

# **ALADJA ROCK MONASTERY (NE BULGARIA) IN SEISMOTECTONIC DANGER**

M.MATOVA

Geological Institute, Bulgarian Academy of Sciences, Sofia 1113, Bulgaria

## **SUMMARY**

The Aladja rock monastery (13<sup>th</sup> c.) is an original cultural monument, placed in seismically active territory. The destructive seismic effects of the local shallow and of the regional intermediate earthquakes could reach an intensity equal or more than VIII degrees.

## **1. INTRODUCTION**

The Aladja rock monastery is placed of the Black Sea coast of the NE Bulgaria. The monastery is 14 km to the NNE of the Varna city and 4 km to the WNW of the resort Golden Sands. That is a territory of intensive economic and the cultural development in the surrounding of the most important coastal city - Varna city.

The monastery is placed on the eastern strongly inclined slope of the Frangen Plateau. The monastery was built in the Upper Tertiary limestone. Numerous fractures, karst manifestations, rockfalls and the landslides are also well presented in the locality.

## **2. PREVIOUS SETTLEMENT AND ALADJA MONASTERY**

The monastery is situated on the upper part of a strongly inclined slope. The slope represents the eastern periphery of the Frangen Plateau. Some archaeological traces of Christian's refuge (2<sup>th</sup>-3<sup>th</sup> c.), of hermit's settlements (4<sup>th</sup>-6<sup>th</sup> c.) were found in the surrounding of the monastery.

The above mentioned activities of the local population had taken place before the formation of the Bulgarian state.

The wave of Hesychasm (a religion with a main principle of silence and of isolation from the society) was largely distributed during the 13<sup>th</sup>-14<sup>th</sup> centuries in Bulgaria. The uninhabited and inaccessible slope attracted the attention of the hesychasts. The remoteness of the locality from the surrounding towns, the presence of considerably eroded limestone rock in the slope, of water reserve, the traces of an historical settlement were among the favorable preconditions for the appearance of the Aladja rock monastery.

That is a two floor's monastery. The monastery were placed in the natural caves and in the supplementary cut territories. The karst development had helped the building of the monastery. The two floors of the Aladja monastery were linked by a wooden staircase placed in a cylindrical groove. The first floor of the monastery includes several small rooms and cells, also a small church. The church sizes are the following: 11 m length, 5 m width and 2 m height. The second floor contains a chapel and other small cells.

The decoration of the church and the chapel testifies to the large distribution of the authority and the influence of the Veliko Turnovo art school (13<sup>th</sup>-14<sup>th</sup> c.). Small sectors of the well decorated murals in the chapel and the church are partially saved now. They could be observed in limited spaces of the monastery.

The hermits had inhabited the Aladja rock monastery until the 18<sup>th</sup> century. Now the territory of the monastery represents an historical museum.

Similar rock monastery is placed 300 m to the W of the Aladja monastery. That is a three floor's construction. The monastery was built in another sector of the same strongly inclined slope. Here the effects of the erosion and the destruction are more impressive than in the Aladja monastery. The collapsed rock materials had formed enormous colluvial cones. A part of the monastery's rock was totally covered by vegetation.

### **3. SEISMOTECTONIC DATA FOR THE LOCALITY.**

The Aladja rock monastery was built on the boundary of the Moesian Platform, closely to its contact with the Black Sea Depression. The most intensive deformation [1] was occurred in the investigated territory related to the Neozoic development of the Black Sea Depression.

Numerous recent active faults and photolineaments are situated longitudinally, transversally and obliquely to the coast. The Kaliakra (NE-SW), the Tyulenovo, the Balchik (NNE-SSW), the Charakman (E-W) and the Fore-Balkan (E-W) fault zones are of big importance for the region [2]. The last three of them are placed near the monastery (Fig. 1). A significant part the above mentioned faults a related to the formation of landslides, rockfalls, land subsidence and earthquakes manifestations.

The strongest local earthquakes with magnitude  $M \geq 7$  (Fig. 1) are represented by the 543 Black Sea earthquake ( $M=7.5$ ), the 1444 Varna earthquake ( $M=7.5$ ). There are some other strong earthquakes to the N of the locality. They are the I c. BC Bizone earthquake ( $M=7.0$ ) and the 1901 Shabla one ( $M=7.2$ ). The destructive influence of the strong intermediate Vrancea earthquakes could be also taken in account.

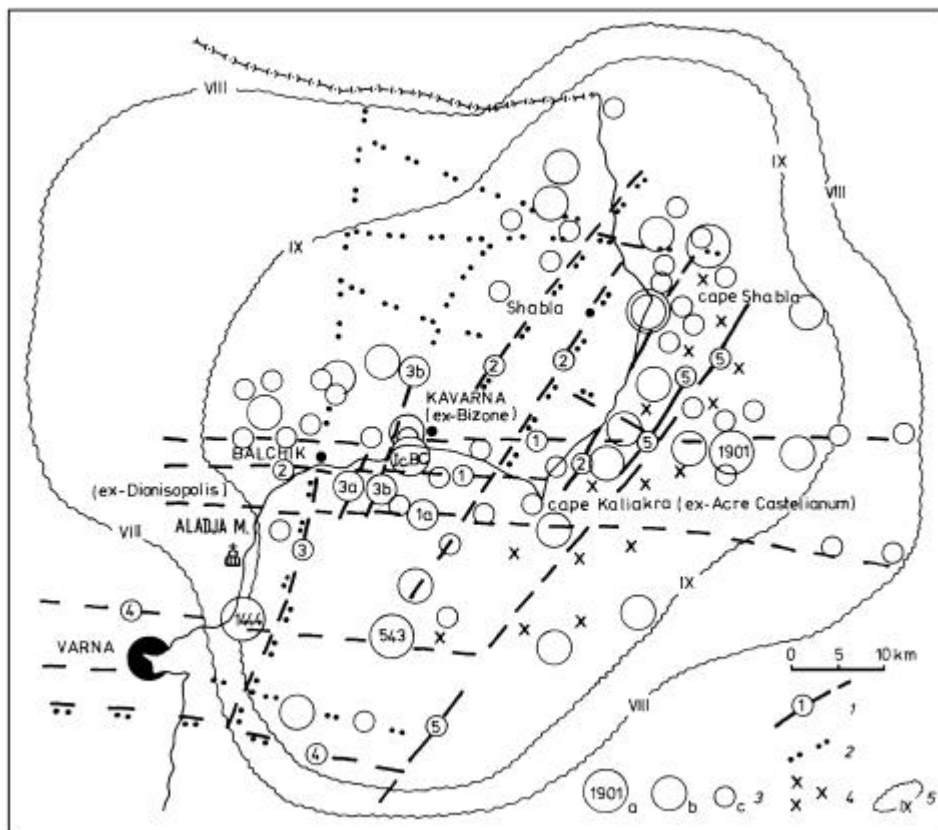


Fig. 1. The position of the Aladja monastery in the seismically active coast of NE Bulgaria (according to [1,3,4,5] with author's compliments).

1 - main fault zones: 1 - Charakman (with 1a - Batovo fault), 2 - Tyulenovo, 3 - Balchik (with 3a - Eastern Balchik and 3b - Tuzlata faults), 4 - Fore-Balkan, 5 - Kaliakra; 2 - photolineaments; 3 - epicenters of earthquakes (I c. BC - 1920) with magnitudes: a -  $M=2.8-4.0$ , b -  $M=4.1-6.0$ , c -  $M=6.1-7.5$ ; 4 - tsunamigenic locality; 5 - maximal expected intensity for a 1 000 year's period.

The above cited local and regional Balkan earthquakes had provoked the activity of fractures, land subsidence, rockfalls and landslides along the coast. A part of the long linear landslides in the monastery's surrounding could be developed during the dated and undated the strong seismic events. Another part of them could be interpreted as a result of previous undated paleo-

and historical seismicity. The direction of the mentioned linear landslides is similar with the same of the Balchik fault zone and the boundary of the Frangen Plateau.

The monastery is situated in a territory where the seismic intensity could reach the value of VIII degrees in 1 000 year's period according the scale MSK-64 (Fig. 1). The territory, where the same intensity could be more dangerous - of IX degrees, is near the monastery.

The Aladja monastery is placed on the coast, where the effects of the tsunami could be considerable (Fig. 1). The distance between the tsunamigenic locality and the monastery is only 25-30 km.

#### 4. CONCLUSIONS

The Aladja rock monastery (13<sup>th</sup> c.) was placed in the calcareous massif of the Frangen Plateau, where the sediments are intensively eroded and fractured. The karst manifestations are also represented. The monastery is a cultural heritage, that need protection.

The seismotectonic conditions of the monastery are very complicated. Several epicenters of strong earthquakes ( $M \geq 7$ ) are placed near it. The Charakman, the Balchik and the Fore-Balkan seismically active fault zones are situated in its surrounding. The tsunamigenic territory of the Black Sea could create also destructive effects on the coast near the monastery. The Aladja rock monastery was constructed in not very stable sediments and in a region of well distributed active faults and epicenters of strong earthquakes. The seismotectonic danger for the monastery is significant.

#### 5. REFERENCES

- [1] Broutchev, I. (Edit.) - *Geological Hazards in Bulgaria. Map 1:500 000. Explanatory text.* "Publ. House of the Bulg. Academy of Sci.", Sofia, 1994, 143 p.
- [2] Matova, M. "Some geoindications of recent geological activity along the Northern Bulgarian coast (NE Bulgaria)" in *Geoindicators. Abstracts of Workshop*, Vilnius, Lithuania, 1999, p. 28-30.
- [3] Ranguelov, B. (1998) - "Earthquakes, tsunamis, landslides on the Northern Black Sea coast" in *Protection and long-term stabilization of the slopes of the Black Sea coast.* "Publ. House of the Bulg. Academy of Sci.", Sofia, 1998, p. 51-63 (in Bulgarian with English summary).
- [4] Ranguelov, B.; Gospodinov, D. - "The Seismic Activity after the 31.03.1901 Earthquake in the Region of Shabla-Kaliakra", *Bulg. Geophys. Journal*, 1994, vol. 20, 2, p. 49-55 (in Bulgarian with English summary).
- [5] Shebalin N.V. et al. (Edit.) - *Catalogue of earthquakes*, UNESCO, Skopje, 1974, 484 p.