Wolfgang Koellisch

Umm er Rasas, a World Heritage Site, Mysterious and Hidden. Preventive Measures against Damage from Earthquakes and Heavy Rains

History of the site

Umm er Rasas is located about 70 kilometres south east of Amman, the capital city of Jordan. The site is situated on the edge of the desert. In 2004 UNESCO inscribed Umm er Rasas as the third World Heritage site in Jordan. Owing to the richness of the inscriptions, the quality of the mosaics and the Stylite tower, Umm er Rasas is one of the most important archaeological monuments in Jordan.

Umm er Rasas can be translated in two ways: the mother of lead or the mother of exact stone building. There is no evidence of lead used or found at the location, but there is stone masonry of good quality; therefore, we believe the stone translation is more plausible.

We can identify Umm er Rasas with Kastron Mefaa, a toponym known from Roman and Arabic sources and from the Bible. Eusebius mentions that a unit of the Roman army was stationed on the edge of the desert at Mephaat (Onomasticon 128. 21).

The identification of Kastron Mefaa is based primarily on the name found in the inscriptions and is reinforced by the discovery of a reused basalt pillar base with a decoration of calyx leaves dated to the Iron Age (7th–8th centuries B. C.). In 1807 the explorer Ulrich Jasper Seetzen recorded the site, which was thereafter visited by a number of travellers. In 1872 Henry Baker Tristram camped at Umm er Rasas and accurately described the ruins. He identified the high and strong walls as a fortified Roman camp. Auxiliary cavalry troops of the Roman army were stationed in the camp of Mefaa under the command of the Dux Arabiae.

The military nature of the locality is underlined by the name Kastron (fort) Mefaa, which is recorded three times in the Greek inscriptions of the Church of Saint Stephen and is also found in the mosaics of the Church of the Lions. The complex of Saint Stephen's is located north of the Kastron. Excavation of the mosaic floor in the church revealed a work of creative genius (fig. 1 and 2).

To see so many churches—more than 40 have already been discovered—on the edge of the desert, concentrated at the site and more than 30 kilometres away from the next important town, is baffling. The »mosaic carpet« from 756 in the Church of St Stephen tells us about important cities in the Nile delta as well as about animals and people. Unfortunately, nearly all the human faces were destroyed by iconoclasts.

Iconoclasts also destroyed all the figures in the hunting, agricultural and pastoral scenes. The mosaic floors, precious examples of cheerful Christian expressiveness in art, are masterpieces and still move visitors today.

Umm er Rasas lies 34 kilometres to the east of the north-south oriented Dead Sea Transform fault zone. The Siwaqa

Fig. 1 The complex of the Church St. Stephen

Fig. 2 Mosaic floor, Church of St. Stephen. The mosaic floors are of the highest quality and the inscriptions important for biblical research.

Fault, a significant east-west fault that has been associated with basalt extrusions, lies 12.5 kilometres to the south.

The Dead Sea Rift, along with its associated perpendicular faults such as the Siwaqa Fault, is the predominant earthquake generator in the region. The majority of these earthquakes are of low magnitude, although infrequent events occur with a local magnitude in excess of 6 on the Richter Magnitude Scale. All earthquakes with a magnitude in excess of 6 have occurred along the Dead Sea Rift.

According to the »Map of Natural Hazards« of the »Munich Reinsurance Company«, the area of the Mujib Dam, which is currently under construction and which is located 11 kilometres to the south-west of Umm er Rasas, belongs to »Zone 3« with intensity VIII on the Modified Mercalli Intensity Scale. Intensity VIII corresponds to 6.2 to 6.9 on the Richter Magnitude Scale and is described as follows: »Panel walls thrown out of frame structures; fall of chimneys, factory stacks, monuments, walls; heavy furniture overturned; sand and mud ejected in small amounts.« The risk is defined as »the probable maximum intensity with an accidence probability of 20 per cent in 50 years, equivalent to one occurrence in 225 years (return period) on average, for medium soil conditions.«[1]

As an illustration, all earthquakes in the region (major and minor ones) for the sample year 1998 are listed in table 1.[2]

The first reported earthquake took place in 749 A.D.; after that there are continuous records of earthquakes within an approximate distance of 200 kilometres from Damascus in 845, 974, 991 and from Tiberias in 854 and 1034.

The consequences of these earthquakes, together with a shortage of water and various other factors were responsible for the decline of Umm er Rasas.

After nearly nine months of the year without rain, there is often very heavy rainfall. The antique site becomes flooded within hours. The soil draws up water, swells and the floor with the mosaic buckles. Soil pushs against the mosaic floor (fig. 3).

The cell of the holy Stylite with its broken lintels and fallen roof construction is in danger (fig. 4 and 5). Because of the unstable situation there is a permanent risk that more damages and losses could occur in future earthquakes and in heavy rainfalls with stormy wind conditions. A conservation and consolidation is planned for 2007 with assistance from UNESCO. The consolidation will strengthen the cell construction to stop the trend toward further deterioration. The idea is to reinforce the cell construction inside with carbon fibre straps and to renew the broken and weathered lintels and some stones. Renewal of the statical construction elements is given

1 Jordan Valley Authority-Amman, personal communication.

2 Natural Resources Authority-Amman, Seismological Department, personal communication.

Fig. 3 After the soil dries up, salts, natural cover and hollows are visible.

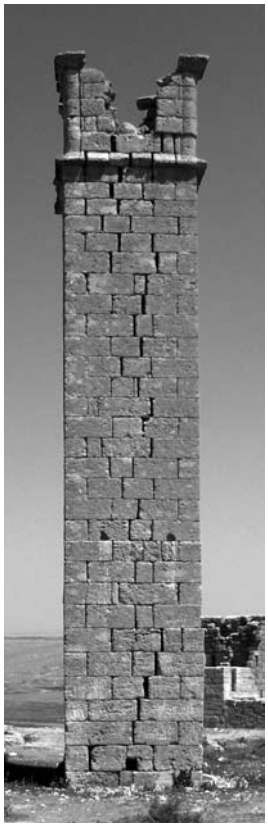

Fig. 4 and 5 The Stylite tower (Byzantine) exhibits earthquake damages.

Date	Latitude	Longitude	Mloc
98 01 05	29,374	34,926	3,29
98 01 07	29,383	34,908	2,72
98 01 07	29,365	34,922	3,2
98 01 08	29,178	34,846	2,38
98 01 09	29,173	34,836	2,42
98 01 09	29,383	34,955	2,85
98 01 10	29,226	34,694	2,68
98 01 10	29,353	34,947	2,3
98 01 13	29,363	34,94	2,52
98 01 14	29,924	35,172	2,57
98 01 14	29,379	34,926	3,23
98 01 18	29,002	34,833	3,37
98 01 20	28,816	34,745	3,23
98 01 20	28,735	34,814	3,12
98 01 24	29,187	34,898	2,49
98 01 25	28,962	34,876	2,47
98 01 25	28,921	34,882	2,81
98 01 25	28,899	34,877	2,99
98 02 01	28,818	34,795	3,04
98 02 13	29,18	34,908	2,8
98 02 13	28,808	34,78	3,16
98 02 14	28,763	34,765	3,11
98 02 20	28,917	34,792	2,95
98 02 26	29,521	35,005	2,94
98 02 27	28,431	34,699	3,5
98 02 27	28,649	34,946	2,99
98 03 01	28,891	34,755	3,27
98 03 02	28,819	34,839	3,14
98 03 04	29,235	34,787	3,1
98 03 04	29,293	34,807	2,36
98 03 06	29,709	35,214	2,53
98 03 07	29,974	34,488	3
98 03 11	29,222	34,756	3,16
98 03 22	29,233	34,736	2,46
98 04 03	29,482	34,939	1,85
98 04 07	28,781	34,57	4,09
98 04 10	28,19	34,514	4
98 04 13	28,962	34,86	2,83
98 04 13	28,995	34,844	3,01
98 04 13	28,93	34,922	2,62
98 04 16	28,873	34,848	3,07
98 04 17	28,835	34,748	4,19
98 05 02	29,399	34,867	2,36
98 05 02	29,821	34,567	3
98 05 04	28,809	34,828	2,83
98 05 09	29,45	34,954	2,81
98 05 10	29,943	35,154	2,26
98 05 12	31,638	34,662	3,09
98 05 21	28,988	34,774	3,78
98 05 24	30,216	35,048	3,26
98 05 31	28,353	34,686	3,64
98 05 31	30,207	35,075	3,3
98 06 02	29,363	35,018	2,11
98 06 04	29,259	34,791	2,86
98 06 04	29,201	34,8	3,7
98 06 05	29,127	34,869	2,86
98 06 05	29,169	34,883	2,4
98 06 06	29,396	35,334	2,58
98 06 07	29,865	35,113	2,45
98 06 12	29,408	34,965	2,24
98 06 12	29,412	34,978	2,34
98 06 12	29,413	34,949	2,18
98 06 12	29,41	34,945	1,76
98 06 12	29,416	34,946	2,07
98 06 14	29,766	34,634	3,02
98 06 14	28,711	34,579	3,52
98 06 14	29,199	34,797	2,72
98 06 14	29,242	34,794	3,08
98 06 15	28,812	34,767	3,44
98 06 18	29,15	34,876	2,64
98 06 19	29,157	34,876	2,93
98 06 19	28,976	34,894	2,56
98 06 24	29,007	34,873	3,1
98 06 25	29	34,915	3,52
98 06 26	29,351	35,017	2,78
98 07 07	29,479	34,986	3,14
98 07 12	31,831	36,519	2,8
98 07 20	29,256	34,987	2,76
98 08 17	31,921	35,56	3,07
98 09 03	28,396	34,737	3,58
98 09 06	31,68	35,624	2,21
98 09 27	28,83	34,734	3,61
98 09 27	28,83	34,795	3,03
98 10 09	28,783	34,76	3,57
98 11 03	29,799	34,54	3,28
98 11 06	29,187	34,816	3,58
98 11 06	28,881	34,849	3,27
98 11 19	29,642	34,489	4,11
98 11 29	31,114	35,166	3,17
98 12 01	28,823	34,831	2,99
98 12 14	31,117	35,202	2,93
98 12 14	31,314	35,562	2,09
98 12 14	31,323	35,582	2,46
98 12 14	31,335	35,602	3,38
98 12 14	31,332	35,537	3,46
98 12 15	32,712	35,81	3,33
98 12 25	29,389	34,884	3,2

Table 1: Earthquakes (dates, geographical co-ordinates of the epicentre) for the sample year 1998 (all registered local magnitude values on the Richter Magnitude Scale)

Fig. 6 During the last decade excavation work concentrated mostly on the period between 200 and 900 A. D. There is now evidence of more than 50 churches.

higher priority than conservation because of the required security for visitors as well as in order to keep the tower together. During the consolidation work the possibilities of an anastylosis of the roof can be studied.

Useful shelters and modest and simple roof constructions are required for the site (fig. 6). The problem of what to do with the large amount of rainwater falling over a short period cannot be solved by drainages because of the unexcavated archaeological parts of the site. At the moment a discussion is in full swing concerning the possibilities of filling the ancient cisterns, as in former times. The idea of reconstructing and revitalizing the open water channels would be very attractive for visitors and could show how the ancient water management system in a settlement on the edge of a desert was constructed (fig. 7).

The Site Management Plan (SMP) takes all necessary security aspects into consideration. The new SMP has the following targets and questions:

- No more anastylosis and reconstructions of single architectural elements.
- Would it make sense to reinforce old anastylosis measures?
- How inappropriate would reinforcement look? (Protection for the entire setting?)

The new Site Management Plan, which includes all future measures at the site, will not allow further unnecessary anastylosis and reconstruction of arches.

Through the fallen arches and stones visitors will learn about and be able to study the architecture as well as the movements and consequences of earthquakes in the past and today.

In any case, it is doubtful that individual reconstructed arches are able to give visitors an idea about ancient architecture and provide information in a third dimension for visualization of a complete building (fig. 8). The »arch architecture« of Umm er Rasas, which has become a rather

Fig. 7 Cisterns and a very intelligent historic water management system were preconditions for surviving in the desert and dry zone of Umm er Rasas.

frequent phenomenon, exemplifies the questionableness of anastylosis measures in terms of safety for visitors as well as with regard to the preservation of antiquities during seismic activities. It is not possible to reinforce the anastylosis of these arches to make them stable against earthquakes; sufficient crosswise stability is not guaranteed. The idea of dismantling these arches again could not be put through. What can we do to safeguard the site and to protect visitors during earthquakes? Build carefully planned walkways. Since the implementation of the first Site Management Plan for Umm er Rasas walkways at the site no longer go under the instable arches.

Visitors will be given an idea of what architecture looked like in ancient times by means of models and panels. One of the great educational possibilities is to study in situ the results of heavy earthquakes with horizontal acceleration of the structures. At Umm er Rasas there are also a few structures that exhibit only minor damage, even after 1300 years and heavy earthquakes; they may have been consolidated.

Fig. 8 (left) and 9 (right) Anastylosis is visible at nearly all excavated locations

Fig. 10 Very few structures at Umm er Rasas exhibit only minor damages

Conclusion

We should use all technical possibilities to safeguard and protect the antique site against natural disasters and catastrophes, to the extent that these do not disturb the setting and are acceptable as conservation measures (fig. 10). In many cases protection from natural disasters is implemented much more easily through careful organisation and planning of sites than through technical measures. Investigation, maintenance, analysis of possible situations, emergency organisation and training of staff can reduce the risk to people and heritage considerably. An anastylosis should be discussed critically, especially because in most cases only part of the architecture would be reerected. The static situation of anastylosis is often dubious, i. e., in many cases the stability is problematic.