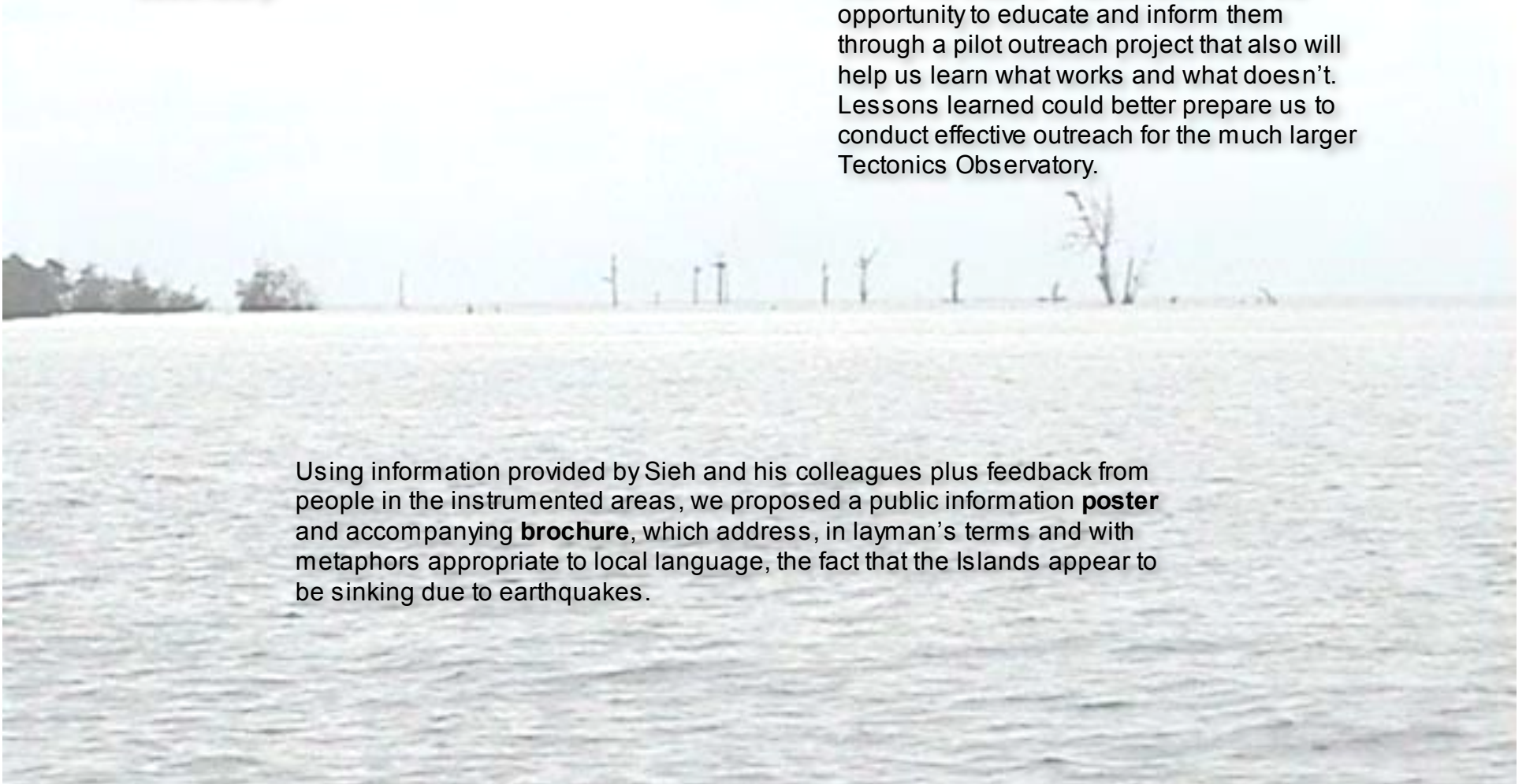


This project was conceived when Jill Andrews and Catharine Stebbins first met with Prof. Kerry Sieh and Dr. Danny Natawidjaja in late 2002. Sieh and Natawidjaja described their seismic monitoring project on the Batu and Mentawai Islands within the context of the Tectonics Observatory.

Because Sumatran citizens in the area of the project have inquired about the research, we discussed how best to address their questions. They want to know the purpose of the project, expected outcomes, and most importantly, how research findings may affect them. The citizens' interest allows us the opportunity to educate and inform them through a pilot outreach project that also will help us learn what works and what doesn't. Lessons learned could better prepare us to conduct effective outreach for the much larger Tectonics Observatory.

Using information provided by Sieh and his colleagues plus feedback from people in the instrumented areas, we proposed a public information **poster** and accompanying **brochure**, which address, in layman's terms and with metaphors appropriate to local language, the fact that the Islands appear to be sinking due to earthquakes.



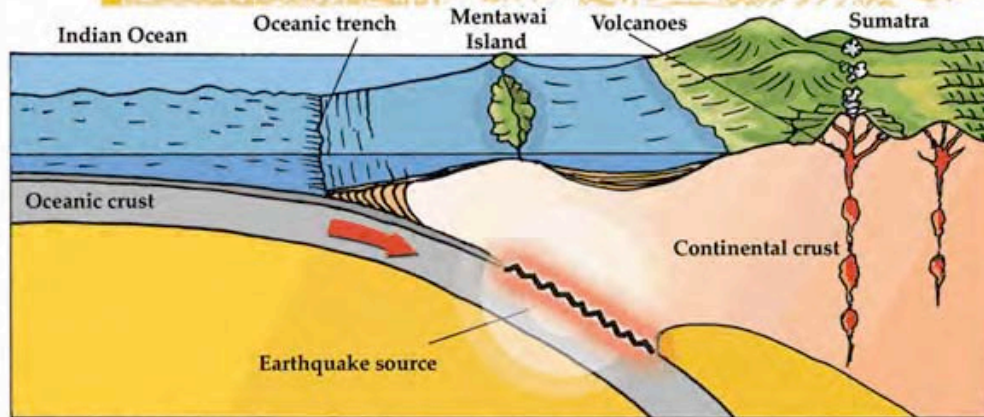
OUR ISLANDS ARE SINKING...
BECAUSE OF EARTHQUAKES!



1 What is an earthquake?

We open with the first questions, "What is an earthquake?" And, "why do earthquakes occur in Sumatra?"

An EARTHQUAKE is a trembling of the ground, caused by sudden breakage and sliding of rock along a fault zone. The region in the west of Sumatra has many earthquake sources, because it is located along the plate boundary, where an oceanic plate is subducting under Sumatra and pushing on the rocks below the islands.



For tens to hundreds of years, the earth blocks squeeze very slowly against each other. The pressure builds up until it exceeds the rock strength, at which time the rocks break suddenly. This sudden breaking causes the islands to pop up and seismic waves to spread through the surrounding region.

We continue with the question, “How do we know our islands are sinking?” – which gives us an opportunity to begin explaining how research plays a role in answering these questions.

How do we know our islands are sinking?



near Basua



Saibi



near Sirabu



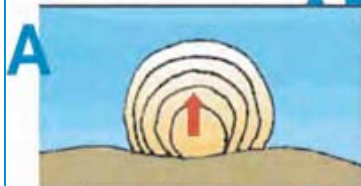
* BEACHES are slowly moving onto land.

* TREES that used to be growing on land have now drowned and are sitting in the water off shore.

* From investigating CORALS and measuring land movements by modern GPS INSTRUMENTS.

The third question, "What do our corals tell us?" allows us to go deeper into an explanation of how studying the corals helps us understand more about what might happen in the future. This leads to...

What do our corals tell us?



Coral grows up to low tide level.



Once at low tide level, coral can only grow sideways.



When the islands sink coral continues to grow upward.



When the islands pop-up during an earthquake, the upper part of coral dies, but the lower part that is still under low tide level continues to grow.

CORAL shaped like cups show the islands are sinking during the centuries between earthquakes.

For tens to hundreds of years, coral growths faithfully record events when the islands pop-up, and periods when the islands slowly sink.

Shaded areas show places where the ocean crust broke underneath the islands, and they rose up to 2 meters during the earthquake.



Historical large earthquakes of the Batu and Mentawai Islands.

1797-99

"During the shake a tidal wave rose along the coast, which reached a height of 50 feet above the usual water-height. At this occasion a reef was lifted up, so that it was a danger for the navigation."



Personal accounts of earthquakes taken from the historical record.

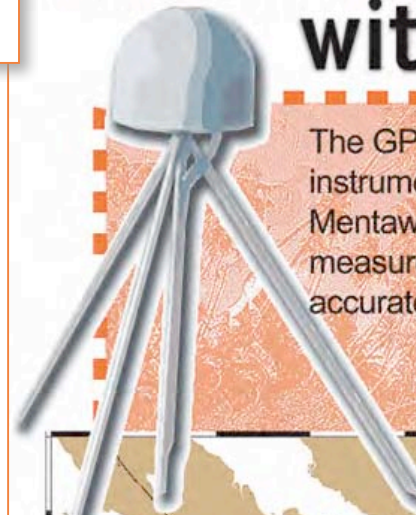
1797 February 10, about 10pm. West coast of Sumatra.

"The first shake lasted one minute, afterwards a tidal wave quickly rose, which with great power pushed into the river of Padang, so that the town was overflowed. Afterwards the water fell so widely, that even the river-bed was drained. This event repeated three times. The village of Ajer Manis at the beach was overflowed and at the same time many cottages were washed away...In the walls of most buildings rose cracks. During the whole night as well as during the whole day the ground was in a moving situation. Every 15-20 minits a hard shaking took place."

... the 4th question, "What is happening now with our islands?" explains how modern instrumentation is helping scientists to measure land movements that indicate the islands are slowly sinking and squeezing toward Sumatra.



What is happening now with our islands?



The GPS (Global Positioning System) instruments deployed in the Batu and Mentawai Islands are modern tools to measure movements of land very accurately.



Records of the instruments show us that the islands are slowly sinking and SQUEEZING toward Sumatra at about a few centimeters per year. This indicates that we are in a period of earth-pressure accumulation that began after the last major earthquakes. This squeezing will continue until the next large earthquake."



Thanks to the people of the islands, for their help and participation in our research.

Question 5 follows with, “What happens to the ocean water if the islands suddenly spring up?”, leading to an explanation of how tsunamis occur as the result of earthquakes.

What happens to the ocean water if the islands suddenly spring up?

When the rocks beneath the islands spring up, the sudden movement causes the ocean water to flow AWAY from the land.

When the ocean comes back onto the islands, it comes in a series of waves. These waves are TSUNAMIS.

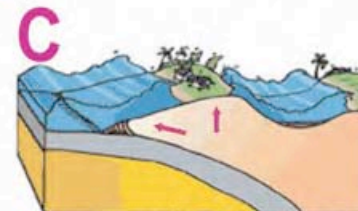
Tsunami waves can be very small (centimeters) to very large (tens of meters).



The plate beneath the ocean is moving toward and under Sumatra. The islands are stuck to the oceanic plate most of the time, so they get slowly squeezed and dragged down.



One day the juncture between the islands and the oceanic plate breaks. This causes a great earthquake, and the islands suddenly spring upward and ocean ward. The rising of the islands forces the ocean to rise up also, and then to flow away from the islands.



The ocean water returns to the islands as a series of waves, called tsunamis.

And the final question 6, "How can we prepare for earthquakes and tsunamis," leads people to embrace the idea of safer building practices, knowing what to do in the event of an earthquake and tsunami, and getting more information from local researchers.

6 How can we prepare for earthquakes and tsunamis?

Earthquakes may strike without warning. However, we can make preparations to lessen their damaging effects. First, let's understand what causes them. Second, let's try to avoid as many earthquake dangers as possible.

- ★ Buildings made from wood or other light materials are safer than those made from heavy materials, because if they fall during an earthquake they are less likely to hurt us.
- ★ Following an earthquake, high ground faraway from the beach is a good place to be to avoid tsunami waves."

**MORE
EARTHQUAKE
INFORMATION**



Puslit Geoteknologi,

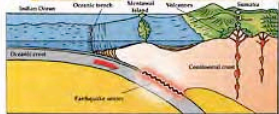
Komplek LIPI Gd. 70, Jl. Sangkuriang, Bandung
Ph: 022-2503654, Fax: 022-2504569
Kontak: Dr. Danny H. Natawidjaja,
Ir. Bambang W. Suwargadi, M.Sc.



OUR ISLANDS ARE SINKING... BECAUSE OF EARTHQUAKES!

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For tens to hundreds of years, the earth blocks squeeze very slowly against each other. The pressure builds up until it exceeds the rock strength, at which time the rocks break suddenly. This sudden breaking causes the islands to pop up and seismic waves to spread through the surrounding region.

2 How do we know our islands are sinking?



BEACHES are slowly moving onto land. TREES that used to be growing on land have now drowned and are sitting in the water off shore. From investigating CORALS and measuring land movements by modern GPS INSTRUMENTS.

3 What do our corals tell us?

A Corals grow into the sea level.

B One of two low tides, outflow or to give subsides.

C When the islands sink, corals continue to grow slowly.

D When the islands pop up, but an earthquake has raised level of sea level, but the lower sea level will under low tide level continues to grow.

CORAL shaped like trees show the islands are sinking during the centuries between earthquakes.

For tens to hundreds of years, corals grow slowly and record events when the islands pop up and periods when the islands slowly sink.

Personal accounts of earthquakes taken from the historical record 1702 February 10 about 10pm, West coast of Sumatra. The first of the islands the most elevated a 1000' above sea level, sank with all great noise pushed up the floor of Padang so that the bottom was cut off. Thereafter the waves fell so low, that even the highest and steepest of the most elevated islands. The village of Ajur Wang at the same place mentioned in the same time many villages were washed away. In the night of next buildings were ruined. During the whole night as well as during the whole day the ground was a moving stream. Every 10-20 minutes a loud shaking took place.

1771 During the night a 500' wave rose along the coast, which reached a height of 50 feet above the usual water level. At the occasion a reef was broken up so that it was impossible for the navigation.

1773 On the 14th of July, the whole of the Batu and Mentawai Islands.

1800 Submergence of the islands of the Batu and Mentawai Islands.

1797 Supra

1833 North & South Papua

4 What is happening now with our islands?

The GPS (Global Positioning System) instruments deployed in the Batu and Mentawai Islands are modern tools to measure movements of land very accurately.

Records of the instruments show us that the islands are slowly sinking and SQUEEZING toward Sumatra at about a few centimeters per year. This indicates that we are in a period of earth-pressure accumulation that began after the last major earthquakes. This squeezing will continue until the next large earthquake.

5 What happens to the ocean water if the islands suddenly spring up?

When the rocks beneath the islands spring up, the sudden movement causes the ocean water to flow AWAY from the land.

When the ocean comes back onto the islands, it comes in a series of waves. These waves are TSUNAMIS.

Tsunami waves can be very small (centimeters) to very large (tens of meters).

A The plate beneath the ocean is rising up and under Sumatra. The islands are pushed the seaward pressure of the sea. They get slowly squeezed and bigger then.

B Suddenly the rocks beneath the islands and the ocean floor breaks. This causes a sudden movement. The water is pushed away and the sea level is lowered.

C The ocean water returns to the islands as a series of waves called tsunamis.

6 How can we prepare for earthquakes and tsunamis?

Buildings made from wood or other light materials are safer than those made from heavy materials, because if they fall during an earthquake they are less likely to hurt us.

Following an earthquake, high ground faraway from the beach is a good place to be to avoid tsunami waves.

make preparations to lessen their damaging effects. First, let's understand what causes them. Second, let's try to avoid as many earthquake dangers as possible.

MORE EARTHQUAKE INFORMATION

Pusat Geoteknologi, Komplek LIPI G4, 75, J. Sangkulang, Bandung
 Ph: 022-2504054, Fax: 022-2504059
 Kontak: Dr. Danny H. Mubandazulu
 Ir. Bambang W. Suwardadi, M.Sc.

The poster is dense and colorful and geared toward a 6th grade level of understanding in order to appeal to a broad range of people. It is meant to capture the attention and imagination – and to be studied. We will arrange for it to be placed in a central area in the villages such as a public building or school where all have access to it.

It should be noted that in the areas proposed for circulation of the brochure and posters, the hazard posed by tsunami alone is imminent. In 1861, for example, one of the islands was completely wiped out. The two large cities and the islands have a large and vulnerable population of over one million.

We think the people on these islands should be made aware, and we hope the poster and brochure will prove an effective way to get that message across.

Attributions

The work was done by Catharine Stebbins (Office of the Provost, Educational Outreach, graphic design and content organization); Danny Natawidjaja (LIPI) for scientific content, advice on local language usage and metaphors; Kerry Sieh (Scientist in charge, editor); Bambang Suwardadi and Dr. Munasri (LIPI, Mentawai / Indonesian education specialist and translator); Juniator Tulus (Mentawai / Indonesian education specialist and translator); Myrna Eindhoven (University of Amsterdam, cultural anthropologist); and Sambas Miharja (graphic illustrations). Jill Andrews provided project oversight and worked on the poster with Catharine Stebbins.