

## ANNEX II / Forms B

<b>Programme Research of Excellence</b>			<b>CEEX/ Form B</b>	
Module	I	Type of Project		
Proposal's Acronym	PROFET		Proposal's Acronym	

Thematic Fields S/T*)	Code 1	6.1	Title	Climate change, pollution and risk
	Code 2	6.4		Earth observation and assessment tools
	Code 3	6.2		Sustainable management of resources
Technological Platform **)	Code		Title	

\*) according to Annex 1 – Activities / Thematic Fields S/T

\*\*\*) according to Annex 1 – Activities / Technological Platforms (for complex projects)

### **B - PROJECT PROPOSAL DESCRIPTION**

(max. 15 pages, Arial 10, 1.5 lines)

#### **1. PROPOSAL'S TITLE IN FULL**

Proposal's Title in full, and its acronym

**« MULTIDISCIPLINARY RESEARCHES ON NATURAL HAZARDS. CASE STUDY: TSUNAMI-TYPE PHENOMENON IN THE BLACK SEA » - PROFET**

1.1 Thematic fields S/T according to Annex 1: 6.1 Climate change, pollution and risk; 6.4 Earth observation and assessment tools; 6.2 Sustainable management of resources

1.2 Proposal's abstract

Scientific studies referring to natural hazards, such as earthquakes, hurricanes, tsunamis, are not to be limited within state borders, as the the areas affected usually occur at regional or global scales. The project proposal on the possible occurrence of the tsunami type waves in the Black Sea falls in the thematic field number 6 (Environment, including Climate Change), Code 6.1 Climate change, pollution and risk – Natural hazards, Research of Excellence Programme. The scientific results required to fundament decisions in order to minimize, or even eliminate the tsunami type hazards can be accomplished within partnerships of research development institutes (NIRD) – education (universities) – and private companies, associations in good agreement with actual national and European trends in science.

As a half-open marine basin limited by active fault systems showing a high regional seismicity, the Black Sea basin represents a suitable area for occurrence of the tsunami-type natural hazards. The characteristic features of the Romanian sea shore (very large shelf, low water depths and low seashore topography) make it highly vulnerable to such phenomena. Unfortunately, information related to historical recordings of such events is almost lacking in Romania, while other countries sharing the Black Sea shoreline (Turkey, Bulgaria, Ukraine) benefit of a large amount of historical evidences and results of recent scientific studies, some of them within European projects.

This project intends to scientifically investigate this natural phenomenon and recommend a monitoring system, with warning possibilities in cases of disastrous events. The research teams that constitute this consortium will carry out multidisciplinary researches (marine and coastal geology, hydrological and engineering geology).

The project objectives will be solved systematically during three main stages: 1) documentation stage; 2) stage that includes marine multidisciplinary researches in the Black Sea basin; 3) analysis and integrate interpretation of all data obtained during the project, aiming at setting a population and coastal infrastructure protection strategy (harbours, touristic facilities, beaches), as well as a monitoring and warning system.

The results of this research will be disseminated in a national and international frame and to the local and

central authorities (General Inspectorate for Emergencies, county and local authorities in the Black Sea coastal area).

## 2. PRESENTATION OF NATIONAL AND INTERNATIONAL CONTEXT WITHIN THE MENTIONED THEMATIC FIELDS:

### A) The national context within the thematic field

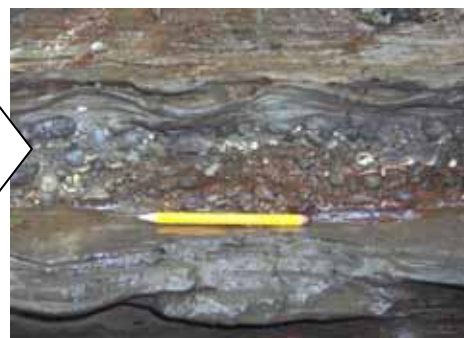
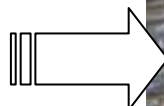
The project intends to initiate a multidisciplinary study, by means of a partnership from the research-education and applied geosciences domains, of an extremely dangerous natural phenomenon, already observed in the region of the Black Sea. In Romania, the tsunami natural hazard is poorly documented by scarce information. Along the Romanian Black Sea coast occurred anomalous hydrodynamic events, usually mentioned by witnesses and rarely measured by instruments of hydrologic stations located on the shoreline. Even these natural phenomena occurred from time to time, they have not been mentioned in written documents or in scientific publications. Rarely, such observations have been noted, those presented as personal communication by Dr. C. Bondar, former Head of Department of Hydrology of National Institute of Meteorology and Hydrology, being based on visual or instrumental measurements on hydro-meteorological stations along the seashore. A summary of these observations is presented in the following:

Year	Month	Type of observation	Zone	Effects
1958	May	Visual	Sulina	Floods on dams situated along the Sulina canal and in the eastern part of the town
1960	December	Visual	Sulina	Complete flooding of the canal dams and of the meteorological station platform; displacements of rock blocks that are fixing the dams; sudden and violent displacement of ships located within the port.
1993	August	Instrumental	Sulina	Floods on the Sulina canal dams
1995	March	Visual	Sahalin island	Total flooding of the island
1995	May	Visual	Sulina	Floods on the Sulina canal dams and of the nearby beach

In all above mentioned situations the uprising of water level occurred as solitary waves propagated from south toward north, their height being higher than 1.5 m. The water level went up rapidly and decreased much slower, during several hours.

The lithofacies of sediment intercalations deposited by tsunami type waves are as follows: irregular boundaries of the deposited strata, looking much alike a sedimentary breccia, mixture of fossils originating from different environments (marine, salmastre, lacustrine) and geological ages (Pleistocene, Pliocene, Holocene).

Bed deposited by a tsunami-type wave



The seismological studies evidenced active hypocenters in the vicinity of the Black Sea basin, high magnitude seismic events being considered as triggering the tsunami type waves. Since 1826, based on historical written evidence on the Black Sea seismicity, a number of 1435 earthquakes have been recorded. Starting with 1945

the earthquakes have been recorded with instruments, the interpreted hypocenters depths ranging between 10 and 60 km. Most of these events occurred in the northern and north-eastern parts of the sea basin (Fig. 1).

The study of the tsunami type hazard may be approached by specialised research institutions, the integrated analysis of the existing information and those obtained during the project leading to suitable proposals in order to prevent natural disasters on the Romanian Black Sea coast. The application of monitoring and protection activities may be done together with the central and local authorities (General Inspectorate for Emergencies) or companies involved in research and environment problems.

Among the research institutions involved in studies directed toward natural hazards, using multidisciplinary approaches (geology, hydrology, seismology, seismics and seismoacoustics, hydrodynamics) we mention:

- national research institutes: National Institute for Marine Geology and Geoecology - Geoecomar, National Institute for Earth's Physics, National Institute for Environment Protection, National Authority for Meteorology, National Institute for Geology, Geophysics, Geochemistry and Remote Sensing, National Institute for Marine Researches, National Institute Danube Delta;
- universities including faculties within the domain: University of Bucharest (Faculty of Geology and Geophysics; Faculty of Physics; Faculty of Geography; Faculty of Biology), Polytechnic University of Bucharest (Faculty of Energetics), University Ovidius located in Constanta (Faculty of Natural Sciences, Faculty of Civil Engineering), University of Civil Engineering located in Bucharest (Faculty of Hydrotechnics, Faculty of Geodesy);
- institute of the Romanian Academy: Institute of Geodynamics, Institute of Geography;
- other institutions: Aquaproject SA Bucharest, ISPIF SA, ISPE SA, GEOTEC SA, IPTANA SA.

The exchange of information between the partner institutions will be realised during meetings gathering the involved scientists and using actual electronic communication possibilities. During the marine cruises the correlation of research activities and information exchanges will be done on the research ship, in meetings at the end of each working day.

The users of the project results are both national and international. In Romania an important user will be the General Inspectorate for Emergencies, its interest being already evident (see the attached Letter of Interest). Other users from Dobrogea counties as well as local authorities will be among those interested in the results. The project results may be useful to small companies involved in research and development activities. Users from abroad are institutions and scientists from countries located around the Black Sea basin: Turkey, Bulgaria, Ukraine, Russia, Georgia, and researchers involved in monitoring European networks for natural hazards (ESPON). An agreement between countries situated around the Black Sea would enlarge the exchange of scientific information and would create a warning system for natural disasters such as high tsunami waves.

#### B) The international context within the thematic field

The first historical information related to tsunami type anomalous waves in the Black Sea belong to the Byzantine historian Theophanes – in 544/545 the sea advanced inland in Thracia with 6 km, covering large territories around the cities of Odessus, Dionysopolis and Aphrodisium. The Armenian historian Mowes Khorenatsi (410-491 AD) has mentioned a similar event on the Black Sea southern shore (Altinok, 1998).

Geological studies that support the occurrence of tsunami type waves in the Black Sea describe sapropelic breccia on the Bulgarian seashore (Chachov and Shanov, 1987). Ranguelov (1994-1996) describes tsunamites, characteristic geological sedimentary formations associated with tsunami events. Oaie (1998-2000) observed within the cores sampled in drillings performed in the Black Sea basin particular intercalations that

could represent effects of tsunami waves (Project RER 2/003 IAEA Viena).

During the last 3000 years more than 100 tsunami type waves have affected the coasts of Turkey (Yildiz Altinok, Istanbul University, Turkey), 40% occurring in the Marmara Sea and 60% in the Black Sea. On the eastern coast of the Black Sea have been observed more than 90 tsunami type events during 1410 BC and 1999 AD (Yalciner, 2001, Middle East Technical University).

On a world wide scale several organisations are involved in the study, monitoring and population warning in exposed zones to seismic waves: International Tsunami Information Center, NOAA-Satellite and Information service and European Spatial Planning Observation Network (ESPON). ESPON is producing the prognosis map of Tsunami type events in Europe, this map **including the Romanian Black Sea coast within the second category of risk for tsunami waves hazard** (Fig. 2). Considering this, Romania has to elaborate its own monitoring network of tsunami type events in the Black Sea. The significance of this natural hazard at a regional scale is sustained by the high interest for this project manifested by similar institutions from Bulgaria: Institute of Oceanology-Varna (Letter of Support) and Geological Institute, Bulgarian Academy of Sciences-Sofia (Memorandum of Understanding).

### **3. OBJECTIVES**

The major objectives of the project are as follows:

1. the characterisation of tsunami hazards for half-open sea basins, such as Black Sea;
2. documentation for the Romanian Black Sea shore of tsunami type natural hazards; multidisciplinary scientific researches; acquisition and complex data processing; catalog of tsunami type events on the Romanian seashore;
3. field and laboratory activities aiming to evaluate the prediction and prevention possibilities in the exposed areas;
4. set of instructions for cases of emergency in the exposed areas; monitoring system for tsunami type natural events with warning possibilities in real time;
5. establishment of a research – education - public institutions & private companies consortium in Earth sciences in view of an integrated utilization of research infrastructures and elaboration of studies on the natural hazards;
6. integration with the European research networks aiming to increase the Romanian contribution to the development of European knowledge in geosciences, as well as cooperation with similar European scientific teams.

### **4. SCIENTIFIC AND TECHNICAL PRESENTATION OF THE PROJECT:**

The degree of novelty consists of :

- accomplishing of studies related to the occurrence of tsunami-type natural hazards on the Romanian Black Sea coast. Such studies have not yet been done in Romania.
  - in order to interpret their real significance, the new research proposed in the project will be completed with historical information;
  - the methodology used is similar to that of international studies in this issue;
  - the project goals will be accomplished within a large partnership of research – education – implementation;
  - the results with immediate applicability obtained will enable integration of Romanian research in the European organizations which study tsunami-type natural hazards;

- the outcomes of the project will be presented as various materials (catalogs, guide-books, instructions), referring to formation and evolution in time of the tsunami-type natural hazards, protection measures in situations of danger, as well as the way of implementation of tsunami monitoring system.

**Degree of complexity.** Considering the diverse mechanisms which produce and propagate the tsunami-type natural hazards, as well as their effects upon the morphology of the relief and on anthropic works, the study a multidisciplinary approach within a project of great complexity is needed. Implication of a large number of researchers from various and distinctive domains will ensure:

- the knowledge of high seismicity areas surrounding the Black Sea;
- location of coastal and submarine zones prone to landslides;
- knowledge of submarine gas emissions, as trigger mechanism of submarine landslides or as perturbing control of the water body related to formation of the tsunami-type waves;
- bathimetric and geological research (sedimentology, granulometry, geochemistry, paleontology, structural geology) on modern and ancient geological formations located along the Romanian Black Sea coast and on the continental shelf;
- engineering geology and geophysical studies (seismo-acoustics, seismics, potential field, magnetometry, etc.), related to the energetic effects of waves upon the coasts and coastal buildings;
- hydrological and hydrodynamic studies for the NW side of the Black Sea, in order to find out the periodicity of occurrence of high-amplitude waves, other than storm-waves; gathering and interpretation of historical data related to major events produced on the Romanian Black Sea coasts; predictions upon the formation of tsunami-type waves;
- elaboration of the tsunami-type catalogue for the Romanian Black Sea coast;
- elaboration of professional documentations (guides, instructions) in order to implement an automated system of monitoring the phenomenon, with real-time warning in case of danger.

The complexity of the subject and total lack of data at national level suppose gathering and updating the information, increasing the data base with related information obtained in the countries adjacent to the Black Sea, their processing, elaborate documentations for application and information (guides, catalogues) and implementation of an automated monitoring system. All these are necessary because tsunami-type natural hazard is not produced at national, but at regional scale. Formation of such an event *anywhere in the Black Sea basin* will have significant effects on the Romanian coast. The importance of the phenomenon for SE Europe, and especially for a semi-closed basin as the Black Sea, derives from the fact that several countries (Turkey, Bulgaria, Ukraine) have done or perform studies strictly focused on the tsunami-type natural hazard (see Annex 1).

Unfortunately, Romania was never part of international consortiums which performed such studies.

The used methodology and techniques, instruments, equipment, software, together with the contribution of each partner. Considering the multidisciplinary of the project, the methodologies used are related to the specificity of each partner's activity.

The studies on sea will be performed with the **multidisciplinary marine research vessel *Mare Nigrum***, part of the logistics of NIRD GEOECOMAR.

The vessel is specially equipped for complex research, on-board with labs specialized in geology, geophysics, bathymetry and seismo-acoustics, geochemistry, biology, samples preparation and study, photo and ichnology.

The on-board equipment can be completed with strictly specialized one. Both on-board equipment and that of

project partners are necessary for the foreseen research operations. The main equipment on-board are: Mark II corers and multicorers (deep geological probing), boden-greifera (sampling of superficial sediments), multibeam system ecosounder SEABEAM 1050 ELAC for 3D bathymetry, DGPS, GPS Sercel si Magnavox pentru positioning, marine protonic magnetometer, CTD and Niskin rosette for physico-chemical measurements in the water column, CHIRP X STAR FULL seismoacoustic profiling system, lateral scanning sonar, computer room and computer network, satellite communication (telephone, fax, E-mail). Each participant will use programes specialized in processing of new and historical information.

The project partners wil bring the following *contributions*:

**Project coordinator** – preparing the marine research vessel *Mare Nigrum* and of equipment specific to marine research; Taking geological bottom samples (surface samples and cores), performing bathimetric and seismo-accoustic measurements; Internal and international methodological documentation; Analysis and interpretation of hidrological and wave energy data (using data of the *Wave monitoring station in Mangalia*, station belonging to GEOECOMAR), marine geology, bathimetry, seismo-accoustics; Construction of a web page in order to disseminate the scientific outcomes obtained on internal and international level; Organizes an internal workshop and an international scientific symposium;

**Partner 1** (Bucharest University – Faculty of Geology and Geophysics) – engineering geology and geophysical observations and measurements on sea and along the Black Sea coast; Internal and external scientific methodological documentation; Analysis and interpretation of geophysical data; Modelling the effects of waves on coastal areas; Participation to the website design, in order to disseminate the scientific results obtained at internal and international scale; Participates in organization of scientific meetings;

**Partner 2** (NIRD of Earth Physics) – Regional seismological observations for the Black Sea basin; Internal and external documentation; Analisys and interpretation of seismological data; Fault plane solutions; Participates to the website construction, necessary to disseminate scientific results obtained on internal and international level; Participates in organization of the scientific meetings;

**Partner 3** (NIRD GIR) – Geological and geophysical research on the Romanian Black Sea coast; internal and external methodological documentation; Analysis and interpretation of geological (lithofacial, structural, tectonic) and geophysical data; Participates to the web page in order to disseminate the scientific results obtained at internal and international level; Participates in organization of scientific meetings;

**Partner 4** (Polytechnical University Bucharest – Faculty of Energetics) – Hydraulic studies related to the energetic impact of waves upon the coast line; Analysis and interpretation of the new and historical information; Participation in the web page construction in order to ensure internal and international dissemination of scientific results; Participates in organization of scientific meetings;

**Partner 5** (SC RADAL Ltd.) – Elaboration of the necessary technical documentation in order to purchase and emplace the monitoring system of tsunami-type waves; Elaboration of use instructions; Participates in organization of scientific meetings.

## **5. PROJECT JUSTIFICATION:**

Elaborated in order to connect to the European priorities, the project proposal is related to the European environmental policies, including climate changes and global sea-level changes.

The distinctive issue of *natural hazards* within the future Framework Programe 7 of the European Comission

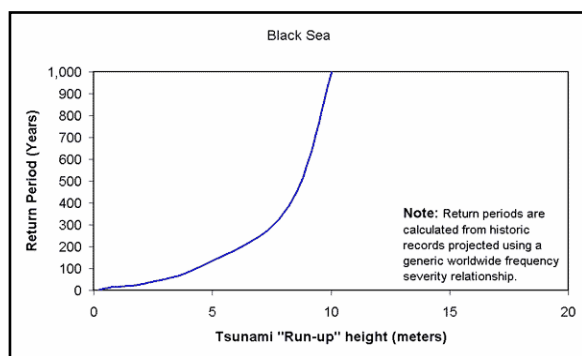
attests the attention given by of the Comission to natural phenomena that might have special effects on the coast area as well as on the society as a whole. The fact that Romania overtook the European problematic as a distinctive issue underlines the interest granted to phenomena that might have very large scale disastrous consequences. On both regional (the Black Sea) and European perspective, chances of success of the research proposed are very high. Considering only that the tsunami-type phenomenon did not have yet disastrous effects in Romania, the phenomenon being weakly documented in this area, then the project chances to succeed are lower. However, we should consider that even if the tsunami-type hazard is rarely occurring in the Black Sea basin, this does not mean that it is unknown in the area. Only documentation for the project elaboration revealed the existence of the tsunami-type danger on the Romanian Black Sea coast. This implies a series of necessary actions, presented in the project plan, to which several other actions might be added, as follows:

**Supervising the phenomenon.** Each time a submarine earthquake is produced, if there is an automated monitoring and warning system in real time, the alarm signal transmitted in the very next minutes yields the longest necessary interval in order to evacuate population in areas exposed to tsunami-type waves;

**Foresight.** The foresight of triggering the tsunami-type wave-generating mechanisms is a constant preoccupation of researches, and several methodologies have been elaborated in this matter:

- evaluation of earthquakes frequency in the past (at each 50, 100, 500 or more years) and present;
- observation of signs preceeding an earthquake: soil deformation, gas emissions, sea level variations;
- knowledge of submarine phenomena (landslides, gas emissions);
- knowledge of unstable escarpments liable to landslides.

On European level, predictions for tsunami-type phenomena have been achieved, including for the Black Sea. A correlation of the periodicity of the tsunami-type phenomenon with their amplitude is shown below (Rosen, 2005).



(Rosen, D. S., 2005)

**Prevention and mobilization at national and regional scale of the factors responsible in disaster situations.** Prevention targets minimization of effects produced by the tsunami-type hazard (ex. number of casualties, material loss). Numerous specialists contribute to this process (ex. geologists, experts in earth physics, geophysicists, specialists in materials shearing-strengths and constructors, architects etc.), this way enabling elaboration of a user guide with instructions to follow in case of danger. Prevention of population and the existence of protective measures specific to this phenomenon implies reducing the risk of flooding, fires, material loss and, implicitly, protection of population. In this matter there is a national plan of supervising and real time alarming, as well as preparing the population through periodic exercises in case of alarm, would contribute to the reduction of the consequences and diminishing/eliminating of human losses. The instructions

will be conformable to the European regulations in the area, especially with the International Disaster Response Laws, Rules & Principles (IDRL), in order to reduce vulnerability and grief of population affected by natural hazards. The monitoring system used on national level would have to work based on a pre-existing agreement, within a regional scale supervising network (the Black Sea basin network).

## 6. DIAGRAM OF PROJECT EXECUTION:

Following the diagram of project execution the project objectives will be approached systematically, starting with the documentation stage, continuing with multidisciplinary researches within the Black Sea basin and terminating with the newly obtained data analysis. At the final stage the dissemination stage and the implementation of the monitoring and prevention network are projected.

Stage	Activity	Deadline	Expences-Categories
<b>Stage I. Definition and documentation of the tsunami -type natural hazard for the half-open sea (Black Sea), using historical and newly obtained information.</b>		27.10.2006	Scientific visits for documentation in Romania for historical recordings. Purchasing instruments, equipments, computers and accessories.
	<b>Activity I.1.</b> Multidisciplinary documentation (geological, geophysical, seismological) in Romania on the occurrence of tsunami type events in half-open sea. Preparation of Mare Nigrum research vessel for marine cruises	15.07.2006	Filed works. Purchasing fuel and lubricants. Purchasing of instruments, equipments, computers and accessories.
Project leader (GEOECOMAR)	Geological documentation (sedimentological, geochemical, biological) on marine geophysics (seismo-acoustics, bathymetry, sea bottom geodynamical processes) and on hydrology (variations of sea level, anomalous events).		Field works. Purchasing fuel and lubricants. Purchasing of instruments, equipments, computers and accessories
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Geophysical documentation (gravity, magnetics, seismology), hydrogeological and coastal documentation		Field works. Purchasing of instruments, equipments, computers and accessories
Partner 2 (National Institute for Earth Physics)	Seismological documentation		Purchasing of instruments, equipments, computers and accessories
Partner 3 (Geological Institute of Romania)	Geological documentation (sedimentological, geological, structural, tectonical) and geophysical (geothermics)		Purchasing of instruments, equipments, computers and accessories
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Documentation on the energy distributed on the shores by waves and currents		Purchasing of instruments, equipments, computers and accessories
Partner 5 (SC RADAL SRL)	Documentation on the monitoring equipments for tsunami type events		Communications and services. Purchasing of instruments, equipments, computers and accessories
	<b>Activity I.2.</b> Marine cruise and field trips in the coastal area in order to perform bathymetrical, seismo-acoustical and geotechnical measurements, geological observations on outcrops and geological sampling (cores). Acquisition of historical and visual recordings Participation in scientific meetings referring to natural hazards	27.10.2006	Field works in Romania and abroad, on sea and on land. Acquisition of historical and visual recordings Purchasing consumables
Project leader (GEOECOMAR)	Researches on sea and on land, along the shoreline, for bathymetrical, seismo-acoustical and geotechnical measurements, geological observations on outcrops and geological sampling (cores).		Sea cruises Purchasing relevant data from archives, visual witnesses



	Management of scientific works on the research vessel following SOLAS and MARPOL regulations Acquisition of relevant data for the project Participation in scientific meetings		Purchasing consumables Travels to scientific meetings
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Geophysical measurements Geotechnical observations on outcrops in the coastal area Acquisition of relevant data for the project		Sea cruises and field works Acquisition of data from various sources (archives, visual witnesses) Purchasing consumables Travels to scientific meetings
Partner 2 (National Institute for Earth Physics)	Acquisition of seismological data at the sea basin scale Participation in scientific meetings		Sea cruises and field works Acquisition of data from various sources (archives, visual witnesses) Purchasing consumables Travels to scientific meetings
Partner 3 (Geological Institute of Romania)	Geological field works Observations on outcrops in the coastal area Acquisition of relevant data from various sources Participation in scientific meetings		Field work on land and sea; Acquisition of data from various sources (archives, visual witnesses) Purchasing consumables Travels to scientific meetings
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Acquisition of information referring to the tsunami type waves mechanisms and effects Participation in scientific meetings		Acquisition of data from various sources (archives, visual witnesses) Purchasing consumables Travels to scientific meetings .
Partner 5 (SC RADAL SRL)	Documentation on the regulations to be followed in case of natural disaster		Acquisition of specific data and consumables
<b>Stage II. Sea cruises and on land field works with multidisciplinary investigations</b>		26.10.2007	Scientific trips within Romania Acquisition of data, instruments and equipments Participation at scientific events (workshops, conferences, congresses).
	<b>Activity II.1.</b> Laboratory analyses, data processing. Construction of a webpage for dissemination of results	29.06.2007	Acquisition of consumables, fuel and equipments Field trips
Project leader (GEOECOMAR)	Performing laboratory analyses (geological / geochemical / biological / mineralogical), processing of new geophysical, hydrological and bathymetric information and of those obtained from other sources, including researches performed in 2006. Preparation of vessel <i>Mare Nigrum</i>		Acquisition of consumables (ex. chemicals, fuel) and equipment; Field work on land and sea.
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Analysis of geophysical and engineering geology information; Preparation of marine research equipments; Construction of a website in order to disseminate information		Acquisition of consumables and equipment; Field work on land and sea.
Partner 2 (National Institute for Earth Physics)	Analysis of own and purchased seismological information; Contributions to the web page		Acquisition of consumables; Field work on land and sea.
Partner 3 (Geological Institute of Romania)	Analysis of newly aquired and own geological and geophysical information; Contributions to the web page		Acquisition of consumables; Field work.
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Critical analysis of the aquired and own information; Contributions to the web page		Acquisition of consumables; Field work on land and sea.
Partner 5 (SC RADAL Ltd.)	Elaboration and submission (to be analysed) of a draft of instructions in case of danger.		Acquisition of consumables;
	<b>Activity II.2.</b> Field work (on sea and land) and	26.10.2007	Field work on land and

	laboratory work in order to complete the data base. Automated data processing and their correlation Organizing a workshop		sea. Editing promotional materials Service expenses
Project leader (GEOECOMAR)	Participation in field work on sea and performing laboratory analyses in order to complete the geological, geophysical, hydrological and biological knowledge base; Data processing and their correlation with those obtained by the partners; Supervizing marine activities according to SOLAS si MARPOL regulations; Aquisition of data from diverse sources; Participation in scientific meetings; Organizing a workshop		Travels to internal and international meetings; Space rentals; Service expenses.
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Participation in field work on sea and land, in order to complete the geophysical and geotechnical knowledge base; Up-grading the web site; Contributes to workshop organizing.		Travels to internal and international meetings; Editing promotional materials.
Partner 2 (National Institute for Earth Physics)	Completarea fondului de date seismologice si corelarea acestora cu informatiile geologice; Contributes to web site upgrading; Contributes to workshop organizing.		Travels abroad and in the country; Acquisition of consumables.
Partner 3 (Geological Institute of Romania)	Completarea fondului de date geologice si geofizice; Contributes to web site upgrading; Contributes to workshop organizing.		Travels abroad and in the country; Acquisition of consumables; Editing promotional materials.
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Completarea fondului de date referitoare la efectele energetice ale valurilor asupra zonelor de coasta si corelarea acestora cu informatiile geologice; Contributes to web site upgrading; Contributes to workshop organizing.		Acquisition of consumables;
Partner 5 (SC RADAL Ltd.)	Field research in order to analyze emplacement areas of tsunami- wave monitoring equipments; Contributes to workshop organizing.		Deplasari interne Servicii cu terti Acquisition of consumables
<b>Etapă III. Complex analysis and integrated data interpretation. Editing the final scientific report. Organization of scientific meetings (international symposium)</b>		15.09.2008	Acquisition of consumables; space rentals, editing publications, guidebooks, catalogues and instructions
	<b>Activity III.1.</b> Integrated analysis of new and historical data, in order to evaluate the possibilities of formation and prediction of the tsunami-type phenomenon in the Black Sea. Editing the final scientific report, annexes included Preparation of the symposium	15.07.2008	Acquisition of consumables
Project leader (GEOECOMAR)	Editing the final report and annexes (catalogue of tsunami-type events on the Romanian Black Sea shore, guidebook with instructions to follow in case of danger, technical documentation for the proposal of the monitoring equipment); Round table with future beneficiaries of project results (IGSU, representatives of Constanta and Tulcea County Halls, local public administrations of the coastal area) Preparation of the symposium		Editing promotional materials; Protocol expenses; Acquisition of consumables
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Participates in preparation of the final report. Participates in preparation of the international symposium Website updating		Acquisition of consumables
Partner 2 (National Institute for Earth Physics)	Participates in preparation of the final report Participates in preparation of the international symposium		Acquisition of consumables
Partner 3 (Geological Institute of Romania)	Participates in preparation of the final report Participates in preparation of the international symposium		Acquisition of consumables
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Participates in preparation of the final report Participates in preparation of the international symposium		Acquisition of consumables
	<b>Activity III.2.</b> Editing the catalogue of tsunami-type events on the Romanian Black Sea coast	15.09.2008	Data aquisition, collecting recent information.

			Acquisition of consumables
Partner 5 (SC RADAL Ltd.)	Editing the catalogue of tsunami-type events on the Romanian Black Sea coast and of the instructions guidebook in case of alarming. Elaboration of technical documentations necessary to acquire and positioning of an automated system of tsunami-type waves monitoring and real-time alarming;		Data acquisition, collecting recent information. Acquisition of consumables
	<b>Activity III.3</b> Dissemination of the scientific data obtained (brochures, CD-roms, published papers; Abstracts volume and CD); Organization of an international symposium; Updating the project website	15.09.2008	Cheltuieli de editare; Inchiriere spatii; Acquisition of consumables
Project leader (GEOECOMAR)	Presentation of results in the final report; Coordinates the works of the international symposium; Dissemination of the final results of the project (Abstracts volume and CD-rom, leaflets, scientific papers, etc.); Proposal to continue activities of the consortium in international partnership (Project proposal for the Framework 7 Programme of the European Commission)		Cheltuieli de editare si publicitate; Inchiriere spatii; Cheltuieli de protocol; Acquisition of consumables.
Partner 1 (University of Bucharest – Faculty of Geology and Geophysics)	Presentation of own results obtained within the project as scientific papers		Editing expenses
Partner 2 (National Institute for Earth Physics)	Presentation of own results obtained within the project as scientific papers		Editing expenses
Partner 3 (Geological Institute of Romania)	Presentation of own results obtained within the project as scientific papers		Editing expenses
Partner 4 (Polytechnic University of Bucharest – Faculty of Energetics)	Presentation of own results obtained within the project as scientific papers		Editing expenses
Partner 5 (SC RADAL Ltd.)	Presentation of own results obtained within the project		Editing expenses

The activities presented in the project are based on the previous experience of partner institutions, as well as on the fact that some of them (ex. the project coordinator) are almost totally involved in marine research, their activity being supported by a marine infrastructure of European standard, including a marine research vessel equipped according to the project goals. Presently NIRD GEOECOMAR, as project coordinator, as well as its partners, are involved in European projects of the Framework 6 Programme of the European Commission (ex. projects Assemblage, Jason, Metrol, Crimea, etc.), as well as in bilateral projects (with France, Italy, Germany, the Netherlands, Bulgaria, etc.), all of them focused on marine issues.

The largest part of projects which study the Black Sea are related to some extent to the present project proposal, a part of the information being of major interest for the foreign partners.

Through their own specific activities, the project partners will cover the complex issues necessary in the approach of the tsunami-type natural phenomenon. They have an outstanding degree of professional expertise, most of them having PhD's in science (geology, geophysics, biology, physics, hydrotechnics, energetics, etc.), are scientific researchers of grades I and II within national R-D institutes, are university professors or associate professors (Bucharest University, Polytechnical University Bucharest, *Ovidius* University in Constanta), members of the Romanian Academy or engineers, highly experienced in various technical domains (hydraulics, hydrotechnics, chemistry). Besides them, undergraduate and postgraduate students (master students, PhD students) and young researchers are involved in the project. Presently, a master thesis on the subject of tsunami-type hazard in the Black Sea is elaborated by one of the team members proposed by the project coordinator.

As are presented in the project plan, the activities performed will cover diversified aspects: multidisciplinary documentation - geology, geophysics, biology, hydrology, engineering – of the tsunami-type phenomenon and its

revealing on the Romanian Black Sea coast, adopting a specific methodology of multidisciplinary research for semi-closed marine basins, performing geophysical measurements, engineering geology studies and sampling Black Sea basin sediments, with detailed sampling along the Romanian shore, integrated analysis of new and historical data in order to evaluate the prediction possibilities of the tsunami-type phenomenon in the Black Sea, data collection and processing, information of central and local institutions and organisms of the Romanian state about the possible effects of the tsunami-type phenomenon in the exposed areas from Romania, internal and international dissemination of the scientific results obtained (scientific papers, CD-roms, abstracts volumes, catalogues, guidebooks, etc.), integration of Romanian researchers in the working groups of international organisms which study and monitorize the tsunami-type natural hazard, organization of national and international scientific meetings.

Legal stipulations related to property rights upon scientific results will be strictly respected, as well as those on intellectual property, dissemination and trading (HG 424/2003, HG 5021/2005). All aspects regarding intellectual property will be mentioned in the subcontracts signed between the project coordinator and partners, accepted by both signing parts.

## **7. RESULTS/ PROFITS AND DIAGRAM/CAPITALIZATION PLAN/ DISSEMINATION**

### **Results:**

- Getting evidences of the tsunami type natural hazards on the Romanian Black Sea coast. The project is tracing two sorts of evidences: historical and actual ones. Using historical evidences, tsunami-type events and their effects, commented by various historical sources, will be integrated. Such information, corroborated with those obtained as results of project activities, will document the occurrence of this natural hazard in the region of Romanian Black Sea shore.
- Forecasts. Based on data offered by the geological-sedimentological studies on cores sampled from drillings performed on the Black Sea, the time intervals between occurrences of significant tsunami-type events.
- Protection. The newly acquired data will be utilised to elaborate a plan for prevention and protection of the coastal population and the infrastructure (harbours, tourists facilities, beaches, erosion effects).
- Data dissemination will be performed toward the central and local authorities (General Inspectorate for Emergencies, counties and localities" authorities).
- Implementation of an automated system for monitoring this natural hazard, including warning possibilities in real time.
- Consolidation of the research-education-applied geosciences consortium, using multidisciplinary activities.
- Integration of the project in ERA-Net and enlargement of partnership at the international scale, aiming to propose a project within Frame 7 Programme (see attached Letters of support).
- Involvement of Romania in international associations and boards dealing with natural hazards, including the tsunami-type hazard.

### **Benefits:**

Considering the negative impact of tsunami waves in coastal areas, any possibility of prediction is considered to bring important benefits for the affected regions or states. The material benefit refers to the saved infrastructure and industrial facilities, often well developed in coastal areas, while the humanitarian benefit refers to the saved human lives, the coastal regions being usually highly populated.

### **Plan of capitalisation/dissemination**

Intermediate results obtained during the project stages and activities will be immediately used, especially in

case of a dangerous event forecasting. The dissemination of each stage results will be firstly done by informing the central and local authorities. Other ways of dissemination will include: a) Dissemination through publications (academic courses, scientific papers in national and international journals), scientific presentations at national and international conferences on natural disasters; b) consultancy and specific technical assistance; c) organising scientific meetings (round tables, workshops); d) participation at scientific exhibitions (National Forum of Research); e) Editing and printing of promotional leaflets, brochures, catalogues, books, journals, posters, CDs, webpage; f) Dissemination of the results through international informational networks.

## **8. TECHNICAL, ECONOMICAL AND SOCIAL IMPACT**

**Technical impact.** The possibility of occurrence of natural hazards requires a monitoring plan, in view of reducing the negative impact on population, environment and infrastructure. To implement such a plan it's necessary to project a monitoring network for each specific hazard. For the tsunami-type hazard, the network may consist of floating sensors whose positioning and communication of recorded data require modern systems of measurement, storage and transfer.

Situations may occur where a high magnitude earthquake generated in a marine basin (open, half-open or even closed), triggers tsunami-type waves with negative effects on the shores. The negative impact of a tsunami wave is doubled, its destructive effects when the wave hits the shore being added to the destructive effects when the marine water retreats from the shore area.

**Economic and social impact.** A tsunami type event endangers the communities and their infrastructure, as well as the protected natural areas. In Romania, the Danube Delta Natural Reserve would be affected, including all the strictly protected areas. In the Constanta and Tulcea counties other protected areas might be affected, such as Vama Veche – 2 Mai protected littoral zone, Chituc and Lupilor sandy barriers, the Corbunesti-Histria lacustrine complex. The coastal area could be affected even deeper inland, few meters-high waves being able to cross the littoral zone toward the lacustrine complex Razelm-Sinoe, with negative impacts on unique biotops such as Lake Techirghiol, or famous archeological sites, such as Histria ancient city. The utilization of a prevention plan, resulted from this project, will considerably reduce the losses and will allow a proper protection of the strategic military facilities and harbours.

The social impact refers to the protection of urban and rural communities situated along the shoreline, mainly Sulina, Sf. Gheorghe, Constanta and Mangalia. A special social interest is represented by the Midia-Navodari oil refinery, which can affect the entire coastal environment in cases of natural disasters.

## **9. PROJECT MANAGEMENT**

The project management will be focused on increasing the scientific standards and competitiveness of the participants regarding: the capacity of solving complex studies in a multidisciplinary sense, the development of an infrastructure adapted to European levels, updating of organising activities and reaching international quality standards.

The project management will use modern methods in organising, monitoring and evaluating activities, results obtained and correlating the ratio allocated funding/spent funding.

The project partners designated a project coordinator; its main activities will be devoted to coordinate the partners activities within the project, to elaborate the stage and annual scientific reports, to initiate consultancy and technical activities.

The evaluation of the activities performed will be done continuously, checking the status of each scientific

objective and their timing. The obtained results will be compared to the projected ones, verifying this way the efficiency of each activity. In cases of significant differences between the initial planning, a re-evaluation of the project budget will be considered.

The project coordination will be assured by the National Institute for Geology and Marine Geoecology – GEOECOMAR, an institution dedicated to the investigation of the marine domain using geological, geophysical, hydrological and bathymetric methods. The project leader will be Dr. Gheorghe Oaie, a scientist with a remarkable background in leading national or international research projects. His experience as scientific manager was recognised by the Ministry of Education and Research, being included as member of the Programme Committee for Frame 6 Programme, section Environment. Climate Change.

## **10. DESCRIPTION OF REQUIRED RESOURCES FOR PROJECT EXECUTION**

The implication in this project of research institutes, universities and private companies intended to have a good coverage with qualified human resources and a proper infrastructure able to support the scientific activities. The participants will contribute with equipments, instruments, computing technique and specific software:

**Stage I** – The computing facilities of the participants, Internet and specialised databases, seismic stations network, copiers, plotters, telephone, fax, email, cars.

**Stage II** – The research vessel Mare Nigrum with all specialised equipments (multibeam bathymetric system, seismo-acoustic system, multicorer, specialised laboratories), cars.

**Stage III** – Specialised laboratories (granulometry, mineralogy, geochemistry, geophysics), spectrophotometers, diffractometers, electronic microscope, photo and video devices, digital projectors.

Due to the fact that the infrastructure specially designed for the marine domain will be used, these activities will require important financial means. The marine researches will use a marine research vessel and that's why an important part of the project funding will be allocated to the marine cruises. In order to make possible the marine research programme, the acquisition of fuel, food, water, as well as harbour taxes and pilot fee need to be paid for. The estimated amount of money equals 350 000 RON for a 12 days marine cruise.

The project funding will cover parts of the research team and technical personnel salary – the estimated amount is 600 000 RON.

The acquisition of equipments and instruments that will be used during the project amounts at 350 000 RON.

Consumables and materials will cost approximately 50 000 RON.

The scientific meetings organised within the project (round tables, workshops, international symposium) and for the results dissemination there will be necessary 60 000 RON.

For scientific trips within Romania and abroad the estimated amount of money is 90 000 RON. The visits will be dedicated to documentation in important national and international libraries and for participation to scientific conferences dedicated to natural hazards.