**Attn.: M.J. Sadykbekov,**

**the Director**

**of the “Azret Sultan” Reserve-Museum**

Memo

Having familiarized myself with the minutes presented to me, I concluded that the specialists performing work on the monument do not have information about the research on the site in full. The statement that the moisture content of materials has been in virtually the same state since 1984 is deeply erroneous. Thus, the moisture content of masonry mortar of the Kazandyk's dome in 1984 had a maximum value of 27.9%, in 1993, before the beginning of the restoration of the facility by a Turkish company, the moisture content of masonry mortar did not exceed 1%. In 2004, the maximum moisture content of masonry mortar was 48.7%. Moisture content changes are described in more detail in the 2004, 2005, 2010 and 2011 reports.

Comments to the “Decision” of Minutes No. 3 of the Scientific and Technical Council of the Research and Design Branch of the Republican State Enterprise “Kazrestavratsiya” dated July 22, 2011;

1. In the project of reconstruction of the roof, developed by the institute “Kazakh Research and Design Institute of Monuments of Material Culture” in 2005 provided for the survey of stalactites of inventory scaffolding, so the decision of the scientific and technical council is somewhat late. I have not seen the project of restoration and conservation work, but I can say that any work on the stalactites should be done with the utmost care, as moistening of the stalactite material will reduce the strength and increase deformations, which may lead to the destruction of the stalactites.
2. I believe that it is not necessary to involve M. Makhsudova to work on the monument. On her recommendations, anhydrite mortar was applied to the mausoleum for restoration (during the restoration work by a Turkish company). As a result, all the materials of the monument, especially the old masonry in the interdome space became saturated with salts. It should be noted that in Uzbekistan anhydrite mortar is not used for restoration of monuments.
3. To find out the reasons for the wetting of the north-west corner of the mosque, it is necessary to engage a hydrogeologist to collect and analyze the necessary data and determine the cause of the wetting. Pits alone may not be sufficient to identify the causes of material wetting. There is no justification for removal of panel linings and duct-vent cleaning. What do they need to be cleaned from?
4. To assess the condition of the drainage system, professionals should be attracted. The drainage system is blown under high pressure, flushing may require large amounts of water and may overwater the area around the monument.
5. There is no justification for work to clear plaster from walls and ceilings in all rooms. What is the reason for this clearing?
6. Any modification to the façades of a monument requires justification and approval by UNESCO.

/*signed*/ L.V.Dubrovskaya

**CONCLUSION**

**on the technical condition of the Mausoleum**

**of Khoja Ahmed Yasawi after restoration in 1993-2000.**

The mausoleum of Khoja Ahmed Yasawi is located in Turkestan city of South-Kazakhstan region on the territory of the State Historical and Cultural Reserve-Museum “Azret-Sultan”. The building was erected in the late XIV and early XV centuries from burnt bricks on clay and gypsum mortars.

During the period of more than 600 years of its existence, numerous repair and restoration works have been performed on the monument.

A large amount of restoration work was performed in 1993-2000 by the Turkish firm “Vakif-Inshaat”. During this period, pile foundations were installed, work on replacement of the roofing with new construction with insulation and a vapor-conducting layer was done, gypsum plaster in the interior was replaced with anhydrite plaster, etc. The restoration work that has had a significant impact on the preservation of the monument is briefly mentioned below.

The piling work was performed in 1993 - 1994 by the Turkish specialized firm S.T.F.A. The piles were installed using jetting technology - injection of cement mortar under pressure of up to 400 atmospheres. As the piling work was performed using large quantities of water, there was significant wetting of the soil around the facility. For a number of reasons, horizontal waterproofing of the walls was not performed during the installation of pile foundations. Two years after the pile foundations were installed, in August 1996, the moisture content of the materials of the lower sections of the walls reached 26% in some places. Compared to 1993 (before the foundations were installed), the moisture content of the materials was more than twice the original moisture content. In subsequent years, observations of moisture content changes in the monument materials were not conducted due to lack of funding.

During the period of restoration works on the monument in 1993-2000, the quality control of the materials used and the works performed was carried out by the specialists of the Research and Design Institute of Monuments of Material Culture on the basis of the order of the Ministry of Culture dated July 10, 1997.

The unsatisfactory quality of certain types of restoration work was noted even in the process of restoration of monuments of material culture by representatives of the Research and Design Institute of Monuments of Material Culture. In particular, when facing the dome of Kazandyk, the joints between the tiles were not filled with mortar during their installation, but were grouted on top after the tiles were installed. Since the width of the joints is 3-5 mm and the depth is 5-7 cm, it is impossible to fill them to their full depth in this way. In addition, the mortar used to fill the joints was of poor quality and the first rains washed the mortar out of the joints. The Turkish company “Vakif-Inshaat” was supposed to fill the joints secondarily, but probably this work was not performed, because in the fall of 2000 the facility was commissioned without the participation of a representative of the Research and Design Institute of Monuments of Material Culture, leading engineering control over the performance of work.

During the restoration works, the representatives of the Research and Design Institute of Monuments of Material Culture repeatedly noted the poor quality of materials - high water absorption, low frost resistance, etc. In 4 restoration works, the Turkish firm used anhydrite instead of gypsum, which was produced in violation of technology. It is known that after the first fall rains in 2000, damp spots appeared on the vaults and domes in many rooms.

The last survey of the facility was performed in April 2005.

**Interiors.**

During the visual inspection of the mausoleum, it was found that there are spots of dampness on the domes and vaults in the interiors in all rooms. There is peeling and flaking of whitewash on domes and vaults (Askhana, Big Aksaray, Small Aksaray, Kudukkhana), and in some rooms and peeling of plaster (Askhana, floor vaults). Damp spots were also noted on the stalactites in the Mosque room. In the north wall of the Mosque, the glazed panel facings installed during the restoration are deteriorating. This deterioration is known to have started immediately after the restoration and individual cladding elements were replaced. In Kazandyk, cracks have appeared on the stalactites of the dome, which are visible without binoculars. The length of the cracks and the width of their opening cause concern for the safety of the stalactites. In addition to the cracks, yellowish colored damp spots can be seen on the stalactites. No cracks in the stalactites or damp spots were observed prior to the 1993-2000 restoration.

In some rooms of the facility there were noted efflorescence in the lower part of the walls - Askhana, corridors “B”, “C”, “E”, Mosque, Kazandyk.

**Roofing.**

An inspection of the roof showed that the restoration work here was of poor quality. Everywhere there is a peeling of restoration bricks on horizontal surfaces. The brick here is laid on anhydrite mortar. The joints between the bricks are destroyed, the mortar of the joints is falling out in whole plates. There are many gaps in the surface of the flat roof where rainwater leaks in (e.g. Mosque, vaults of corridor “B” of the second floor, minarets, ridge of the Main Portal vault, etc.).

During the construction of the flat roof, a “pie” of different layers was laid, including insulation (which does not allow water to pass through), vapor duct made of plastic. The two layers must have airtight joints. However, the presence of leaks on the roof indicates poor quality of the joints of these layers.

During the survey of the facility, a pothole was made on the flat section of the roof of the Great Aksaray, above the place of the greatest wetting of the vaults. It was found that under the steam line, the roof brick has a high moisture content of 18% - equal to the water absorption of the brick. The steam line is designed to evaporate condensation moisture. But as rainwater penetrates into the masonry (due to poor quality of the joints between the different layers), this amount of moisture cannot be removed through the steam line and moisture accumulates in the materials.

On the west wing of the flat roof of the Main Portal, there is no water drainage curb, and rainwater flows directly onto the face of the masonry of the south façade. The masonry at the point of water runoff is covered with salts.

A structural survey of the Kazandyk's dome and stalactites revealed that rainwater leaks inside through the seams between the cladding tiles. Damp spots on the stalactites of Kazandyk's dome are rainwater leaks. In the interdome space there are visible water flows on the surface of the stalactite structures, there are also spots of dampness and discoloration on the masonry of the dome. The inner surface of the masonry of the Kazandyk's dome is covered with efflorescences, which also indicates the penetration of water into the masonry. Solution samples were collected in the interdome space to determine the moisture content of the materials. In some places the moisture content of the dome masonry mortar reaches 48.7%. The highest moisture content of the dome masonry mortar was noted in the nests where wooden beams were previously located.

Water leaks through the joints cause wetting in the wood beams embedded in the masonry. In addition, wood beams show signs of woodworm activity and many beams are significantly damaged by woodworms.

**Facades.**

Damp spots of various sizes were noted around the gutters on the facade walls. The facades in the gutter area have developed efflorescence over an extensive area of cladding. In some places the cladding of the previous restoration - on the octagon and quadrangle of Kazandyk, on the eastern facade - is destroyed from the influence of salts. The brickwork of the main portal at the gutters and water leaks shows spots of efflorescence.

**Conclusions**

Five years have passed since the 1993 - 2000 restoration work was completed. Although the unsatisfactory quality of certain types of restoration work was noted during the restoration process, there were no observations of the condition of the facility after restoration due to lack of funding. As a result of water leaks inside the structure, the technical condition of the monument deteriorated significantly after restoration:

* cracks appeared in the stalactites of Kazandyk's dome;
* there is wetting of wooden beams of Kazandyk's dome and their destruction;
* facade cladding and other materials are destroyed by salts.

**Recommendations.**

Due to the current situation at the monument, the following priority actions are recommended:

1. To dry the dome masonry from accumulated moisture - carefully remove the glazed cladding of the Kazandyk's dome with tile marking and storage, perform mortar clearing to the native masonry and expand the joints of the masonry with gypsum mortar.
2. On flat roofs, seal all gaps where water penetrates with gypsum mortar (G16). On the west wing of the Main Portal, make drainage curbs. Perform temporary sealing of gaps in gutter locations with gypsum mortar.
3. Examine the stalactites of the Kazandyk's dome in the interior (set up scaffolding in the Kazandyk's room).
4. 4. In the stalactites of the Kazandyk's dome to open additional holes for airing and drying the masonry (with the participation of employees of the Research and Design Institute of Monuments of Material Culture).
5. Determine the presence and species of woodworms in the beams of the interdome space of the Kazandyk's dome (Plant Protection Institute).
6. Procure materials for the replacement of the roof structure: purchase G16 gypsum and start producing 25x25x5 cm bricks using traditional technology.
7. Remove salts from cladding on facades (scaffolding to be erected).

Once the priority measures are completed, roof restoration should be performed to repair leaks and prevent deterioration of old materials of the facility.

Head of the Research Experimental Laboratory of the Research and Design Institute of Monuments of Material Culture, PhD in Engineering

L. Dubrovskaya

*This translation from Kazakh language into English was done by the Translation Agency “Number One Translations”.*

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