

LANDSLIDES IN BULGARIA

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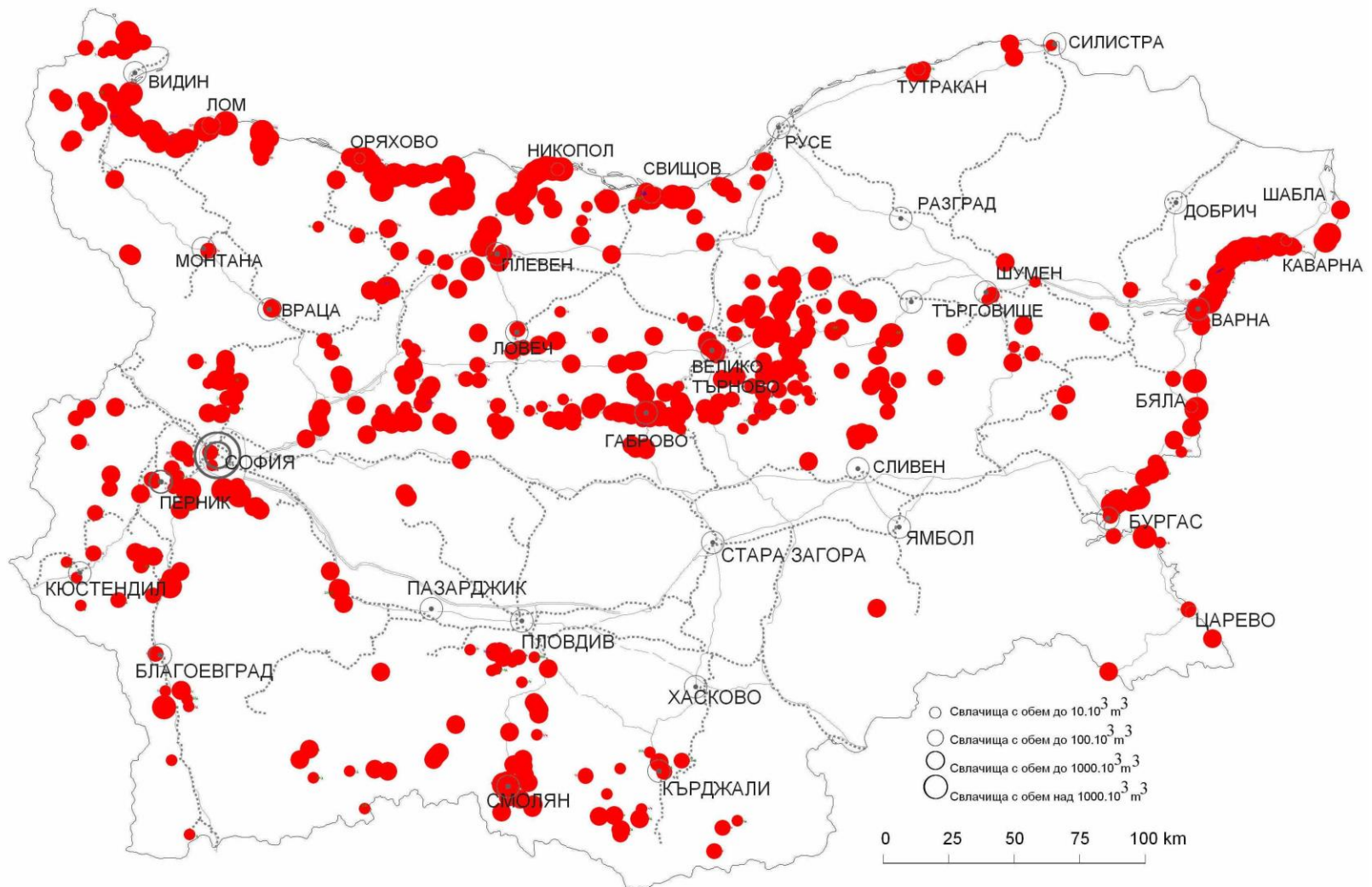
Department of Geohazards

**A SCIENTIFIC NETWORK FOR EARTHQUAKE, LANDSLIDE AND
FLOOD HAZARD PREVENTION - SciNetNatHazPrev - PROJECT
WORKSHOP, MARCH 13-14, 2014, ISTANBUL, TURKEY**

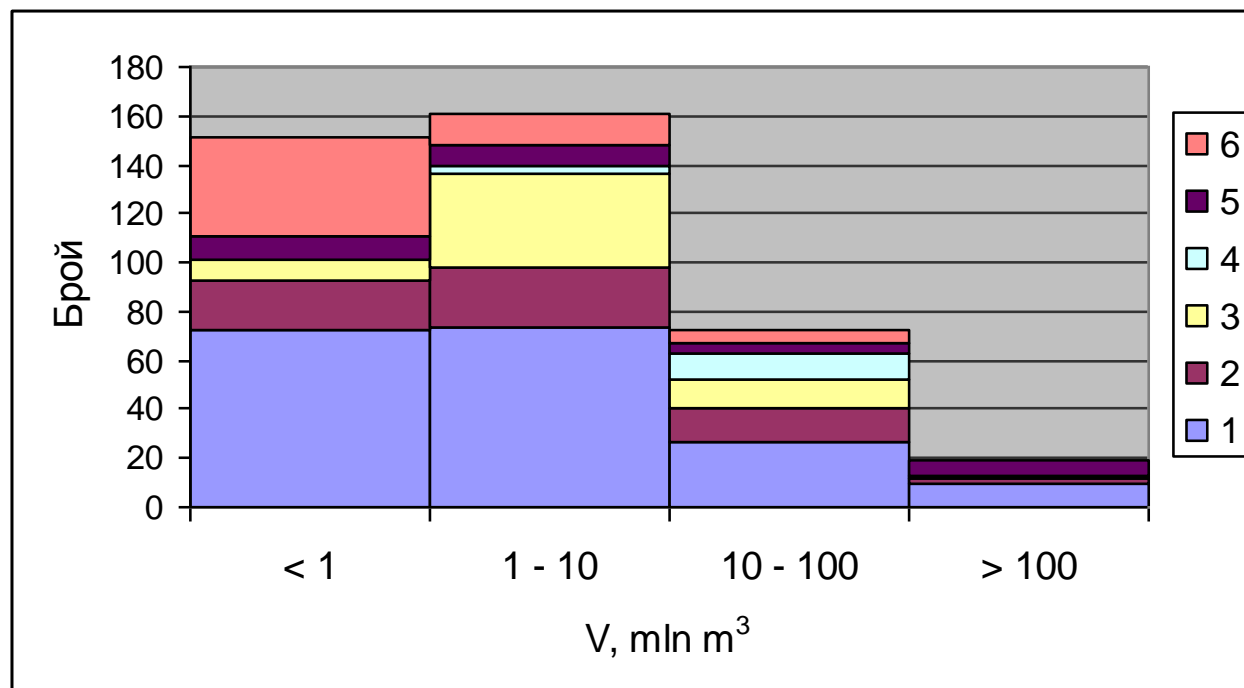
The landslide problem

- Bulgaria is characterized with a high prevalence of landslides, which are the order of thousands. Every year, landslides cause serious problems in the country as damages and losses of properties in urban areas, interrupting major roads and railways, affecting agricultural areas. Damages are estimated at millions of euros. Although rare, they cause losses of lives. There is a clash between the high rate of urbanization and the severe consequences of the many active landslides.
- Landslides are one of the main elements forming the geological hazard in Bulgaria. They are widely but unevenly developed in the country territory. There are all known and described in the literature types of landslides: ancient and recent, active and potential, shallow and deep, etc. Almost all landslide types described in Varnes' classification are represented in Bulgaria.

Distribution of Landslides in Bulgaria



Number of landslides and their volume



Number of landslides and their volume (V) in the different region in Bulgaria: 1. Danube coast; 2. Black sea coast; 3. South-west Bulgaria; 4. Maritsa-Iztok; 5. Rhodope region; 6. Balkan and Fore-Balkan

Main destabilising factors

Upon the occurrence and activation of landslides affect many factors - endogenous and exogenous.

- ❑ **Neotectonic and contemporary movements**
- ❑ **Earthquakes**
- ❑ **Erosion and abrasion**
- ❑ **Surface and groundwater**
- ❑ **Precipitation**
- ❑ **Man-made impacts**

Earthquakes



Earthquakes



Chirakman Cape (near Kavarna town). The Greek colony Bizone was destroyed during an earthquake in the second half of I century BC.

Then, most of the colony sank into the sea. Process of destruction has passed very quickly including a manifestation of rock fall and mudflow.

Erosion and abrasion

- River erosion (deep and lateral) is observed at steep slopes in Balkan Mts, East Rhodopes, W Bulgaria and Danube River bank.
- Abrasion is displayed approx. on 70 % of the length of the Bulgarian Black Sea coast. The maximum values for abrasion are observed in the coastal sections near Kavarna, Balchik, Kranevo, Ravda and Sarafovo.



Erosion and abrasion

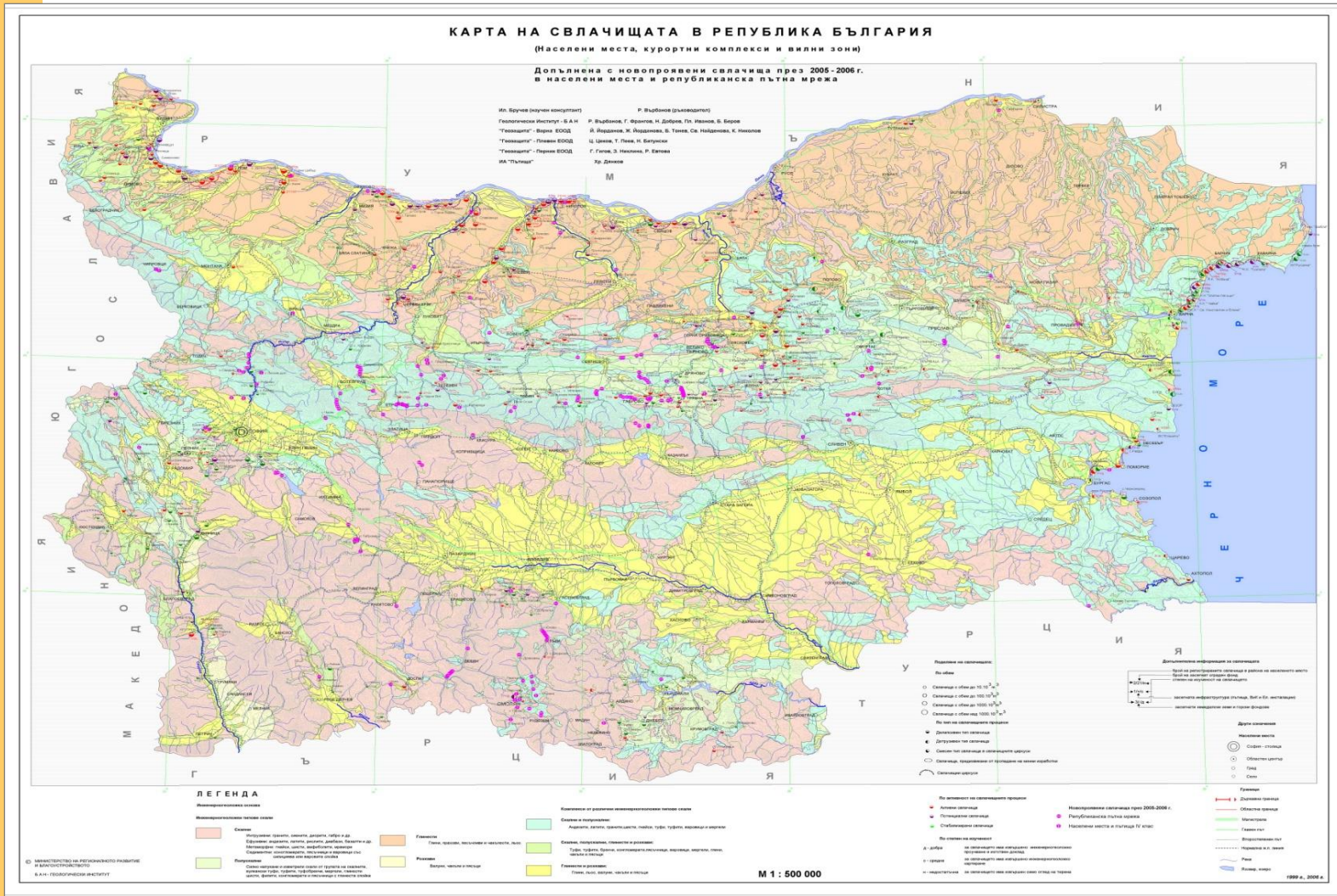


Surface and ground water, precipitation



Kabakum Landslide (1996) – North Black Sea coast

MAP OF LANDSLIDES IN BULGARIA



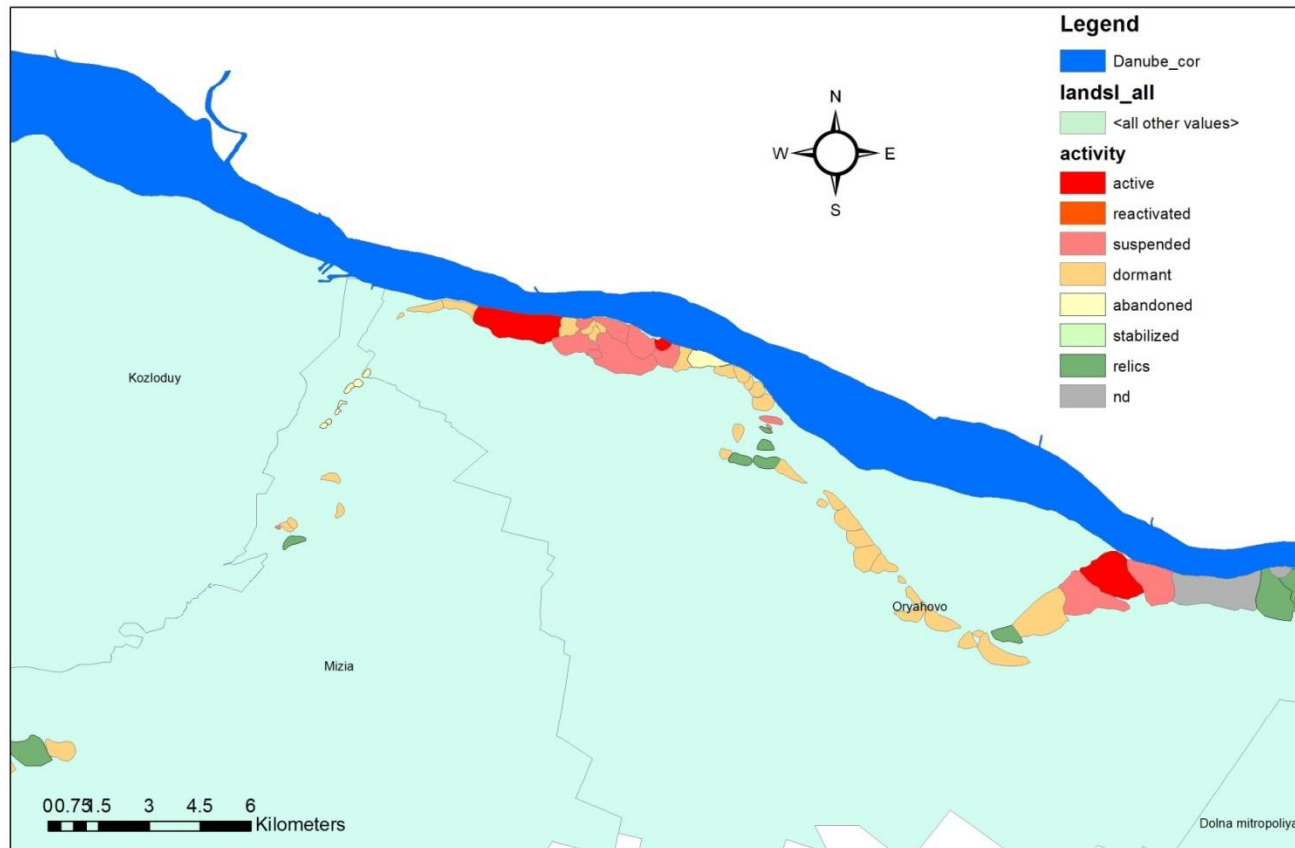
The data-base of the landslides in towns and villages and a map of their distribution in scale 1: 500000 have been composed in 1999. The information about 917 landslides was collected in unified questionnaire. In 2006 the map was added with 55 new appeared landslides in the towns and villages and 135 landslides along roads.

Landslide inventory mapping

Romanian - Bulgarian Cross-border Joint Natural and Technological Hazards Assessment in the Danube Floodplain.
The Calafat- Vidin - Turnu Măgurele - Nikopole Sector -
ROBUHAZ-DUN

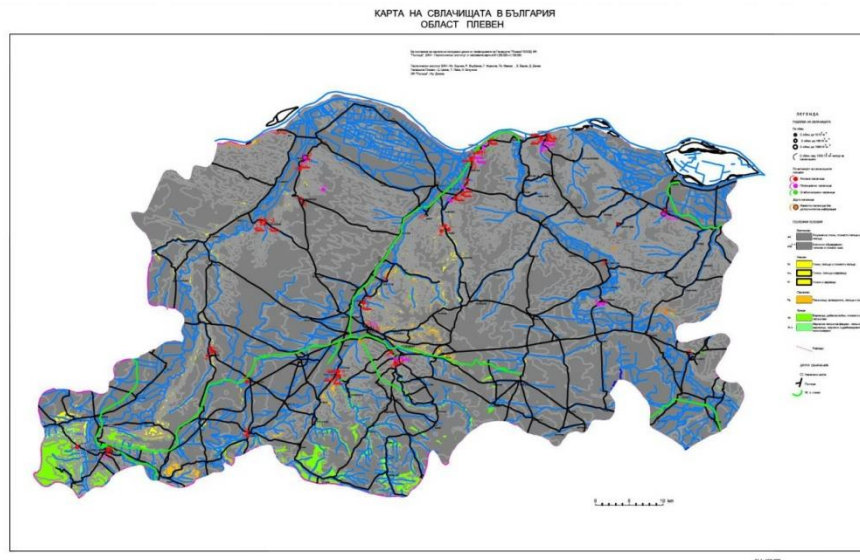


Landslide inventory mapping

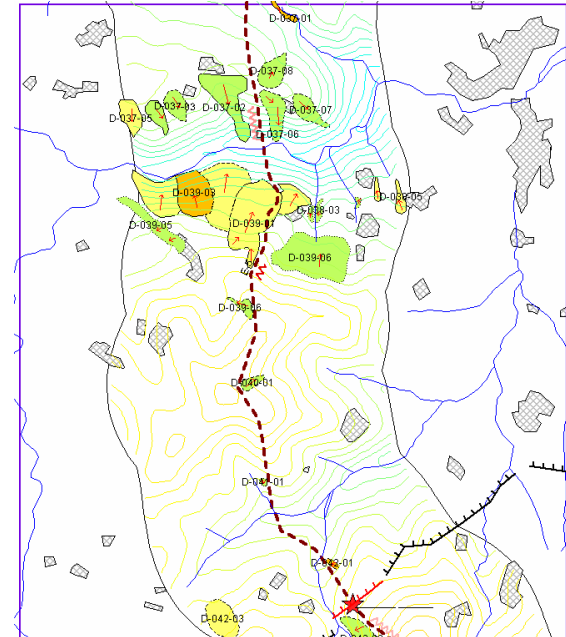


Detail of
Landslide map of
Vidin-Nikopol
sector, by state of
activity (acc. to
WPWLI 1993)

Landslide inventory mapping

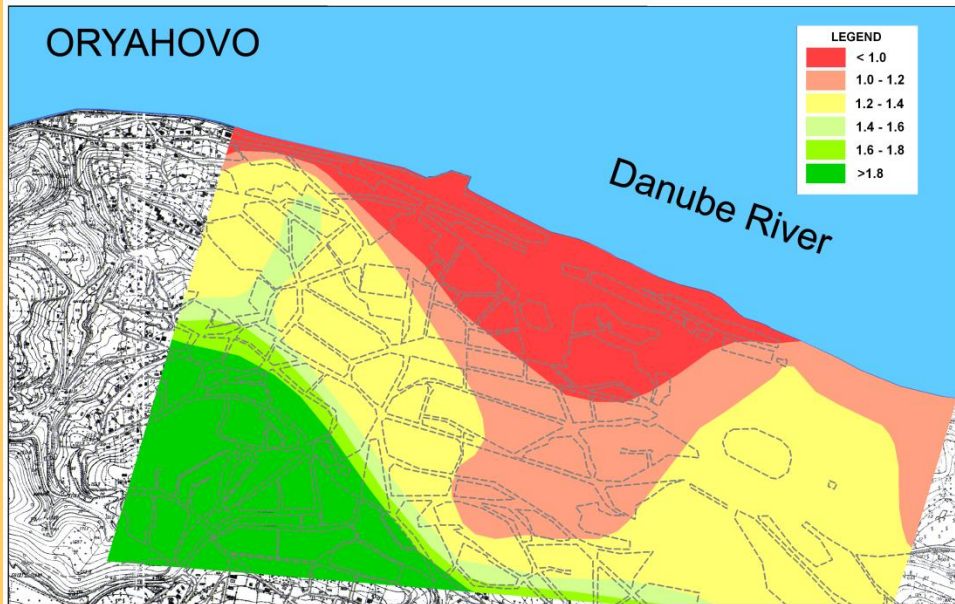


Map of Landslides in Bulgaria,
scale 1:100,000 (2000-2002)

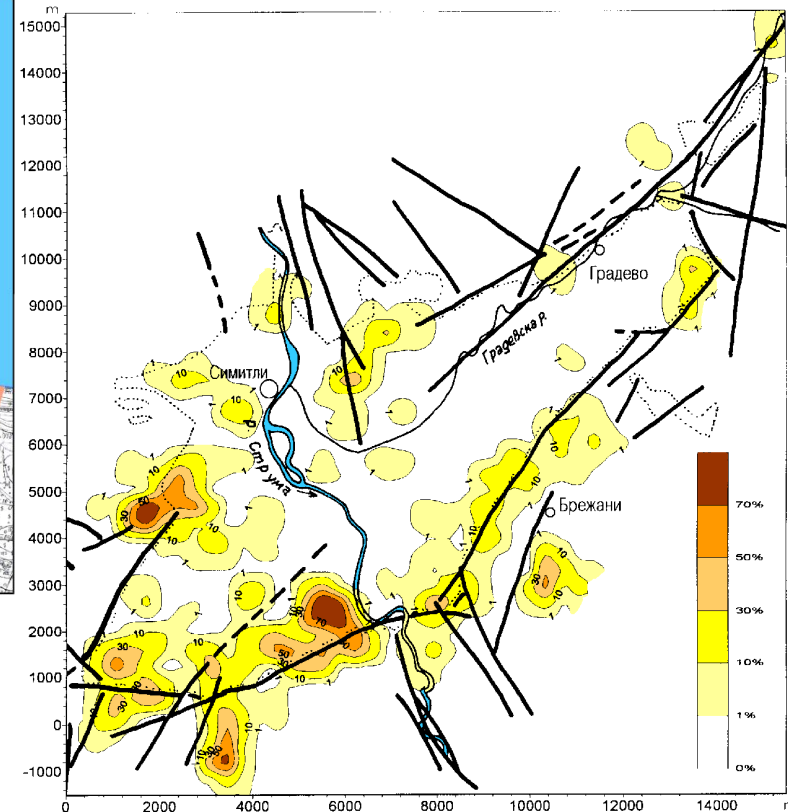


Landslide Map for local use,
scale 1:25,000 (2008)

Landslide susceptibility mapping



Landslide susceptibility map of Oryahovo, by safety factor, in scale 1:5000

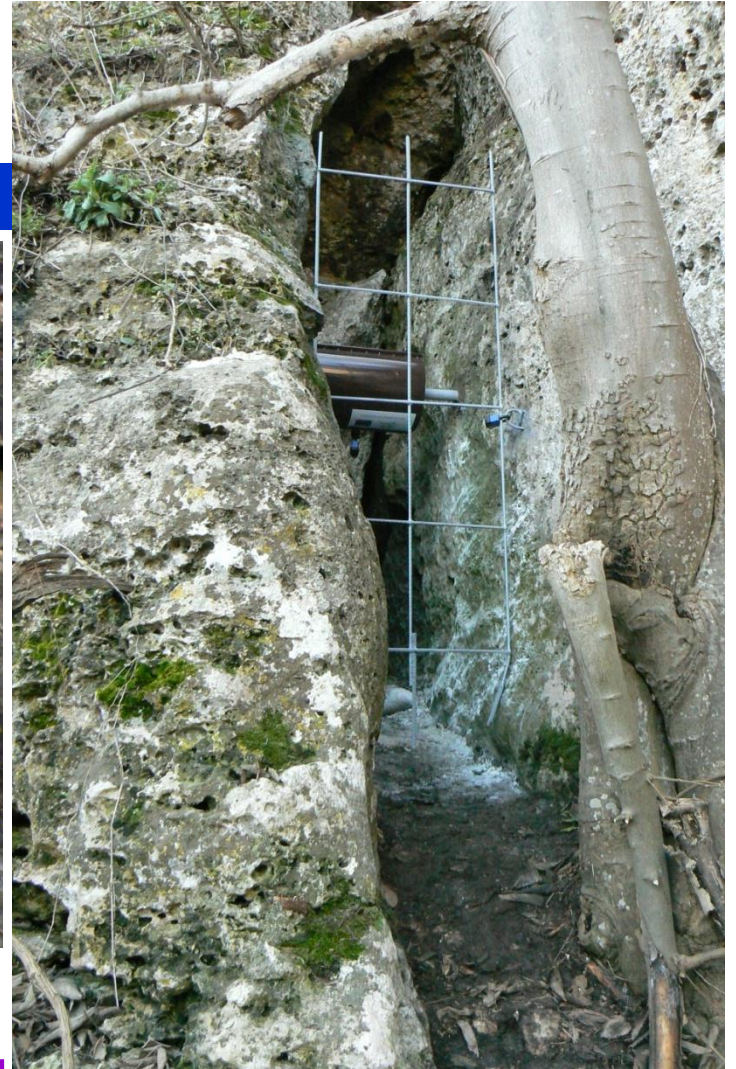


Landslide susceptibility map of Simitli graben,
SW Bulgaria, isopleth method, in scale 1:25000

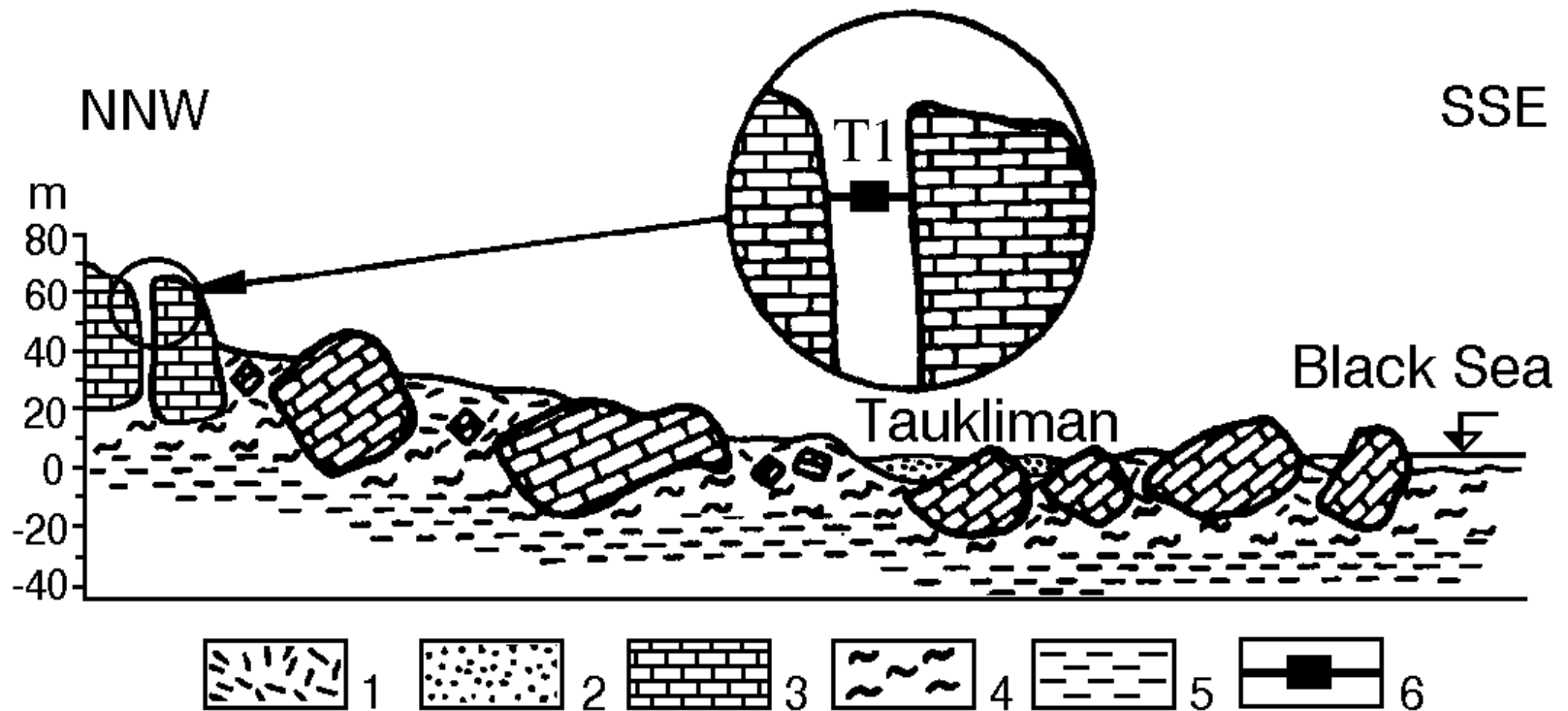
Monitoring



Use of 3D mechano-optical extensometers for in-situ monitoring



Monitoring



Taukliman-Rusalka Landslide



Rhodopes deep-seated landslides



Orsoya Landslide, Lom area (1978) West Danube River bank



Oranovo landslide



Conclusion

- The most hazardous regions are determined to be built of slightly lithified Paleogenic and Neogenic clayey sediments, wide fault zones, all subjected to the intensive action of erosion, abrasion, earthquakes and man-made impact. Such regions are the Western Danubian Bank, the Northern Black Sea coast, the East Rhodopes Mts., and Tertiary grabens.

THANK YOU FOR ATTENTION!

