Euro-Méditerranean Symposium, november 20 and 21, 2007
Working Group 2 (20/11/07 15:00-19:00)
Geological hazards : earthquakes, slope unstabilities, tsunamis, coastal erosion

Chair : Karim Yelles (CRAAG, Algeria)
Convener : Louis Géli (Ifremer, France)
Rapporteur : Pol Guennoc (BRGM, France)

I. Workshop agenda

15 :00 -15:05 Introduction - Karim Yelles

15 :05-15 :15 The Euro-Méditerranean Seismological Center : an original organization for the coordination and federation of the seismological community, Gilles Mazet-Roux (CSEM/EMSC)

15 :15-15 :25 Tsunami hazards in the North-Eastern Atlantic, Mediterranean and adjacent seas, Miguel Miranda (Faculdade de Ciencias, Universidade de Lisboa)

15 :25-15 :45 Submarine landslides, slope unstabilities and catastrophic events. The importance of seafloor mappig and imaging. Francesco Chiocci (Università La Sapienza, Roma)

15:45-16:05 Erosion Processes, Nicole Lenôtre (BRGM) & Bouchta El Moumni (Université de Tanger)

16:05-16:15 Seafloor observatories : an essential tool for geohazard assessment and mitigation, Paolo Favali (INGV) & Roland Person (Ifremer)

16 :15-16 :20 European Plate Observatory System, François Cornet, (IPG Strasbourg) & Massimo Cocco (INGV)

16 :20-16 :30 Eurofleets : a tool to access to oceanographic facilities (Antoine Dosdat, Ifremer)

16 :30-19 :00 Discussion & conclusions

II. Preliminary document distributed to all participants (prepared with the contribution of L. Géli[1], P. Cochonat[1], N. Lenôtre[2], P. Guennoc[2], B. El Moumni[3], M. Sahabi[4]. K. Yelles[5], F. Cornet[6], F. Chiocci[7], P. Favali[8], F. Briand[9])

[1] *Ifremer, Centre de Brest, BP 70, 29280 Plouzané, France*
[2] *BRGM, 3, Avenue Claude Guillemin - BP 36009, 45060 Orléans Cedex 2, France*
[3] *Faculté des Sciences et Techniques, Université ESSADI, B.P. 416, 90 000 Tanger, Maroc*
[4] *Université Chouaïb Doukkali, Faculté Des Sciences, BP 20, 24000 El Jadida, Maroc*
[5] *CRAAG, Route de l'Observatoire B.P. 63, Bouzareah Alger, Algérie*
[6] *IPG-Strasbourg, 5 rue René Descartes, 67084 Strasbourg-Cedex France*
[7] *Dipartimento di Scienze della Terra, Università "La Sapienza", P.le Aldo Moro 5, 00185, Roma, Italia*
[8] *Istituto Nazionale di Geofisica e Vulcanologia (INGV), Via di Vigna Murata, 605 - 00143 Roma, Italia*
[9] *CIESM, 16 bd de Suisse, MC 98000 - Monaco*

II.1 Introduction

Located in the Africa-Eurasia convergence domain, the Mediterranean Basin is highly exposed to geological hazards. Seismicity is diffuse, distributed on a great number of faults that are still largely unknown, most particularly offshore. Besides seismicity and related hazards (landslides and tsunamis), the coastal zones are also threatened by other catastrophic events (sub-marine avalanches, slope instabilties or volcanic collapses), the trace of which is found in the submarine sediment deposits. All these events interact (for instance, the submarine landslides trigerred by the Boumerdes earthquake offshore Algeria originated telephone cable failures). Triggered tsunamis may considerably amplify the damages caused by earthquakes or landslides. The tsunamis of Lisbon, in 1755, or Messina in 1908 (which caused 100000 casualties) are among the 5 most disastrous in history. If such events occur today, the death toll is likely to be much higher, due to the population increase and urban concentration in the coastal areas. In addition, the demographic pressure increases coastal erosion. Even small-magnitude landslides, such as that occurred in 2002 at Stromboli (Italy) or in 1979 at Nice (France), are able to generate tsunami waves with run-up in the order of 5-10m. They may have a tremendous effect when occurring on summer season on crowded pocket beaches on rocky coast, very common in the Mediterranean Sea.

The mitigation of geological hazards requires a global approach, both local and regional and a knowledge from deep to shallow water. For instance, the failure of the Stromboli slope would produce a devastating tsunami affecting the entire Western Mediterranean basin. The tsunami that devastated Alexandria in 365 AD was probably triggered by an earthquake of magnitude larger than 8 that occurred in the Hellenic arc, hence the imperious necessity of regionally coordinated public policies of hazard mitigation. In addition, the sea-level rise induced by global change (~ 60 cm by 2100) is expected to accelerate the effects of coastal erosion and increase the intensity of extreme events (storms, floods, droughts). Beaches and low relief coastal areas, generally highly populated, will be the most affected by erosion and marine submersion, but high relief coasts with cliffs are also concerned.

Geological hazards concern the whole Mediterranean Basin, but the first step for this symposium will be to focus on the Western Mediterranean.

II.2 Present status of the south-north collaboration

Multinational networks or initiatives are presently ongoing for the monitoring of geological hazards in the Euro-Mediterranean area, among which are, for example : i) the Euro-Mediterranean Seismological Center (ESMC) ; ii) the Unesco Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS ; this group is also backed up by the CIESM-IOC MedGLOSS network that monitors quasi instantaneous changes in sea-level rise) ; iii) the European Plate Observatory System and European Multidisciplinary Seafloor Observatories that are currently being discussed within the European Strategy Forum on Research Infrastructures.

Numerous bi-lateral programs are also ongoing on land. Seagoing programs for data acquisition involving countries from partners of the northern and the southern shores of the Mediterranean are very few (e.g. Ifremer/CIESM compilation of high resolution maps of the seabed based on multibeam surveys, based on data collected by more than 10 oceanographic institutions). For the Maghreb, the few examples concern : i) studies of active deformation and slope unstabilities offshore Algeria, conducted namely by IUEM (Institut Universitaire Européen de la Mer), CRAAG (Centre de Recherche en Astronomie, Astrophysique et Géophysique) and Ifremer (MARADJA and PRISME); and ii) ongoing programmes to study the stability of the north-western atlantic platform off Morocco (PROTIT and NOMADS). The impetus given by these projects result in increased awareness among scientitsts of the south Mediterranean countries that a long-term marine science research policy is required, based on naval facilities, to address national and trans-national scientific priorities.

Concerning coastal erosion, some programs have been activated these last years, among which the EC-funded EUROSION programme, set out to quantify the status, impact and trends of coastal erosion in Europe and assess needs for action at EU, Member State and regional levels. The EUROSION study clearly concludes that efforts should be made to improve coastal resilience through improved sediment management and allocation of sufficient space for coastal processes. The countries of the southern shore of the Mediterreanean were not involved in this programme. Tunisia is involved in the BEACHMED Programme, for the monitoring and mitigation of erosion of Mediterranean beaches and for setting-up mitigation policies for this very sensitive environment. It is also important to note those studies funded by the International Commission for the Scientific Exploration of the Mediterranean - an unique institution that supports a researchers from all shores of the Basin – that have shown that rate of increase of coastal erosion seems alarming in many Mediterranean shores.

While important efforts are made on land, much remains to be done in the off-shore and near-shore domain, whereas the marine component is critical to assess geohazards in coastal areas and improve monitoring and warning systems.

II.3 Required actions

- Conduct off-shore/on-shore actions (including multibeam bathymetry and high resolution seismics) to map active faults and coastal bathymetry
- Characterize the dangerousness of submarine slopes in exposed, populated areas
- Improve land seismological networks by deploying offshore stations
- Develop and maintain monitoring networks of coastal erosion
- Develop and maintain tsunami early warning and mitigation systems
- Encourage advanced research (e.g. seafloor observatory ; ocean drilling ; numerical modelling of coastal erosion and sediment transport, etc).

II.4 Expected symposium outputs

- Elaborate a multi-disciplinary research program on geological hazards, integrating land and marine aspects and involving the countries from the northern and southern Mediterranean
- Develop training and mobility of students and researchers
- Structurate marine and coastal sciences research at the Euro-Mediterranean level (develop access to marine research infrastructures)
- Implement a pluri-annual programmation of trans-national cruises involving countries from both shores of the Mediterranean (connexion with Eurofleets).

III. Summary of key points expressed during the discussion

1. Due to the long recurrence rate of geohazards related catastrophes, there is still too little awareness of the real risk among political authorities in most countries. It is important to increase public awareness, so as to influence public policies on risk mitigation.

2. It is hardly being realized that costal erosion and marine submersion will increase severely with increased human population and global, climatic change. Here also, more efforts are needed to survey, mitigate and increase public awareness.

3. Adressing geohazards in submarine environments require ***an integrated land-sea approach***, with specific methods and observing systems, as well as sea-going facilities : bathymetric and coastal low land mapping, high-resolution seismics and deep seismic soundings, seafloor observatories, etc. These specificities involve a ***high level of funding, compared to land. Hence the necessity to build up partnerships at the international level.***

4. Strong need expressed for more detailed knowledge of seabed and sub-seabed and ***basic research*** on processes at all levels : local, regional, from the deep crust to the surface.

5. ***Various public means exist but are not enough structured.*** The different oral presentations of the workshop clearly show that there are a number of on-going initiatives at the national and international level : in Italy (e.g. Magic Progetto), in Greece, in Europe (ESONET/EMSO, EPOS, EUROFLEET), at the inter-governmental level (CIESM), etc. On land, the Euro-Mediterranean Seismological center (EMSC/ CSEM) appears to be an examplary initiative that federates more than 50 institutions at the Euro-Med level.

6. Urgent need is expressed for a better coordination of projects, tool development and database integration. The participants insist repeatedly on the need for a better structuration and better networking at the Euro-Med level. For instance, the useful role of the CIESM (www.ciesm.org) is underlined and recognized.

7. Representatives from Insu (Institut National des Sciences de l'Univers) mention their intention to launch a programme for basic research in the Mediterranean focused on earth and environmental sciences. North-South cooperations will be encouraged.

8. The Eurofleets call (opened nov 07) offers the possibility to provide access to marine facilities (vessels L>35 m), submarine or embarked tools to Euro-Mediterranean countries.

9. Strong need to develop or strengthen links with industry (existing in N and S countries) for the access to advanced technology and unique sets of data (eg very deep and good resolution seismics, drill holes, etc)

10. Besides these intitiatives, the participants from the southern shores of the Mediterranean (Morocco and Algeria) mention their strong needs :

    - To have access to oceanographioc vessels and tools
    - To share experience on scientific concepts,
    - To be fully involved in the project building process, from the beginning
    - ***To develop local marine research facilities***

11. Hence, the necessity to move from « cooperation », based on short-term projects to « partnership », based on shared, long-term efforts, ***with sustainable facilities on each shore of the Mediterranean***.

IV. Conclusions

1. A concessus appears on the necessity :

- to evaluate geological hazards through integrated land-sea projects including detailed swath bathymetric surveys, HR seismics, etc
- to study the potential slides on slopes and their impacts on coastal zones
- to complement the seismic networks with marine stations
- to install permanent systems for monitoring the coastal erosion

- to estimate the impact of climate change on coastal zones (marine submersion)
- to install / reinforce Tsunami Alert and mitigation Systems integrated at the Euro-Med level and possible impact on coastal zones
- to conduct basic researches including seafloor observatories, boreholes, numerical modelling for sediment transport, tsunami impacts, etc…
- to develop training and mobility of students and researchers from both shores of the Mediterranean.

2. A second Euro-Mediterranean workshop will be held in Italy in September 2008. In the meantime, new steps should be taken to establish a real and full North-South partnership:

- to elaborate a multi-disciplinary research program on geological hazards, integrating land and marine aspects and involving the countries from the northern and southern Mediterranean from the early stages (objective definition) to the scientific valorization of the data

- to structure marine and coastal sciences research at the Euro-Mediterranean level (most particularly with the development of the access to marine and coastal research infrastructures

- to implement a pluri-annual programmation of trans-national cruises involving countries from both shores of the Mediterranean (connexion with Eurofleets).

- To create North – South Mediterranean coordination structures at all levels associating : policy makers, funding agencies and scientific organizations ; scientists / project managers and regional authorities in charge of spatial management, socio- economic aspects,

- These steps should help pave the way for the development of sustainable, permanent, marine and coastal research infra-structures in the countries from the southern shores of the Mediterranean.