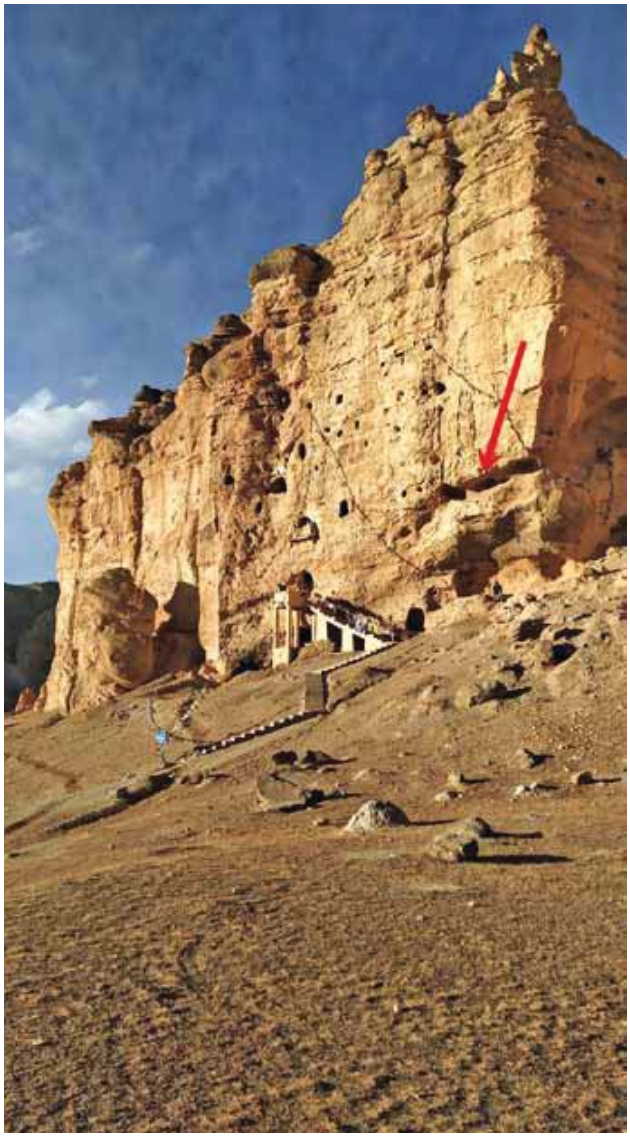



Fig. 4 – Artificial cave system of Chhoser. Plans and longitudinal section (mapping by I. Grek).

*Fig. 4 – Sistema di grotte artificiali di Chhoser. Piante e sezione longitudinale (mappatura di I. Grek).*



exiting from room 32 is unknown. Perhaps this is an unfinished gallery for connecting the western part and other sections of the third level. Obviously, the development of the western part of the third horizon (and the western part of the fourth level) was carried out through the doorway of corridor 28 that opens onto the facade. At this point we asked ourselves: where did the central and eastern parts of the hypogeal complex come from? We noticed that the small chambers located west of corridors 39 and 44 (they are marked with a question mark on the plan fig. 4) are very similar to the chamber with shaft K6, east of corridor 23 on the fourth level. We assume that the vertical shafts coming from the lower levels locked in these chambers[12]. In this case, the exits from the shafts may be located in a gallery that is severely destroyed and currently inaccessible in the western part of the front cliff (E1 in fig. 4, and fig. 5). We recorded a similar defensive device combining a horizontal tunnel and a vertical shaft in Drakmar, south of Tsarang (figs 1 and 8). An alternative assumption that the central and eastern parts of the third level had access and were developed from the fourth horizon does not seem logical to us.

[12] For example, like shaft K9.

Fig. 5 – Facade of the Chhoser Cave system (photo A. Zavodsky).

*Fig. 5 – Facciata del sistema della Chhoser Cave (foto A. Zavodsky).*

Fig. 6 – Stone bed in room 7 and connection point A (photo N. Moldavskaya).

*Fig. 6 – Letto di pietra nella camera 7 e punto di connessione A (foto N. Moldavskaya).*

### Second level.

On the second level, a wide corridor 45 opens onto the facade with a doorway. In this place there are well preserved wooden beams for a small balcony. Later, this opening was closed with masonry, made of clay bricks. From the east, the door of the large room 47 opens, probably a living room with window to the facade. Room 47 is currently used to house the museum. Another room 48 comes to this room from the east, apparently a storehouse. A low tunnel exits the corner of room 48 and leads to room 49 with three small windows opening onto the cliff face. The design of this site has no analogues among other rooms of this complex. We assume that both room 49 and the tunnel were made later. The windows were used as an observation post or as a loophole covering the approaches to the foot of the cliff from the flank.

At the northern end of corridor 45, storage room 46 opens with a doorway with a small window and niches for fixtures. Another door opens into corridor 45 from the east. This room is currently divided by a clay brick wall. Obviously, this wall separated the passage to the third level, which arose after the appearance of the K8 shaft. When examining room 50, we noticed an unusual sound of the floor. When we examined one of the cavities at the foot of the cliff, we noticed a shaft (K9) in the roof, going up and covered in the upper part with a wooden ceiling. The modern entrance - the K10 shaft comes into the middle of corridor 45. The walls of the shaft are not oxidized. Obviously, this passage was made at a later time.

Evidently, K9 shaft is an earlier entrance to the second level of the underground complex. Perhaps, initially this level consisted from two parts, the western one consisting of room 50-50a, with the entrance through shaft K9, and the eastern one, including rooms 45-48 with the entrance through the door of which opens onto the facade of corridor 45. Thus, the premises of the second level were created and used for some time quite independently of the premises of the 3, 4 and 5 levels.

Fig. 7 – Toilet at level 4 and mouth of the shaft K7 (photo N. Moldavskaya).

*Fig. 7 – Latrina nel livello 4 e imbocco del pozzo K7 (foto N. Moldavskaya).*

## The premises of the artificial cave complex in Chhoser

The premises of the underground complex were carved from the tuff massif, probably with the help of a pickaxe. These tracks do not differ from those on the walls of most artificial caves carved into the rocks[13], but they are not always well preserved due to erosion. (fig. 6 or fig. 9)

1. Storage rooms. Among the premises of the cave complex, one can distinguish those that do not have windows. As a rule, such rooms have the shape of a smoothed quadrangle. We believe that such premises were created to store supplies. The entrances to these rooms used to be equipped with wooden doors, which were removed later. Because now we see lack of patina where wooden doorframes used to be, but there is patina on the walls around. Besides, we see now notches under the places where the doorframes were.

Some of these rooms have black patina. We do not exclude the possibility that during many hundreds of years of operation of cave complexes, someone lived in these rooms. Niches for oil lamps were carved in the walls of some rooms for storing supplies. Sometimes we can see rings carved in stone, obviously used to hang supplies.

The majority of the rooms in the cave complex in Chhoser were for storing supplies – there are 32 of them. In the premises: 4, 10, 12, 17.19, 22, 25, 27, 29, 31, 38, 40, 41, 42, walls made of adobe bricks have been preserved. Those are low walls dividing

[13] For example, we can see similar tool marks in Cappadocia (in Turkey), in Kerch (in Ukraine) or in Khndzoresk (Armenia) or in Uplistsikhe (Georgia).

Fig. 8 – Drakmar. A defensive device in the form of a horizontal tunnel and a vertical shaft opened by a landslide (photo N. Moldavskaya).

*Fig. 8 – Drakmar. Dispositivo difensivo costituito da un cunicolo orizzontale ed un pozzo verticale sventrati da una frana (foto N. Moldavskaya).*

the room into compartments (fig. 9). Such walls were described in Simons & Schön (1998), where such compartments are called "structures". These authors believe that adobe brick masonry appeared in artificial cave complexes in the middle of the 13th century AD. It is important to note that the adobe brick compartments were also laid out in those rooms that had previously been used as residential. This indicates that the purpose of the rock-cut premises changed.

Fig. 9 – Masonry of adobe bricks inside the rooms allocated the compartments. Traces of tools on the walls are clearly visible (photo N. Moldavskaya).

*Fig. 9 – L'interno delle camere è suddiviso in scomparti da muratura in mattoni crudi. Sui muri sono chiaramente visibili le tracce degli attrezzi (foto N. Moldavskaya).*

2. Living rooms. The rooms we consider residential have windows that open onto the facade. There are 9 such rooms in the hypogeal complex. Five of them have an irregular shape with niches in the walls similar to beds. A stone bed was found only in the room 7. It is interesting to note that the shape of such rooms is very similar to the shape of the burial chambers of some late antique crypts (Bystritskaya, & Grek, 2017). However, the absence of dromos-like entrances opening onto the facade in such rooms refutes the version of the existence of earlier burials in these rooms. In three cases, the living rooms were equipped with toilets. We assume that while the toilets were being created in those rooms, the latter were the highest rooms in the separately existing parts of the rock-cut settlement.
3. Corridors[14], in our opinion, determine the structure of the hypogeal complex. These are tunnels

[14] Here we use terminology similar to that used to describe the complexes of artificial caves by German researchers (Simons & Schön, 1998).

Fig. 10 – Mouths of shafts were protected by movable hatches (left, shaft K3) or fixed sealing (right, shaft K5) (photo N. Modavskaya).

*Fig. 10 – Le bocche dei pozzi erano protette da portelli mobili (a sinistra, pozzo K3) o chiusure fisse (a destra, pozzo K5) (foto N. Modavskaya).*

with width from 1 to 1.4 meters and length of up to 9 metres, extending deep into the cliffs, perpendicular to the plane of the facade. These corridors, with their southern tip, open onto the facade with windows or doorways (in two cases). In some cases, they have a very small length of up to 2.5 meters. Rooms, both storage rooms and residential ones, open by doorways into the corridors. The number of rooms like this varies from a few to a dozen. Obviously, corridors were used to remove excavated rock during the development of underground spaces. The complex of Chhoser Cave contains 8 corridors.

4. Galleries. In the artificial cave complex described by us in Chhoser, there is only one gallery[15], the no. 14 (fig. 4), with a length of 14 meters. In this case, we have reason to say that gallery 14 was carved to connect separate cave complexes that existed earlier.
5. Shafts. Chhoser recorded 10 vertical communication shafts. The average depth of such a shaft is 3.1 meters. However, most of the shafts have depth of about 2 meters. Holes and ledges for hands and feet used for climbing were cut down in the walls of the shafts. Their mouths were protected by covers or beams and sealing (fig. 10). The section of the shafts is usually rectangular. Dimensions fluctuate around one meter by one meter. The mouths of the shafts come to upper horizons in some cases in the centre of the premises, and in some cases in a special niche located in the wall. For example, in one of such niches there is K6 shaft.

Thus, the artificial cave complex in Chhoser, according to our estimates, has a total development of 247 m, consists of 53 rooms and 10 shafts. Among these premises are: 9 living rooms, 32 storage rooms, 8 corridors and one gallery[16]. The height of the top

[15] By the term "galleries" we mean tunnels stretched along the facade of a cliff.

[16] The structure of the complex also includes: sentinel room 49, two unfinished tunnels 6a and 37, and room 1 is probably also unfinished.

point of the complex, room 1, above the base of the cliff is about 20 meters. The average height of the rooms inside the complex is 1.6 metres (this average height was displayed in our section of fig. 4).

## Conclusion

The construction features of the large complex of artificial caves in Chhoser show its development from several, four or five, separate shelters. We assume that such small separate shelters belonged to individual families. Reconstruction of the initial configuration of these units is presented in fig. 4.

You may notice that in the structure of such cavities the functions of shelter and storage were combined. The number of living rooms and storage rooms shows the ratio of these functions quantitatively. Over time, there was a change in the functional purpose of individual rooms and the construction of the complex as a whole. Changes in the construction of the settlement were probably associated with a change in the historical situation and its collective use at a later time[17].

One can note the similarity of large complexes of artificial caves of the Upper Mustang with several rock-cut complexes of Cappadocia. Therefore, they are two regions in many respects similar to each other. In both cases, these are dry and treeless lands, made up of tuff rocks (more homogeneous in Cappadocia), with deep valleys and many rocky outcrops. The active phase of the development of several large artificial cave complexes falls on the same period of the 10-15th century AD.

This similarity of historical and natural conditions makes it possible to use, for artificial caves of Mustang, an already well developed methodology for analyzing the rock-cut complexes of Cappadocia (Bobrovskyy & Grek 2019).

This external similarity becomes even more intriguing when analyzing individual structural details and techniques used in creating cavities. Some architectural details and design techniques show a striking resemblance, while others used in Cappadocia were not used at all in Mustang. Our observations are important for understanding the general laws or the differences of development of rock-cut architecture, and can be used to analyze similar monuments[18].

[17] It is interesting to note that similar structural changes are also characteristic of other rock-cut shelters, for example, those of Cappadocia (Bobrovskyy & Grek, 2019).

[18] We see hundreds of artificial cave complexes in Mustang. This does not mean that other settlements were created on the same principle.

### Bibliography


Bixio R., De Pascale A., 2015, *Defensive devices in ancient underground shelters: comparison among the sites of Aydintepe, Ani, Ahlat and Cappadocia in Turkey*, in International Symposium on East Anatolia – South Caucasus Cultures, October 10-14, 2012, Erzurum (Turkey), Vol. 2. Cambridge: Scholars Publishing: pp. 461-480.

Bixio A., Bixio R., 2019, *Cavità artificiali sul Tetto del Mondo. Testimonianze dal diario di una spedizione scientifica della Reale Accademia d'Italia in Tibet nel 1933*, in Opera Ipogea 1/2019. Società Speleologica Italiana, Bologna: pp.39-46.

Bobrovskyy T., Grek I., 2019, *The patterns of development of cave shelters in Cappadocia*. Proceeding of International Congress of Speleology in Artificial Cavities "Hypogea2019", Bolgaria, Dobrich, May 20/25-2019, p. 12.

Bystritskaya D.D., Grek I.O., 2017, *Catacombs of Kerch (Ukraine)*, in Proceeding of International Congress of Speleology in Artificial Cavities "Hypogea2017". Cappadocia, Turkey, March 06/10-2017, p. 413.

Parkash Darnal, 2008, *Reconnaissance of Caves in Upper Lo Mustang.* Ancient Nepal, no. 166/2008. Kathmandu, Department of Archaeology pp.1-31.

Schön W., 2001, *Häuser und Höhlenwohnungen in Mustang (Nepal)*. Archäologische Berichte 14. Universitat zu Koln: pp.167-185.

Simons A., Schön W., 1998, *Cave systems and terrace settlements in Mustang, Nepal.* Beiträge zur allgemeinen und vergleichenden archäologie. band 18/1998. Mainz, Verlag Philipp Von Zabern: pp. 27-46.

Tucci G., Ghersi E., 1934, *Cronaca della missione scientifica Tucci nel Tibet occidentale (1933).* Roma: Reale Accademia d'Italia.

Грек И.О., Молдавская Н.Н., Широков М.Н. 2019. *Некоторые сведения об искусственных пещерах в Северном Мустанге.* Материалы международной конференции по спелеологии и спелеостологии. Россия. Набережные Челны. 2019г. (в печати). [Grek I.O, Moldavskaya N.N, Shyrokov M.N., *Some information about artificial caves in the North Mustang. Materials of the international conference on speleology and speleostology*. Russia. Naberezhnye Chelny. 2019 (in the press)].

Пессель М., 1978, *Путешествие в Мустанг и Бутан*. Мысль.1978.226 с. [Pessel M., 1978, *Travel to Mustang and Bhutan*. Misl, 1978, p. 226].