Mega Earthquakes - impacts, cause and predictions

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THE PROBLEM

A mega-earthquake suddenly releases a large to extremely large amount of kinetic energy in the Earth's crust and on ground surface within a few tens to two hundreds seconds.

However,

such vast, dramatic and devastating kinetic actions in the Earth's crustal rocks and on the ground soils cannot be known or predicted by people before they happen.

Therefore,

mega-earthquakes have caused and would continue to cause huge disasters, fatalities and injuries to our human beings.



Facing this tragedy, as a teacher & engineer, I had to do something to solve the PROBLEM!!!

THE QUESTION

Why do we have the PROBLEM?

My simple and quick answer is that our human beings still DO NOT correctly understand the Earth and her earthquakes.

To correctly understand the Earth and her earthquakes, I need to recall Newton's four rules of reasoning in natural inquiries.





Phenomena or Appearance of Earthquakes

"RULE I.

We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances."

> "To this purpose the philosophers say that Nature does nothing in vain, and more is in vain when less will serve; for Nature is pleased with simplicity, and affects not the pomp of superfluous causes."

Isaac Newton (1686, 1713, 1725) "Mathematical Principles of Natural Philosophy"



























At 12:00 on May 17, 2008, the gas emission and eruption during an aftershock M5.9 at site between Lixian & Wenchuan.





huge dusts erupted suddenly & highly many rock falls along the highway No. 317 in LiXian.







- The ground ruptured zone was about 426 km long and several 100 m wide.
- It was in permafrost ground with ice.





- The ruptures and deformation were in permafrost with ice sheet covers.
- They were tensile ruptures.
- The ruptured ice fragments were angular and had no melted signs. Some angular ice fragments were ejected onto the ice cover.
- They show that the earthquake energy did not heat the ruptured and 1) deformed ground soils and ice sheets.
- The energy did not thaw or melt away any ice on the frosted soil. 2)















Earthquake M7.2 at Mexicali on April 4, 2010

During & after quaking, the ground sounded, huge dusts flying and erupting out of the mountains.







- The dust and gas erupted highly over the entire city. 2)
- It kept covering by dusts for several hours. 3)



















Dust cloud over Christchurch CBD





2011 Christchurch earthquake 6.3 Isolated Collapse of Single Building with Huge Amount of Gas and Dusts after Mainshock







非常緊張。





Snow, Heavy in Sendai

































The Cause of Earthquakes

- a) An earth quaking is an adiabatic process.
- b) The adiabatic process is the interaction between the rapid upward migrating and expanding of natural gas and its surrounding crustal rocks and ground soils.
- c) The gas is mainly methane gas and is escaped from its traps in deep fault zones of the lower crustal rocks.
- d) The gas has a huge volume, is of extremely high pressure (300 to 400 MPa) and density (1.0 to 2.0), and generated in the mantle.
- e) The interaction is instantaneous and flashing and can be complete within tens to hundreds seconds.
- The interaction is under the confinements of the rock down-ward gravity, the rock tectonic stresses, the rock rigidness and the rock strengths.











- It also absorbed heat & cooled down the ruptured ground.
- 4) So the ices in the soil and on the ground remained un-melted.



 The gas was escaped from the deep crust & rapidly migrated to city soil ground from fault channels.















- The single building was subject to the powerful expansion energy highly pressurized natural gas.
 The gas was rapidly migrated/flowed to the foundation from deep
- The gas was rapidly migrated/flowed to the foundation from deep ground channel/fault.



- 4) So, it was the gas expansion power causing the damages and
 - fatalities at the ground.









basins at shallow depths during non-earthquake days.4) So, the gas and oil fields can be refilled with new gas in time.









- Highly pressurized natural gas quickly escaped from deep faults in the crust.
- Its powerful entrance into seawater and expanding in the seawater caused tsunami!









The settlement volume can be equal to the escaped gas volume.













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Italy puts seismology in the dock

cientists who assessed earthquake risk at L'Aqu ould be addeted on manslaughter charges.

ME

The deadly earthquake that struck the central Italian toy of LQaulia on 6 April 2009, has had a bizarre aftershock: some of Italy's top seismologists could far honges of manslaughter for not alerting the populatic before the disaster. The indictment has outraged sperts around the world, who note that earthquakes cannot be predicted and who say that the Italian overment niggicted to enforce building codes that the second seco

e indictments, aued on 3 June by a L'Aquila public secutor's office,

Seven People indicted:

Enzo Boschi, president of the National Institute for Geophysics and Vulcanology (INGV) in Rome, the main institute in charge of seismic monitoring Giulio Selvagni director of the

 Giulio Selvaggi, director of the National Earthquake Center based at INGV

Franco Barberi, a volcanologist at the University of 'Roma Tre'; Claudio Eva, a professor of earth physics at the University of Genoa

3.

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physics at the University of Genoa Mauro Dolce, head of the seismic risk office in the Italian

government's Civil Protection Agency Gian Michele Calvi, director of the European Centre for Training and Research in Earthquake Engineering in Pavia

A government official, Bernardo De Bernardinis, deputy technical head of the Civil Protection Agency, is also under investigation.



Abnormal Phenomena Observed before Earth Quaking

Foreshocks Thermal infrared increases Hot and stuffy weather felt by people Climate change (drought) Animal or plant abnormal Abnormal in ground electromagnetism Change in ground topography (swelling) Abnormal in groundwater In-situ rock stress Geophysical fields, Seismic wave velocities, Ground sounding Lightening in sky Gas emission or blow-out

Regularities of the Observed Abnormal Phenomena

Diversity in abnormal Heterogeneity in temporal distribution Heterogeneity in spatial distribution High complexity in abnormal

Abundant abnormalities approaching large quaking Consistence between abnormal statistics and quake magnitude Consistence between fault and earthquake

Abnormal Phenomena Used as Precursors for Predicting or Forecasting Earthquakes

Seismic events and waves Seismic wave velocities Infrasonic waves Ground topographic (deformation) survey Ground tilt measurement Groundwater level temperature and chemical changes Radon gas, Mercury gas Gravity Geomagnetism, Geo-electricity, In-situ rock stress Tidal force Animals, Plants Meteorology (drought) Thermal infrared abnormal

The Question

After having made great effort over last fifty or more years, however,

human beings still have not found any precursors that are one to one correspondence with the occurrence of damaging or mega-earthquake.

According to the statistical data of China Earthquake Administration Bureau, its successful rate of earthquake prediction was about 7%.

Why did we have such poor result?

Breakdown statis damaging earthq	stics causing the success uake prediction achieve	s rate 7% in ed by China
= (1) Faults & × (2) Active f × (3) Many se × (4) Human	plate tectonics aulting and foreshocks condary abnormal phenon efforts and comprehensive	iena approach
= 50% × 50% × <50% × <50% < 7.5%	<pre>(correct probability) (correct probability) (correct probability) (correct probability) (= the highest success rat existing theory/method</pre>	Why? Why? why?
$\frac{7.0\%}{7.5\%} = 93\%$	which shows that the su China's earthquake pred	ccess rate of liction is high!

"In China, earthquake prediction is not merely a topic of research, but a government-sanctioned, law-regulated, and routinely practiced measure of disaster prevention."

After Chen & Wang, 2010

- 1) In other words, the Chinese Governments have put lots of resources to and made great efforts in earthquake prediction of the nation.
- 2) Many Chinese people believed and still believe that, as a natural phenomenon, damaging earthquake can be predicted.



Numbers of CEA Stations Designated to Monitor Earthquake Precursory Anomalies in April 2008							
Table 1 Numbers of CEA Stations Designated to Monitor Earthquake Precursory Anomalies in April 2008							
Cristal Deformation	Magnetic Field	Electrical Field	Aquifer Chemistry	Well Water Level	Gravity Field	Stress/Strain	Electro-magnetic Field
358	255	109	493	504	24	76	36
	 Cru Ma Ele Ele Aq We Gra Str Ele 	ustal D egnetic ectrical uifer C ell Wate avity F ess/Str ectro-m	eformat Field Field Chemistr er Leve ield ain nagnetic	tion ry l Field	358 255 109 493 504 24 76 36		





S.C			111/11			
Numbers (of Macroscopic A Bureau Pi	nomaly Reports rior to the 12 Ma	Received by the ay 2008 Wenchu	Sichuan Provin an Earthquake*	cial Seismologi	ral
Ground-Water	Unusual Sighting [†]	Electro-magnetic	Animal Behavior	Plant Peculiarity	Weather Pattern	Annual Total
37/?	3/?	0	6/?	0	1/?	47/2
16/?	3/?	0	4/?	0	1/?	24/?
6/?	0	0	0	1/2	0	7/2
9/2	1/2	0	7/2	0	0	17/2
15/13	2/1	0	1/0	2/2	0	20/16
2/1	0	0	0	0	0	2/1
3/3	0	0	1/0	0	0	4/3
	Ground-Water 37/? 16/? 6/? 9/? 15/13 2/1 3/3	Burcau Pr Ground-Water Unusual Sighting* 377/2 3/2 16/7 3/7 6/7 0 9/? 1/? 15/13 2/1 2/1 0 3/3 0	Bureau Prior to the 12 M. Ground-Water Unusual Splings Excus-magnetic 377? X7 0 167? X7 0 67? 0 0 97? 1/7 0 167 2/1 0 2/1 0 0 3/3 0 0	Bureau Prior to the 12 May 2008 Wenchu Grownd-Wate Unusud Spitnigs Externmentic Animal Relativistic 3777 377 0 672 1677 377 0 672 67 0 0 0 972 1177 0 772 1573 271 0 100 201 0 0 100 201 0 0 100	Bureau Prior to the 12 May 2008 Wenchuan Earthquake* Grownd-Wate Unusud Splitnig* Externmentic Animal Hetrorie Plant Peculiarity 3777 377 0 6/7 0 6/7 0 16/7 377 0 6/7 0 0 0 10/7 0 7/7 0 6/7 0 10/7 10/7 10/7 10/7 10/7 0 17/7 0 17/7 0 17/7 0 17/7 0 17/7 0 15/13 2/1 0 10/0 2/2 2/1 0 0 0 0 0 1/2 1/2 1/2 0 0 0 0 0 0 1/2 1/2 1/2 0 0 0 0 1/2 1/2 1/2 0 0 0 0 1/2 1/2 1/2 1/2 1/2 1/2 0 0 0 0 1/2 1/2 1/2 1/2 1/2 0<	Bureau Prior to the 12 May 2008 Wenchuan Earthquake* Gnond-Wate Unsud Spling* Externmentic Animal Hehrwir Para Pecularity Weather Pattern 3777 377 0 67? 0 17? 1672 377 0 67? 0 17? 1673 377 0 67? 0 17? 67 0 0 0 17? 0 97 1/7? 0 7/? 0 0 167 37 0 10 10 10 167 37 0 1/0 0 0 167 37 0 0 17? 0 167 2/1 0 1/0 2/2 0 15/13 2/1 0 10 0 0 3/3 0 0 1/0 0 0







The First Basic Question

Is there a precursor that is one to one correspondence with the occurrence of damaging earthquake?

My answer is Yes!

There is a precursor that is one to one correspondence with the occurrence of damaging earthquake.

The Second Basic Question

What is the precursor that is one to one correspondence with the occurrence of damaging earthquake?

My answer

- It is the abnormal change of huge amount of methane gas with high pressure and increasing volume in shallow ground (within 5000 m deep).
- Such natural gas is also abnormally or non-regularly released or emitted from the ground and into the air and sky.
- In addition, the emitted gas may also carry ions for changing electromagnetic fields and/or lightening in the sky.























The Cause	of This	Power
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"GENERAL SCHOLIUM

Hitherto we have explained the phenomena of the heavens and of our sea by the power of gravity, but have not yet assigned the cause of this power. "

"This is certain, that it must proceed from a cause that penetrates to the very centres of the sun and planets,, decreasing always as the inverse square of the distances."

Isaac Newton (1686, 1713, 1725) "Mathematical Principles of Natural Philosophy"

Phenomena	Existing Propositions	My Propositions
Earthquake	Collision of crustal plates	Gas: dense methane
Tsunami	Active rock faulting	Gas flow & expansion
Natural gas/oil	Ground organic lives	Gas from Mantle/core
The Earth Interior	Solid & liquid layers	Gas (a spherical seam)
Land subsidence/drift	Rock plate rebounding	Gas escaping at base
Seismic waves PSLR	Rock faulting/rupturing	Gas flow in rock faults
Ground rupture	Seismic faulting/shaking	Gas expansion/deform
Liquefaction	Seismic shaking	Gas expansion/flow
Rock avalanche	Seismic shaking	Gas expansion/rupture
Rain after earthquake	Unknown	Gas to sky/convection
Cold after earthquake	Unknown	Gas expansion cooling
Sky color change	Dusts flying in air to sky	Gas carrying dusts sky
Atmospheric pressure	Tsunami waves	Gas flows into sky



The natural gas is mainly methane (CH_4)

- The Earth's crust contains huge amount of methane and methane can be reproduced & accumulated quickly in the crust, which is consistent with the fact that hundreds and thousands earthquakes occur each year.
- Methane is colorless, odorless and lighter than air, which is consistent with the fact that it was not noticed by people during earthquake.
- Methane is not toxic, which is consistent with the fact that people were not injuries by toxic gas at epicenter areas.
- Methane is highly flammable, which is consistent with the fact that colored lightening were observed during earthquakes.
- Methane (5–15%) and air mixture can be explosive by itself, which is consistent with the fact that explosions were observed during earthquakes.
- Methane has much higher specific heat capacitythan air, which is consistent with the fact that the air temperature would decrease immediately after earthquakes.
- Methane is lighter than air and can react with oxygen for water, which is consistent with the fact that several hours after earthquakes, heavy rainfall would occur at epicenter areas.





The Cause of this Power

I have inferred and induced that there is a thin highly compressed and dense methane gas spherical seam/layer of variable thickness between the crust and the mantle.





The Method of This Investigation

"In this philosophy particular propositions are inferred from the phenomena, and afterwards rendered general by induction."

Isaac Newton (1686, 1713, 1725) "Mathematical Principles of Natural Philosophy"

Concluding Remarks

(They will be extremely important to human beings)

Hitherto I have explained the phenomena of the earthquakes and of the interior of our Earth, and have assigned the cause of this power of methane gas from mantle & core.

This is certain, that

the dense and compressed methane gas can proceed from the cause and penetrate into
the very faults/voids of the crust rocks and the atmosphere.
Its volume increases always as its distance to its origin increases.
It is eventually decomposed into CO₂ and H₂O (water) on ground.

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- Sichuan Earthquake Administration Bureau
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- CEA China Earthquake Response Support S
 CEA China Earthquake Networks Center
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CAS = China Academy of Sciences CEA = China Earthquake Administration