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ASIAN DISASTER REDUCTION CENTER
VISITING RESEARCHER FY 2012A
(AUGUST-NOVEMBER 2012)

DISASTER RISK REDUCTION.
CURRENT SEISMIC HAZARD ASSESSMENT.
ANOMALOUS RADON CONCENTRATION AS AN EARTHQUAKE-PRECURSOR.

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ARMENIAN NSSP

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FINAL REPORT
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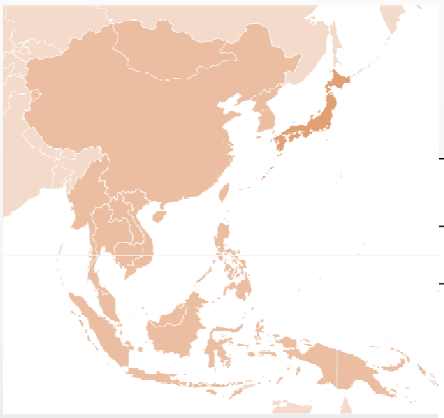
ARMENIAN NSSP

GENERAL INFORMATION

Republic of Armenia

Official name	Republic of Armenia (RA), briefly – Armenia. (Armenian: Հայաստանի Հանրապետություն).
Name in official language	Hayastani Hanrapetutyun, briefly - Hayastan
Head of the State	President
Legislative power	one-chamber National Assembly
Official language	Armenian (is part of Indo-European family of languages)
Capital	Yerevan
Administrative and territorial unit	Marz (11 Marzes in all including Yerevan city)
National currency	Dram (international currency code - AMD)
Territory	29.74 thousand square km (about 1/13 the territory of Japan)
Average elevation above sea level	1800 m.
The highest peak	Aragats mountain - 4090 m
The lowest altitude	Debed river canyon - 380 m
The greatest extent	365 km
Region	north latitudes of subtropics
Climate	dry, continental
Average temperature	in January - -6.8°C, in July - +20.8°C
Time zone	Greenwich mean time + 4 hours

Japan



Official Name	Japan (Japanese: 日本 Nihon or Nippon; formally 日本国 Nippon-koku or Nihon-koku, literally the State of Japan)
Geographic coordinates:	36 00 N, 138 00 E
Map references:	Asia
Area:	total: 377,835 sq km land: 374,744 sq km water: 3,091 sq km note: includes Bonin Islands (Ogasawara-gunto), Daito-shoto, Minami-jima, Okino-tori-shima, Ryukyu Islands (Nansei-shoto), and Volcano Islands (Kazan-retto)
Area - comparative:	slightly smaller than California
Land boundaries:	0 km
Coastline:	29,751 km

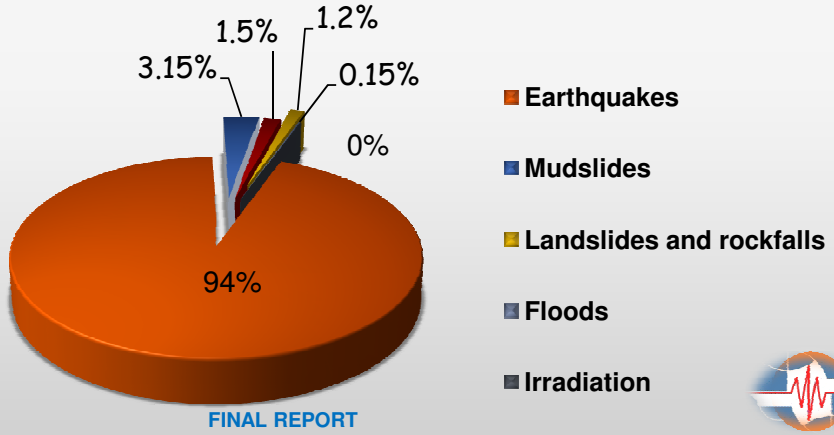
Japan

Maritime claims:	territorial sea: 12 nm; between 3 nm and 12 nm in the international straits - La Perouse or Soya, Tsugaru, Osumi, and Eastern and Western Channels of the Korea or Tsushima Strait ↓ contiguous zone: 24 nm ↓ exclusive economic zone: 200 nm
Climate:	varies from tropical in south to cool temperate in north
Terrain:	mostly rugged and mountainous
Elevation extremes:	lowest point: Hachiro-gata -4 m ↓ highest point: Mount Fuji 3,776 m
Natural resources:	negligible mineral resources, fish
Land use:	arable land: 12.19% ↓ permanent crops: 0.96% ↓ other: 86.85% (2001)
Irrigated land:	26,790 sq km (1998 est.)
Natural hazards:	many dormant and some active volcanoes; about 1,500 seismic occurrences (mostly tremors) every year; tsunamis; typhoons
Environment - current issues:	air pollution from power plant emissions results in acid rain; acidification of lakes and reservoirs degrading water quality and threatening aquatic life; Japan is one of the largest consumers of fish and tropical timber, contributing to the depletion of these resources in Asia and elsewhere
Environment - international agreements:	party to: Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Seals, Antarctic Treaty, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands, Whaling
Geography - note:	strategic location in northeast Asia
Time zone:	JST (UTC+9) /Summer (DST) not observed (UTC+9)

DM STRATEGY IN ARMENIA

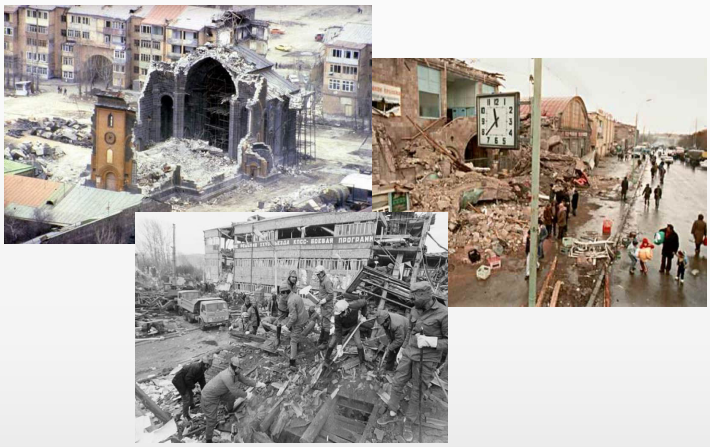
Natural Hazards Likely to Affect the Country

Earthquakes	94%
Mudslides, Landslides, rockfalls, Floods, Irradiation	6%



Natural Hazards Likely to Affect the Country

Spitak (1988) Destructive Earthquake



The most tragic seismic event in Armenia's recent history was the Spitak earthquake on 7 December 1988. The earthquake impacted 40% of the territory of Armenia, a densely populated region of one million. The affected area covered 3,000 sq. km, and the disaster left 514,000 people without shelter, 25,000 people injured.

ARMENIAN NSSP

Armenian NSSP

Armenian NSSP is a state body functioning in the structure of Ministry of Emergency Situations of Armenia (MES of RA).

MES of RA is a republican body of executive authority, which develops, implements and coordinates RA government's policy in the area of civil defense and protection of the population in emergency situations.

The main objectives and aims of Armenian NSSP:

- provision of seismic hazard monitoring in the territory of Armenia
- assessment of the seismic hazard and seismic risk of the territories
- seismic risk reduction
- assessment of the levels of caused seismicity
- assessment of other secondary hazards connected with the seismic hazard.

Structure

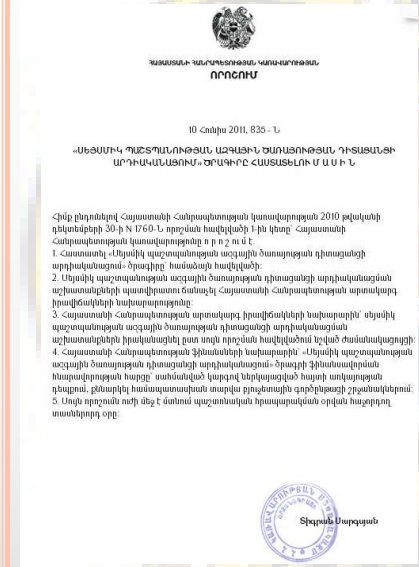
"NSSP" AGENCY			
"Northern Survey For Seismic Protection" State Non-Commercial Organization	"Southern Survey For Seismic Protection" State Non-Commercial Organization	"Western Survey For Seismic Protection" State Non-Commercial Organization	"Eastern Survey For Seismic Protection" State Non-Commercial Organization

IT TAKES VARIOUS MEASURES FOR EARTHQUAKE DM.

ARMENIAN NSSP

The Legal Authority in SRR

Law of Republic of Armenia	
The Law of the Republic of Armenia on Seismic Protection	2002
Resolutions of Government	
The Complex Program of Seismic Risk Reduction in the Territory of Armenia	1999
The complex program of seismic risk reduction in Yerevan city	1999
The Resolution of the Government of RA on establishment of the list of critical important and general facilities in the field of seismic protection	2003
Regulation	
"National Survey for Seismic Protection" Agency	2008



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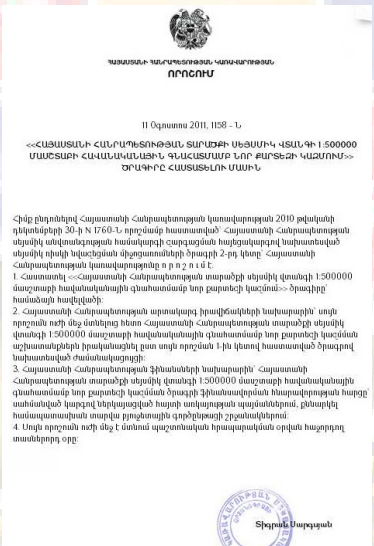
ՈՐՈՇՈՒՄ

10 Հունիս 2011, 835 - Ն

«ՍԵՅՍՄԻԿ ՊԱՇՏՊԱՆՈՒԹՅԱՆ ԱՋԳԱՅԻՆ ԾԱՌԱՅՈՒԹՅԱՆ ԴԻՏԱՑԱՆՑԻ ԱՐԴԻԱԿԱՆԱՑՄԱՆ» ԾՐԱԳԻՐԸ ՀԱՍՏԱՏԵԼՈՒ Մ Ա Ս Ի Ն

Տիգրան Սարգսյան



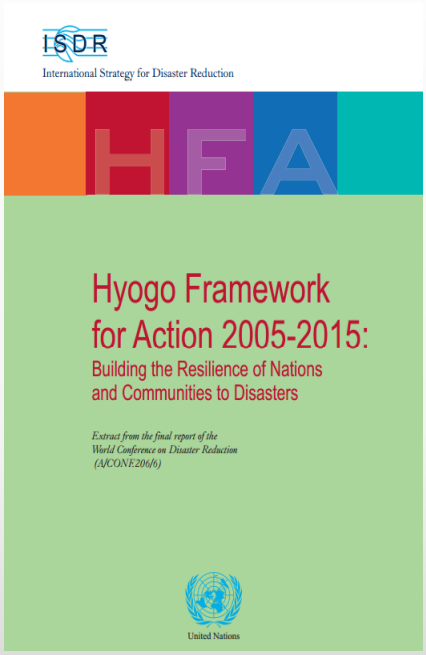
ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԿԱՌԱՎԱՐՈՒԹՅԱՆ
ՈՐՈՇՈՒՄ

11 Օգոստոս 2011, 1158 - Ն

<<ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ՏԱՐԱԾՔԻ ՍԵՅՍՄԻԿ ՎՏԱՆԳԻ 1:500000 ՄԱՍՇՏԱԲԻ ՀԱՎԱՆԱԿԱՆԱՑԻՆ ԳՆԱՀԱՏՄԱՄԲ ՆՈՐ ՔԱՐՏԵԶԻ ԿԱԶՄՄԱՆ>> ԾՐԱԳԻՐԸ ՀԱՍՏԱՏԵԼՈՒ ՄԱՍԻՆ

Տիգրան Սարգսյան

DM Strategy based on the HFA



- Armenia is committed to achieving the strategic goals of the HFA 2005-2015 "Building the Resilience of Nations and Communities to Disasters" and has taken a number of significant initiatives in this regard
- Armenia became the 1st country in the region where by the Government's decision the "ARNAP" national DRR platform was established
- Crisis Management Center was established
- National Disaster Observatory are in process

DM Strategy based on the HFA

Crisis Management Center

- **Coping with disasters globally is possible only with joint efforts and partnerships.**

ARMENIAN NSSP

Disaster Education and Human Resource Development: Current Situation of the Training and Disaster Education in Armenia

Basic tasks of SRR are:

- reduction of territories vulnerability
- raising population knowledge and preparedness
- training of trainers in government bodies and local authorities
- creation of earthquake early warning system
- ensuring medical preparedness
- organization of relief and rehabilitation of population and sustainable recovery

The raise of knowledge and preparedness of population is provided by means of state training system.

The state training system includes the following subsystems, which are done regularly:

- training of target groups beginning from kindergartens and schools
- educational programs, methodical manuals, relevant interactive materials
- TV and radio programs, publications in mass media
- social-psychological preparedness

ARMENIAN NSSP

Current Situation of the Training and Disaster Education in Armenia

YEREVAN BASIC SCHOOL №56

TRAININGS IN ARMENIAN POLICE

with Police Academy students and stuff

"BE PREPARED TO FACE DISASTER" QUIZ- GAME

Recent Major Project on SRR

Based on Japanese earthquake experiences, Japan International Cooperation Agency (JICA) has been supporting Armenian earthquake disaster prevention through "Seismic Risk Assessment and Risk Management Planning Project" by utilizing Japanese technology.

Test-Presentation of the Real Time Seismic Intensity Display System

DM SYSTEM IN JAPAN

The DRR in Japan

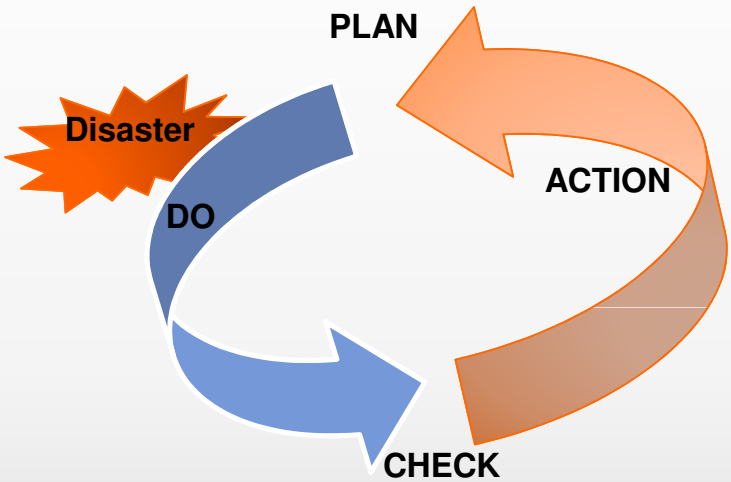
Kobe Earthquake (1995)

Japan's swift and effective response is a clear reflection of the focused preparations the country has made in disaster preparedness, especially since the Kobe earthquake in 1995.

The Great Tohoku Earthquake and Tsunami (2011)

Japan has a world leader in DRM systems. It also is a leader in helping other countries address these critical needs.

The DRR in Japan



Disaster Risk Management is as a Continuous Improvement of Disaster Reduction Quality (Deming circle)

Main Activities of ADRC

❖ Information Sharing on Disaster Reduction

ADRC VRs (2012A term) in Unzen Volcanic Area Global Geopark

❖ Human Resources Development

❖ Building Communities Capabilities

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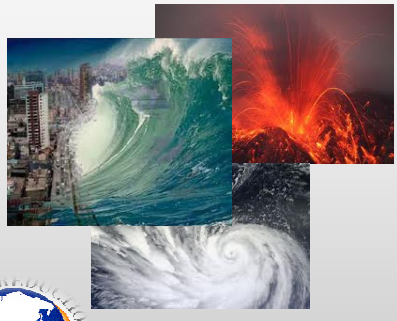
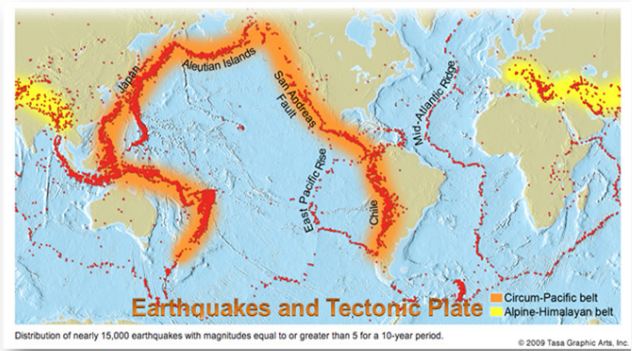
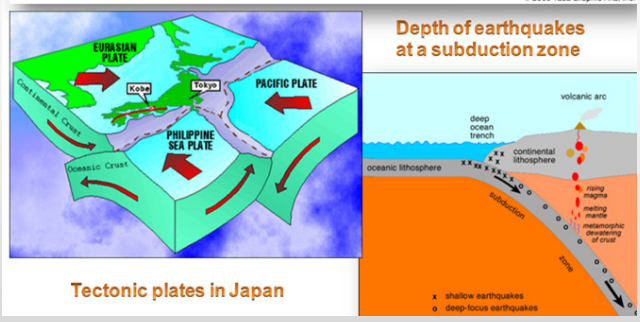
The Natural Hazards (Earthquakes) in Japan

- ✓ Earthquakes
- ✓ Volcanoes
- ✓ Tsunamis
- ✓ Typhoons







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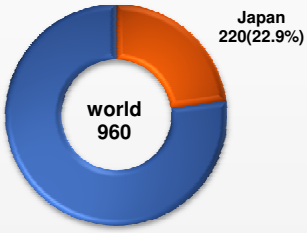
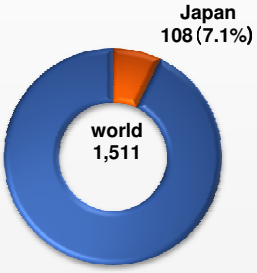
✓ Earthquakes

The number of earthquakes M> 6.0 (1994-2003)



The number of active volcanoes



About 20 % of large scale earthquakes in the world occur in Japan

(Japan's data from Japan Meteorological Agency and the world data from Cabinet Office based on USGS)

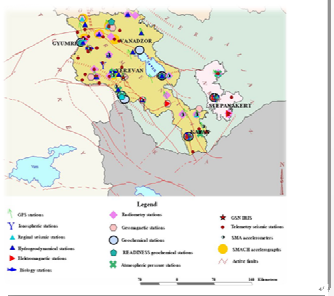
Active volcano is defined as volcano which erupted within about past 10,000 years.

(Japan's data from Japan Meteorological Agency (JMA) and the world's from Cabinet Office based on Smithsonian Institution (1994))

RESULTS OF THE RESEARCH

- **Current Seismic Hazard Assessment and Earthquake Prediction in Armenia**

National observation network



One of the Seismic hazard assessment elements is the primary seismic hazard assessment, which includes current assessment (short-term) of seismic hazard.

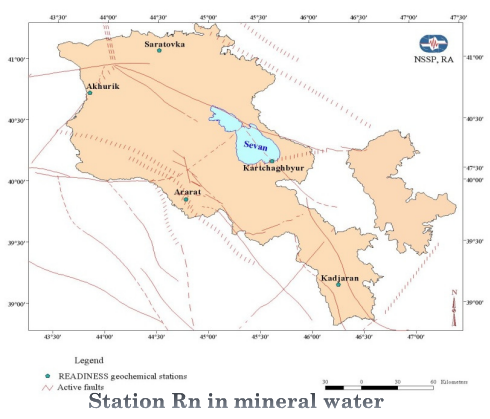
The national multiparameter network of seismic observation operates for seismic monitoring and CSHA in the territory of Armenia.

Directly on the seismic stations various parameters are monitoring, and after, the received results are transmitted to the data acquisition center, where they are collected in unified databank.

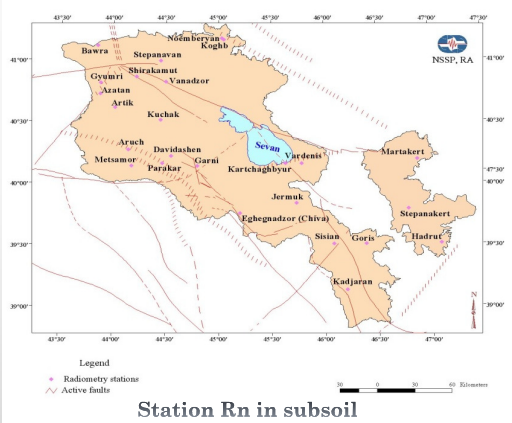
Anomalous radon concentration as an earthquake-precursor (Armenian experience)

In Armenian NSSP Radon gas concentration observes:

- ✓ in mineral water (imp/min) ,which includes Hydrogeochemical READINESS network
- ✓ in subsoil (imp/min)



Station Rn in mineral water

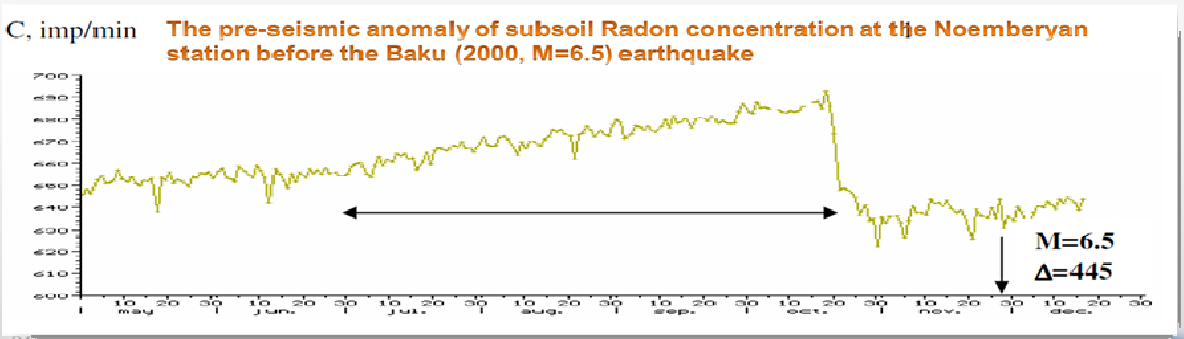


Station Rn in subsoil

Anomalous radon concentration as an earthquake-precursor (Armenian experience)

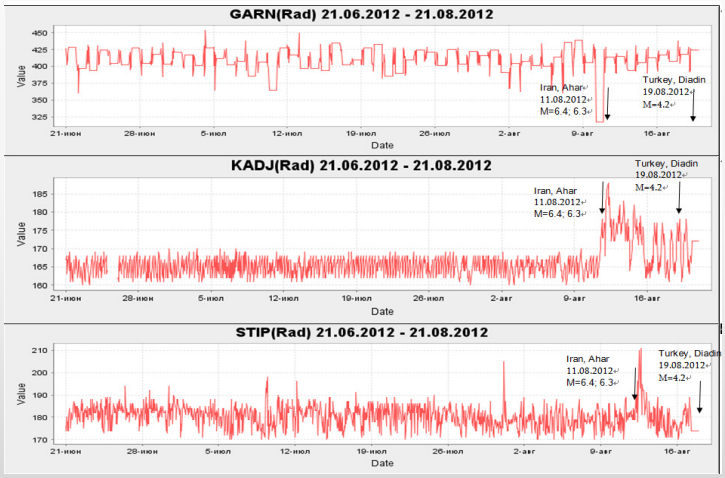
Both in Armenia and adjacent territories the size of earthquakes ranges up to magnitude 7.0.
Focal depth is avr. 10km.
The recurrence interval of large earthquakes (M>5.5) comprises 30-40 years.

Based on retrospective analyses it is possible to outline short-term, medium-term and long-term seismogenic anomaly of various fields.



Anomalous radon concentration as an earthquake-precursor (Armenian experience)

For the resent seismic events in the adjacent territories (M=6.4;6.3, in 2012, Iran), (M=4.2, Turkey)
In subsoil Rn gas concentration probably-seismogenic short-term anomalies at the Garni (operative), Qajaran and Stepanakert stations.



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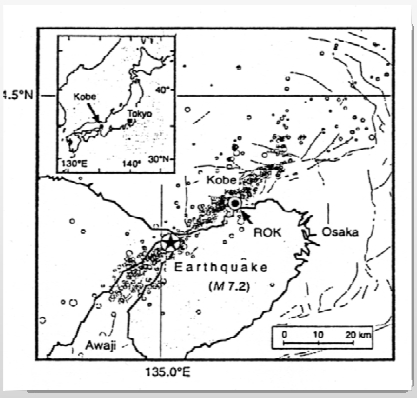
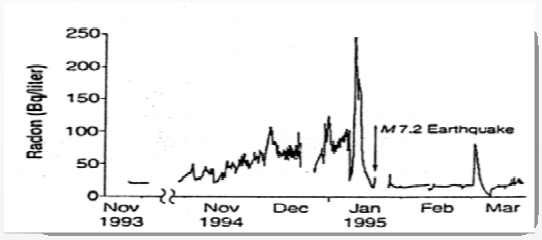
Anomalous radon concentration as an earthquake-precursor (Japanese experience)

The relationship between radon anomaly and earthquakes has been studied for more than 30 years. Most of the studies dealt with radon in soil gas or in groundwater.

Magnitude 7.2 earthquake struck Kobe Jan. 17, 1995



Rn in groundwater



There was a rapid increase (several months) of Rn in groundwater, and the max concentration occurred 10 days before Kobe earthquake in 1995, then returned to background levels after the main shake subsided.

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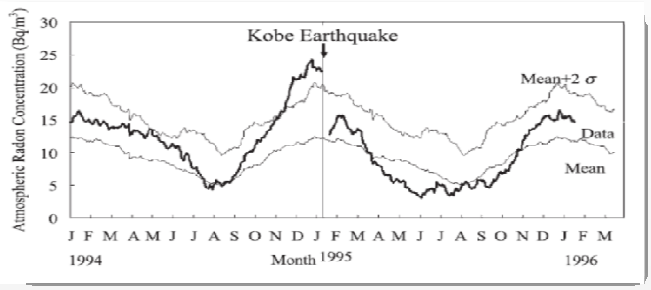
Anomalous radon concentration as an earthquake-precursor (Japanese experience)

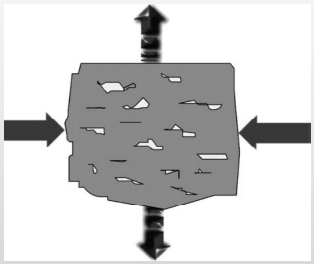
Changes in atmospheric radon concentration at Kobe.



In the Kobe Pharmaceutical University, measured athmo-spheric radon 1984-1996 on one o the Rokko fault lines, which was the source of the Kobe earthquake in 1995.

Before a large earthquake rupture, increasing stress growing up, because of emanation process in microfractures (expansion or compression).

Rn Emanation Processes



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Conclusion

- ✓ The researches for earthquake prediction is being carried out in many countries of the world, including both in Japan and Armenia.
- ✓ Earthquake-proof strengthening of the structures and infrastructure, population knowledge and preparedness, and earthquake prediction are the 3 pillars of the earthquake disaster reduction.
- ✓ Extensive damage by a large earthquake is still inevitable, and a lot of lives will be saved if the earthquake is foreseen a day or even one hour before. This is why earthquake prediction is always ranked at the top of urgent problems in all the public opinion polls.
- ✓ The short-term prediction is important, which requires catching short-term precursory phenomena. The problem are both in Japan and Armenia, that the seismic observation isn't enough for this purpose. It is therefore necessary to adopt a new strategy of encouraging observations of anomalous changes in non-seismic phenomena, including not only crustal deformation but also underground water, gaseous release such as radon and carbon dioxide, and terrestrial magnetism and earth currents etc.
- ✓ It is important to increase amounts of data, new theories, and powerful computer programs, and scientists are using those to explore ways that earthquakes might be predicted in the future.

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I certainly hope that in future we'll be in a world where an earthquake can be anticipated and predicted before it occurs.

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Thank You

ありがとうございます

FINAL REPORT
ADRC VISITING RESEARCHER FY2012A

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