FOREWORD

This manual is designed to provide the teachers and students of primary schools with the knowledge and skills of disaster preparedness.

We acknowledge with appreciation the support and encouragement provided by Fiji Meteorological services, Mineral Resources Department and Suva Fire Brigade.

Prepared and Produced by The Fiji Red Cross Society 1991

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Many people have made a considerable contribution in the preparation of this manual.
While it is not possible to acknowledge all by name, Fiji Red Cross Society wishes to record special thanks to its Director-General for the foresight in getting this project off the ground.

The following people made special contribution during preparation and trial workshop.

1. Prof. Patrick Nunn - USP

2. Mr Trevor Jones - Mineral Resources

3. Mr Trevor Lawson - Mineral Resources

4. Mr Rajendra Prasad - Met. Office

5. Mr Rishi Raj - Hydrology PWD.

6. Mrs Anne Jepson - International Primary

7. Suva Fire Brigade

Thanks are also due to the 12 Primary schools throughout Fiji who attended briefings, conducted classroom trials and evaluated the manual prior to the drafting of its final format.
Budget rentals, National Insurance Co Ltd., Queensland Insurance and Nand's Rentals made special grants for our visits to these trial schools.
Last but not the least Mrs Rejieli Mua for typing the manuscript and Mrs T Keith-Reid for proof-reading the project.

EDUCATIONAL RESOURCES DEVELOPMENT OFFICER

EARTHQUAKES & TSUNAMIS

Source: Mineral Resources

CONTENTS

EARTHQUAKES

Earthquakes are perhaps the most terrifying of all natural disasters, because they usually happen without warning. With adequate plans and with understanding of earthquakes and related problems, should a serious one occur during school hours, both you and your pupils' chances of survival will, hopefully, be increased. During an actual earthquake each child will have to be self-sufficient and react by instinct instilled by regular practice.

LESSON 1 RECOGNITION OF EARTHQUAKES

Specific Objectives — At the end of their lesson pupils should be able to:—

1. describe in their own words what an earthquake is, and
2. explain what could happen if one occurs. It is hoped to make such a serious topic fun. As for fear only paralyses.

Teacher Preparation

1. Familiarise yourself with the school disaster plan.
2. Take particular note of the instructions relating to earthquakes, care of injured children, evacuation procedure, etc.
3. Locate the school's emergency assembly area and plan several possible routes from your class.
4. Identify what alarm system is used in the school and also find out if there is an alternative in case of power failure.
5. Check your own classroom for potential hazards; books, jars and other heavy or breakable items on high shelves; glass windows.
6. Having evaluated these hazards, some decision has to be made as to what is an acceptable risk. While it is not possible to secure every item of furniture, heavy and tall items should be secured.

Teaching Methodology

Although it is not possible to simulate an earthquake realistically, talk about them and what can happen. This is IMPORTANT because when an earthquake strikes, reaction has to be reflex. During a serious earthquake there will be a great deal of noise, and a lot will be happening, making it difficult for children to concentrate on any instructions the teacher may attempt to give.

Teaching Resources

1. Prepare a bowl of jelly at room temperature.
2. Obtain a small model house—a painted box will do.
3. If possible arrange access to a trampoline.

Suggested Activities

A. Ask pupils if they have felt an earthquake. Get them to tell what happened. Ask if they felt a big truck go past and make the earth shake.
THIS IS A LITTLE EARTHQUAKE
Sometimes we have a big earthquake. In a big earthquake the ground shakes a lot. Illustrate with the bowl of jelly and model house. Talk about what is happening.

B. Each child could make their own 'earthquake' by standing a wooden block on their hand, then jiggling the hand.

C. Get pupils to make some observations:— shaking ground is hard to stand on, making things fall over. It is IMPORTANT that pupils use their own vocabulary and reach their own conclusions.

D. Use the word EARTHQUAKE, talk about it, write it down.

Related Activities

Draw/paint pictures shaking ground.
Write a class story.
Establish that an earthquake is the ground moving/shaking.

LESSON 2 CLASSROOM PROCEDURES BEFORE, DURING AND AFTER A SERIOUS EARTHQUAKE

Objective

To make everyone safer during an earthquake.

Teacher Preparation

1. Collect a number of plastic items: jugs, cups, plates, some tall containers and place them on the table.
2. Re-establish that an earthquake can be very small or very big. Sit around the table and give it a good shake. Talk about what has happened, things have fallen over or moved. Talk about what would happen if a big earthquake shook the classroom, what could fall over?
3. Discuss with pupils how to make the classroom safer. Move heavy objects to lower cupboards and shelves. Talk about keeping jars in boxes on the floor. Can we find safer places for the items?
   Can we make the classroom safer?

   Find the earthquake hazards in your classroom and around your school:

   Glass.....

   Objects on wheels .....

   Unsecured cupboards/shelves .....

   Heavy objects stored above head height .....

   Exits that could be blocked .....
4. Explain how some animals have a hard shell to protect themselves eg, a hermit crab. We can give ourselves a shell by crawling under a table - practise this! Hold on to its legs. Otherwise the table might "hop off" in an earthquake.

Extension Work

The pupils could:—

1. Paint/draw pictures of a turtle or themselves under the table.
2. Make a display in the information corner, of the animals with shells.
3. Mime or make and dramatize plays about being safe during an earthquake.

Practice

Tell the class a major earthquake will strike in one minute. Then wait and observe what happens. Who takes cover, who, if anybody moves. After the minute is up, walk about the class. Get those who have not taken protective cover and those sitting near windows to lie down on the floor.

Explain why they have serious cuts from flying broken glass, and pupils sitting near unsecured furniture have crush injuries. Build up a picture of what has happened. Things that may happen are:— collapse of the ceiling, doors may close and jam, pupils can be injured, pupils are inclined to move and make the injuries worse, fire as a result of broken electric wires, pupils may panic.

STRESS upon pupils not to PANIC.
STRESS that all wires be treated as live and pose serious threat when touched.

Discuss with pupils how you would develop a classroom plan.

Related Activity

Draw a plan of your classroom showing "safe" areas—where you would go in an earthquake.
Show where heavy items are in your classroom.

Further Drill

Go through the drill. Leave the classroom and walk to the emergency area. When you return, talk about it, why you did it, why we make ourselves safe. It's serious, but make sure you keep the tone low.

DON'T EVER HURRY THE PUPILS. REMEMBER YOUR EXAMPLE IN THE REAL EVENT WILL BE CRUCIAL. The practice is as much for you as it is for the pupils.

Practice as often as is necessary to remind pupils of what to do and why.

LESSON 3 THE CAUSES OF EARTHQUAKES

Objectives

If pupils know of how and why earthquakes happen, then hopefully some fear can be removed. While undertaking the study of earth faults and fault movement, the volcanoes and theory of plate tectonics and other causes, which is rather technical, the intention of this lesson is to help pupils explain in their own words the causes of earthquakes.

Teacher Preparation

You as a teacher should obtain reasonable information of what causes an earthquake.

Here is a brief account of what causes earthquakes:

Earthquakes occur throughout the world but certain areas are more prone to them than others. Fiji is within the Pacific Rim of Fire; the zone of earthquakes and volcanoes which surrounds the Pacific Ocean. However, there are no active volcanoes in Fiji and the number of earthquakes is less than for the most active areas around the Pacific, such as, Japan, Alaska, Chile, Tonga, Vanuatu and Papua New Guinea.

Earthquakes are due to failure of rocks under stress. Some rocks are able to adjust by folding but if the vibrations are rapid enough they will break and form a FAULT, which is usually too deep in the earth's crust to be seen.

There are two types of Earthquakes:

1. **Volcanic**—associated with the movement of molten rocks underground less then 30km deep. They occur near the surface of volcanoes—often called tremors and occur frequently.

2. **Tectonic**—these are the more common type and are due to the movement of solid parts of the earth's crust pushing against each other. They occur along weak zones which are called "fault lines" and at "plate boundaries". The initial shock of an earthquake may last from a few seconds to almost a minute, to be followed by aftershocks which are generally lesser in intensity than the first.

Severity of an Earthquake

The severity of an earthquake can be expressed in terms of both intensity and magnitude. However the two terms are quite different.

Intensity is based on the observed effects of quakes on people, buildings and natural features. It varies from place to place.

Magnitude is related to the amount of seismic energy released at the hypocentre of the earthquake. The magnitude of an earthquake is represented by a single, instrumentally determined value.

Earthquakes are the result of forces—deep within the Earth's interior—that continuously affect the surface of the Earth. The energy of these forces is stored in a variety of ways within the rocks. The area of the fault where the sudden rupture takes place is called the Focus or Hypocentre of the earthquake. The point on the Earth's surface directly above the focus is called the EPICENTRE of the earthquake.

The Richter Magnitude Scale

Seismic waves are the vibrations from earthquakes that travel through the Earth; they are recorded on instruments called SEISMOGRAPHS. Seismographs record a zig-zag trace that shows the varying amplitude of ground oscillations beneath the instruments. The time, location and magnitude of an earthquake can be determined from the data recorded by seismograph stations. It is called Richter Scale because the method was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The Richter Scale is not used to express damage.

The Modified Mercalli Intensity Scale

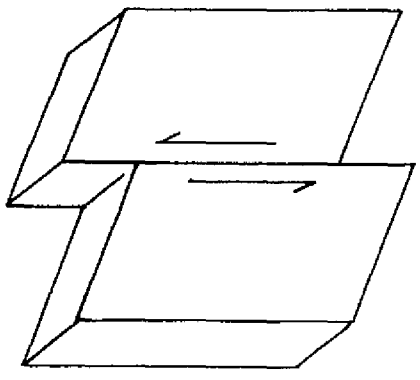
The effect of an earthquake on the earth's surface is called the intensity. It enables a person to estimate the strength of an earthquake based on what movement is seen and felt during the event. This scale was developed in 1931 by the American Seismologists Harry Wood and Frank Neumann. The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the non scientist than the magnitude because intensity refers to the effects actually experienced at that place. After the occurrence of widely-felt earthquakes, questionnaires are sent to the disturbed area requesting the information so that intensity values can be assigned. The maximum observed intensity generally occurs near the epicentre.

Teaching Methodology

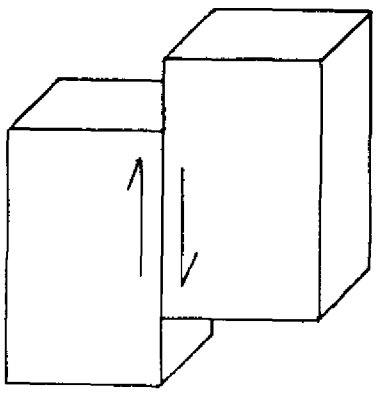
1. Show the pupils the diagram of the probable composition of the earth's interior. Draw the earth's interior composition either on vanguard sheet or use overhead projectors. Explain that an orange is a model of the world. Cut it in half and relate it to the diagram of earth's composition. The outside layer is called crust. The crust is approximately 80 kilometers thick under the continents. The outside crust is cold. The mantle rock, which is hot, is capable of very slow movement. Unlike the orange skin, which is solid, the outside crust of the earth is broken up into a number of plates.
2. Show the world map and talk about what can be observed. Where is Fiji? Discuss the fact that the mantle is hot and that it moves slowly, perhaps 2mm per year. Discuss with pupils the principles of convection, how heat rises. This causes the earth crust to move also. In some places on the earth the plates are pushing against one another.
3. Explain what is happening with the plates. It is the sudden release of energy that produces the earthquake.
4. Show the fault movement on the chart. Show and discuss the vertical movements and horizontal movements. Discuss what can be observed. The build up of stress and pressure within the plate is released in small lines of fracture. These smaller fracture lines are called FAULTS Sometimes the faults are many kilometers long.
5. Discuss the fault lines in Fiji in relation to your school. Use your own local area map showing the faults. These may be obtained from the Ministry of Lands, Energy and Mineral Resources.

Look at the diagrams below and practise moving the wood or cardboard in similar directions.

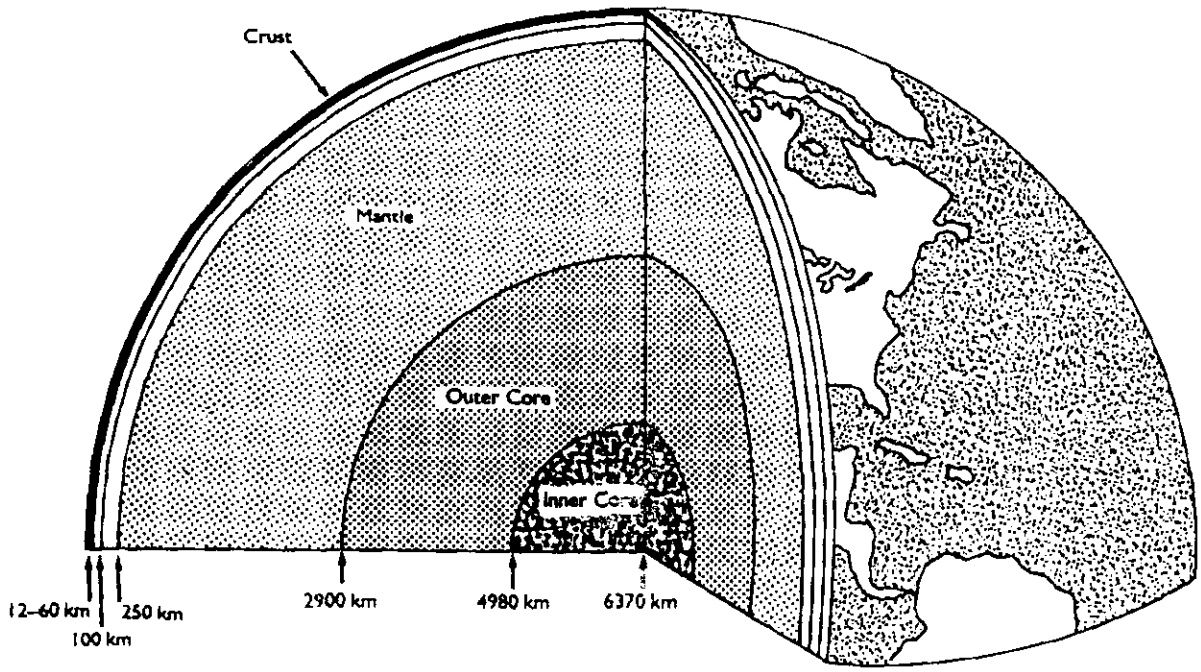
(a)
Horizontal movement

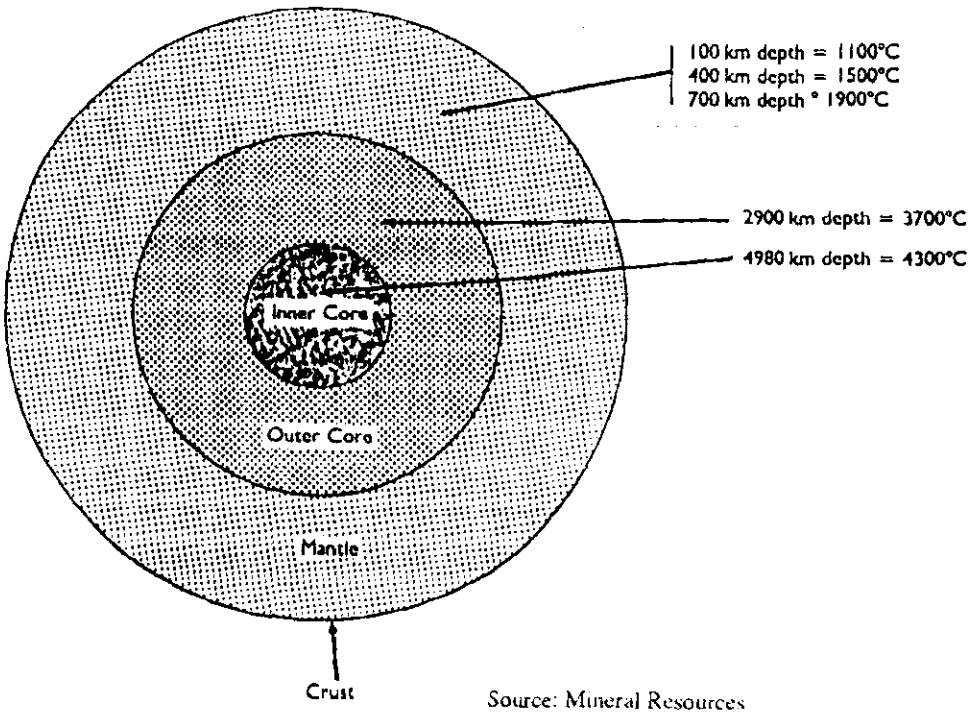


(b)
Vertical movement



COMPOSITION OF THE EARTH





Source: Mineral Resources

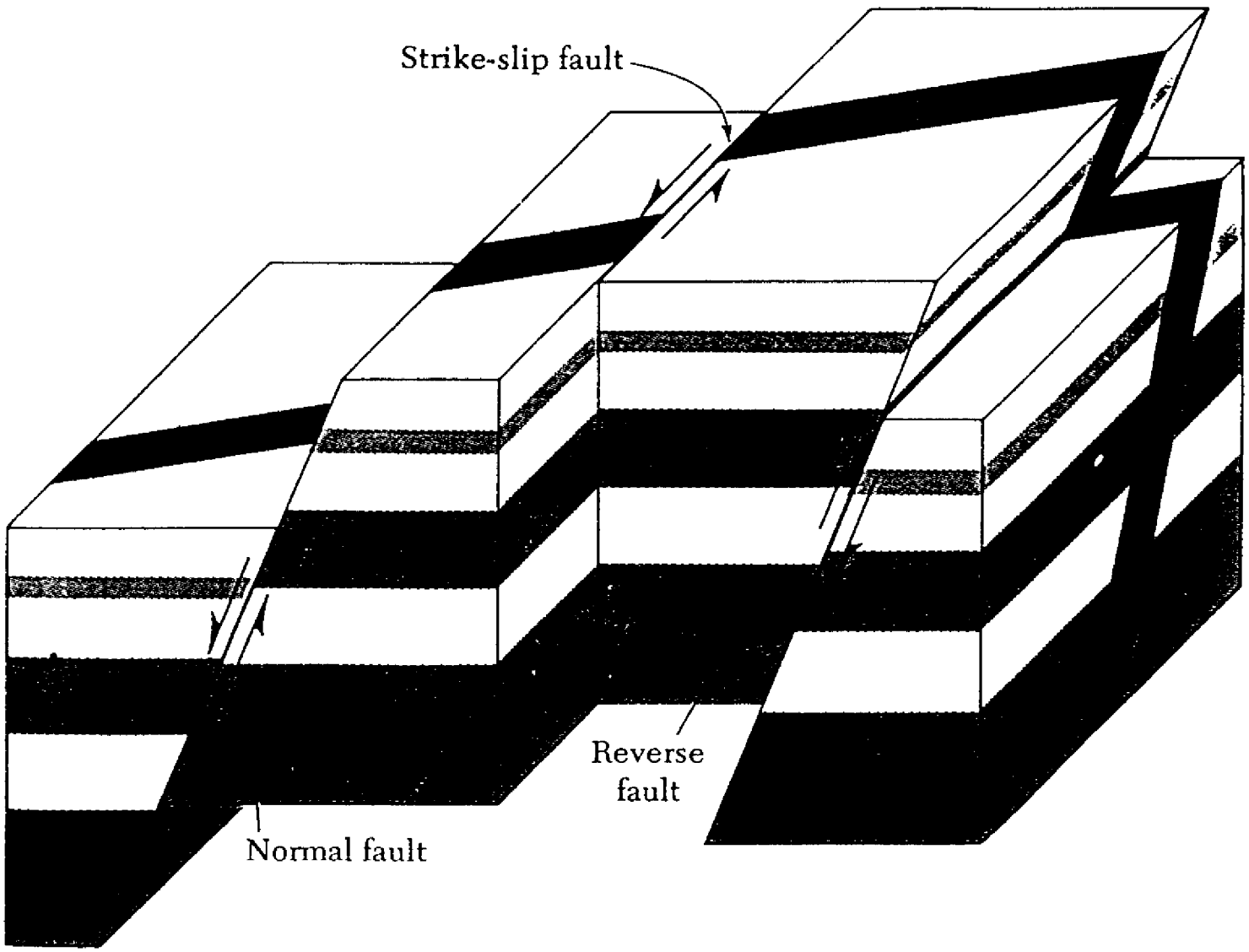


Diagram showing the three main types of fault motion.

Source: Mineral Resources

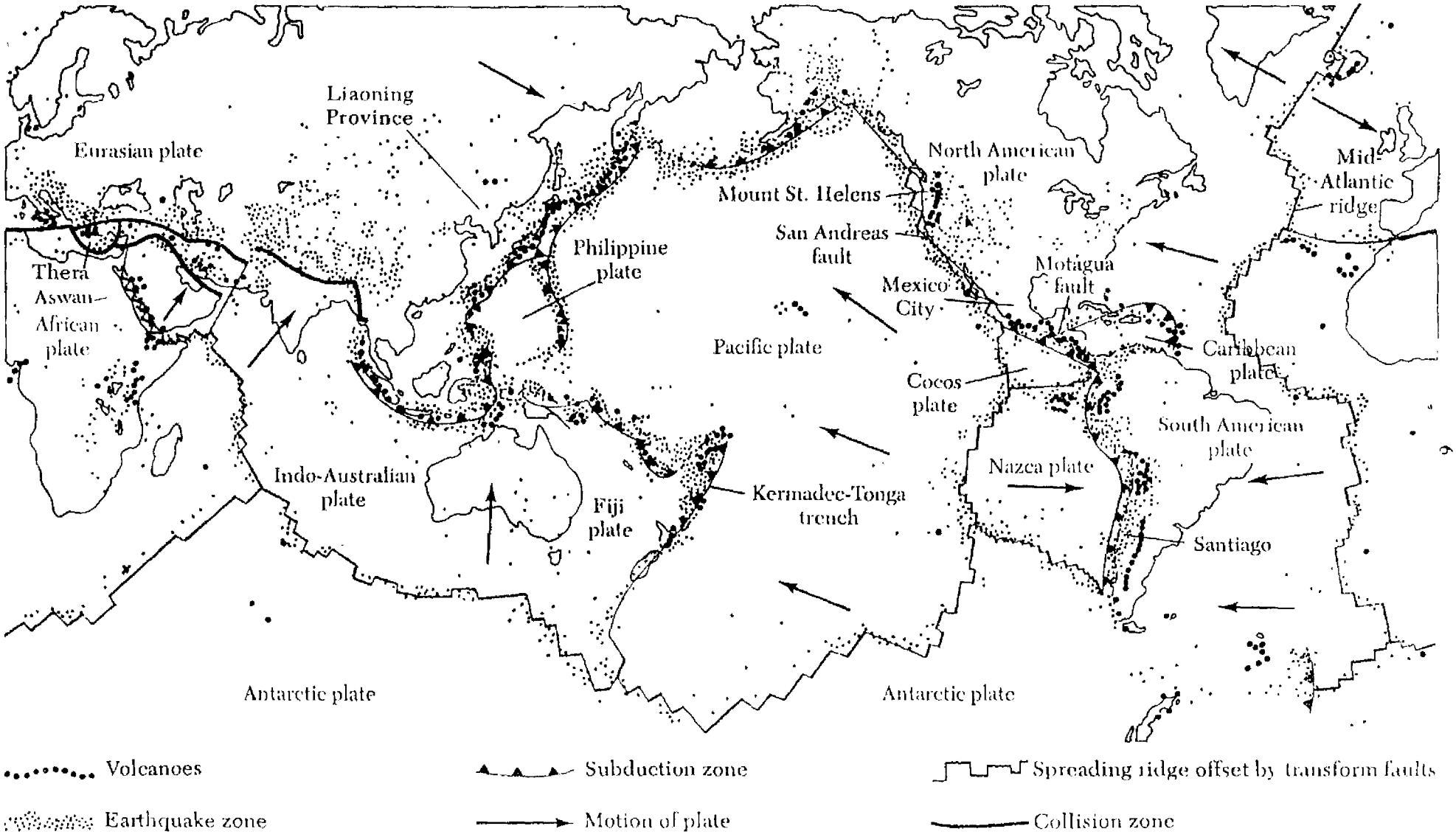
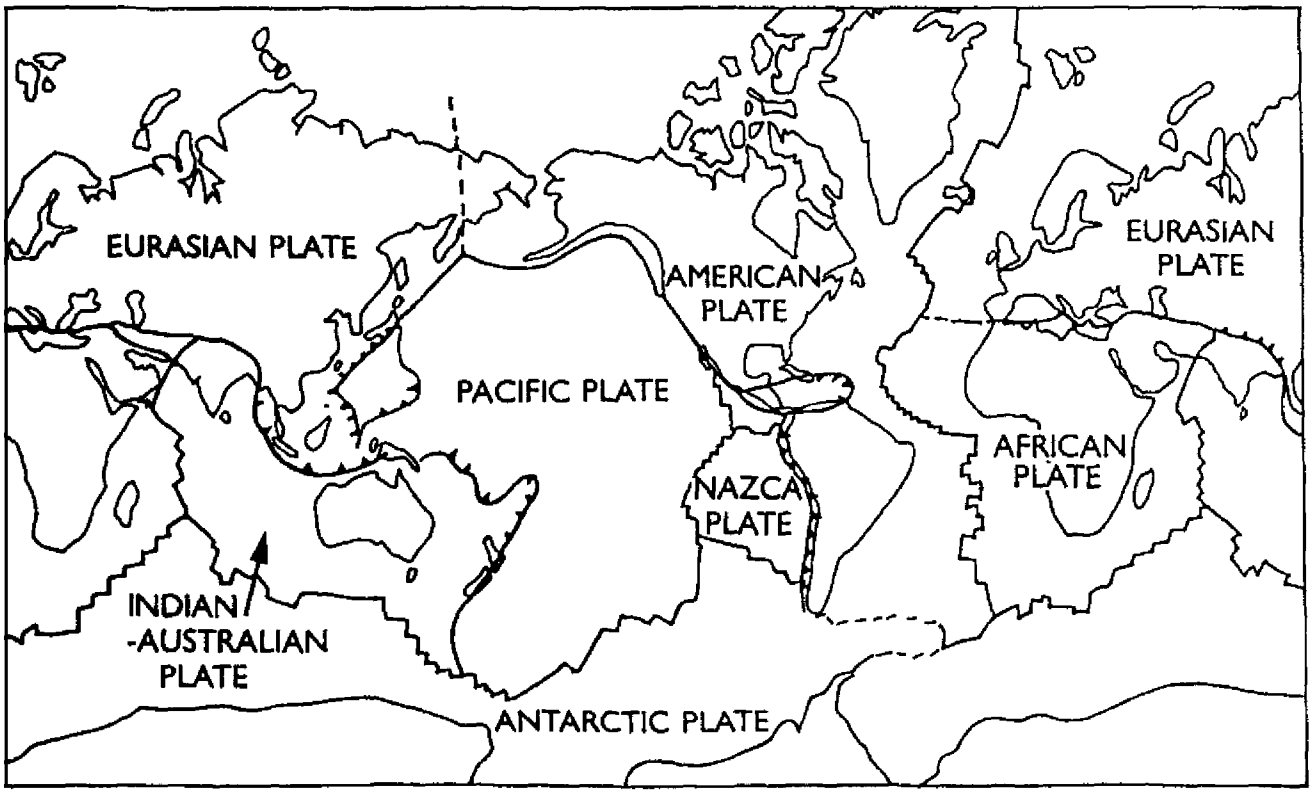
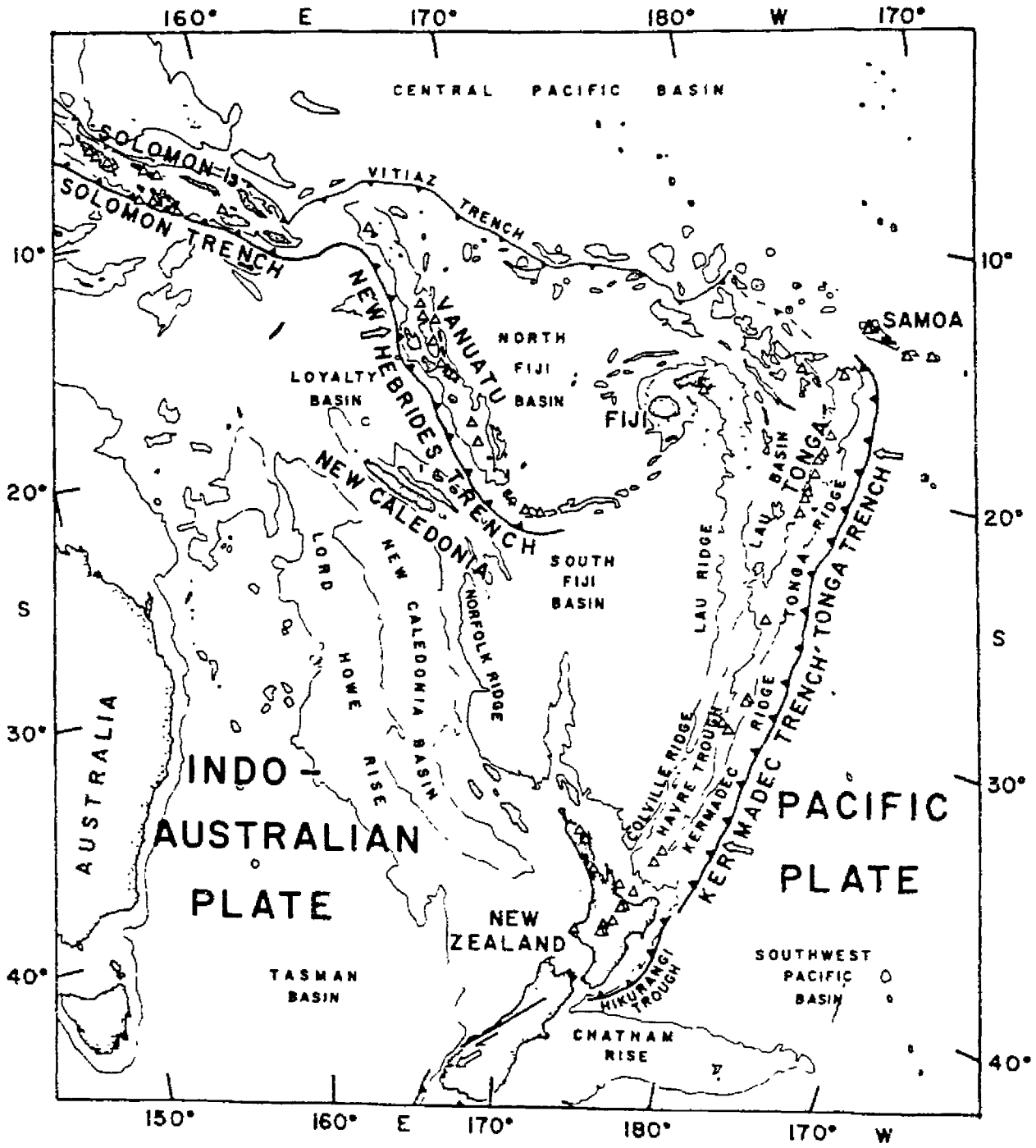


Figure 4 World map showing relation between the major tectonic plates and recent earthquakes and volcanoes. Earthquake epicenters are denoted by the small dots, and the volcanoes by large dots



The earth's surface is made up of "plates". These are called Tectonic Plates and are in constant motion.


160° E
170°
180°
W
170°
CENTRAL PACIFIC BASIN
SOLOMON ISLANDS
SOLOMON TRENCH
VITIAZ TRENCH
10°
NEW HEBRIDES TRENCH
VANUATU
NORTH FIJI BASIN
LOYALTY BASIN
SAMOA
FIJI
TONGA
LAU BASIN
TONGA RIDGE
NEW CALEDONIA
SOUTH FIJI BASIN
LAU RIDGE
20°
S
LORD HOWE RISE
NEW CALEDONIA BASIN
NORFOLK RIDGE
COLVILLE RIDGE
HAVRE TROUGH
KERMADEC RIDGE
KERMADEC TRENCH
TONGA TRENCH
30°
AUSTRALIA
INDO-AUSTRALIAN PLATE
PACIFIC PLATE
NEW ZEALAND
TASMAN BASIN
SOUTHWEST PACIFIC BASIN
HIKURANGI TROUGH
CHATHAM RISE
40°
150°
160° E
170°
180°
170° W

6. Earthquakes can also be caused by volcanic activity. It is the movement of molten rocks from the mantle up through the earth's crust.

There can be other, man-made, causes of earthquakes, eg.

1. detonation of explosive devices
2. pumping water into underground rock cavities
3. filling dams and reservoirs with water.

Widening of Experiences

1. The pupils form a vocabulary list with explanations in their own words, crust; mantle, core, Pacific plate, molten rocks, convection, stress, earthquakes and faults.
2. Study the diagrams for examples of fault movements.
3. A talk from a geologist on how and why they study faults.

Six Serious Earthquakes in Fiji

Date	Place Felt	Magnitude
June 21, 1928	Taveuni	7.0
February 17, 1932	Rabi	6.6
February 13, 1950	Kadavu	6.5
September 14, 1953	Suva/Navua	6.8
November 17, 1979	Taveuni	6.9
October 13, 1984	Yasawas	6.1

Lesson 4

PREPAREDNESS FOR AN EARTHQUAKE

OBJECTIVE

The objective of this lesson is to evaluate the preparedness of your own school and the local community. Earthquake resistant buildings and a general awareness about preparedness are comparatively new concepts. Such preparedness requires money, political will, and the support of the public.

DURING THE EARTHQUAKE

DON'T PANIC! TRY TO CALM AND REASSURE OTHERS.

1. **If you are indoors,** STAY THERE! Get under a sturdy table or desk or brace yourself in a doorway or corner. Move to an inside when possible. Choose a location which will allow you air to breath in the event the building collapses around you. Stay clear of windows, bookshelves, cabinets, and other heavy objects. Watch for the falling plaster.
2. **If you are outside** move to an open area away from power lines, power poles, trees and walls.
3. If you are on a sidewalk/footpath near buildings, duck into a doorway to protect yourself from falling bricks, flying glass, plaster and other debris.
4. In a crowded store or other public place DO NOT rush for exists. Move away from display shelves containing objects that may fall.
5. In a High Rise Building get under a desk and stay away from windows. Stay in the building on the same floor. Avoid USING ELEVATORS.
6. If you are in a car, pull to the side of the road and stop the car. DO NOT park on bridges or under?/near? overhead wires. Stay in your car until the quake stops. Stay in your car if electrical wires have fallen across your vehicle.

AFTER THE EARTHQUAKE

1. **Immediately check for injuries**, trapped persons and the handicapped in your family, neighbourhood, or among fellow mates.
2. Wear shoes for protection from debris or broken glass.
3. Use a torch when searching for gas leaks. Don't use lighted matches. Don't use electrical switches.
4. Check gas, water, electrical lines and check appliances for damage.
5. Shut off electrical power if you suspect damage to wirings.
6. Immediately clean up spilled medicines, drugs or other potentially harmful materials.
7. Never touch broken power lines.
8. Check water supplies.
9. Check and see that sewage lines are intact before flushing the toilet.

10. Do not use your telephones except for emergency calls.
11. Tune in your battery operated radio for further information. DO NOT SPREAD RUMOURS.
12. Notify your out of town contact person about your situation by mail if other communications are not available.
13. Do not use your car unless there is an emergency. DO NOT GO SIGHT-SEEING.
14. Be prepared for aftershocks.
15. Co-operate with public safety efforts.
16. Should you be close to the sea, move to high ground in case a Tsunami is generated.

LESSON 5

TSUNAMI

(PRONOUNCED — Soo-narm-ee)

OBJECTIVES

The purpose of this lesson is to encourage the teachers and pupils to consider how to prepare to survive a tsunami. Of course, many schools are not near the sea. Remember, WE, IN THESE ISLANDS ARE NOWHERE FAR FROM THE SEA. Any Fiji person living near the sea at any particular time should be aware of tsunami dangers and what should be done if one happens.

Teacher Preparation

The most frightening example of the destructive power of the ocean has been termed "tidal wave" though it has nothing to do with tidal forces at all. ALWAYS USE THE WORD "TSUNAMI" RATHER THAN THE WORD "TIDAL WAVE". The tide has nothing to do with such a wave.

Tsunami's are usually caused by earthquakes or volcanic eruptions. They are able to travel swiftly, undetected, across oceans before striking coastal waters.

Three examples illustrate the potential dangers of tsunami :

1. The eruption of KRAKATOA volcano in 1883 in the Sunda Strait between JAVA and SUMATRA created a tsunami 20-40 metres high. It destroyed 300 towns and villages, killed 36,380 people and sunk many ships.
2. In 1946 a tsunami struck the island of OAHU, Hawaii. Waves were some 20 metres high. A total of 173 people were killed and more than 1,000 buildings were destroyed.
3. In 1964 the town of ANCHORAGE in Alaska was devastated by a tsunami created by a nearby major earthquake.

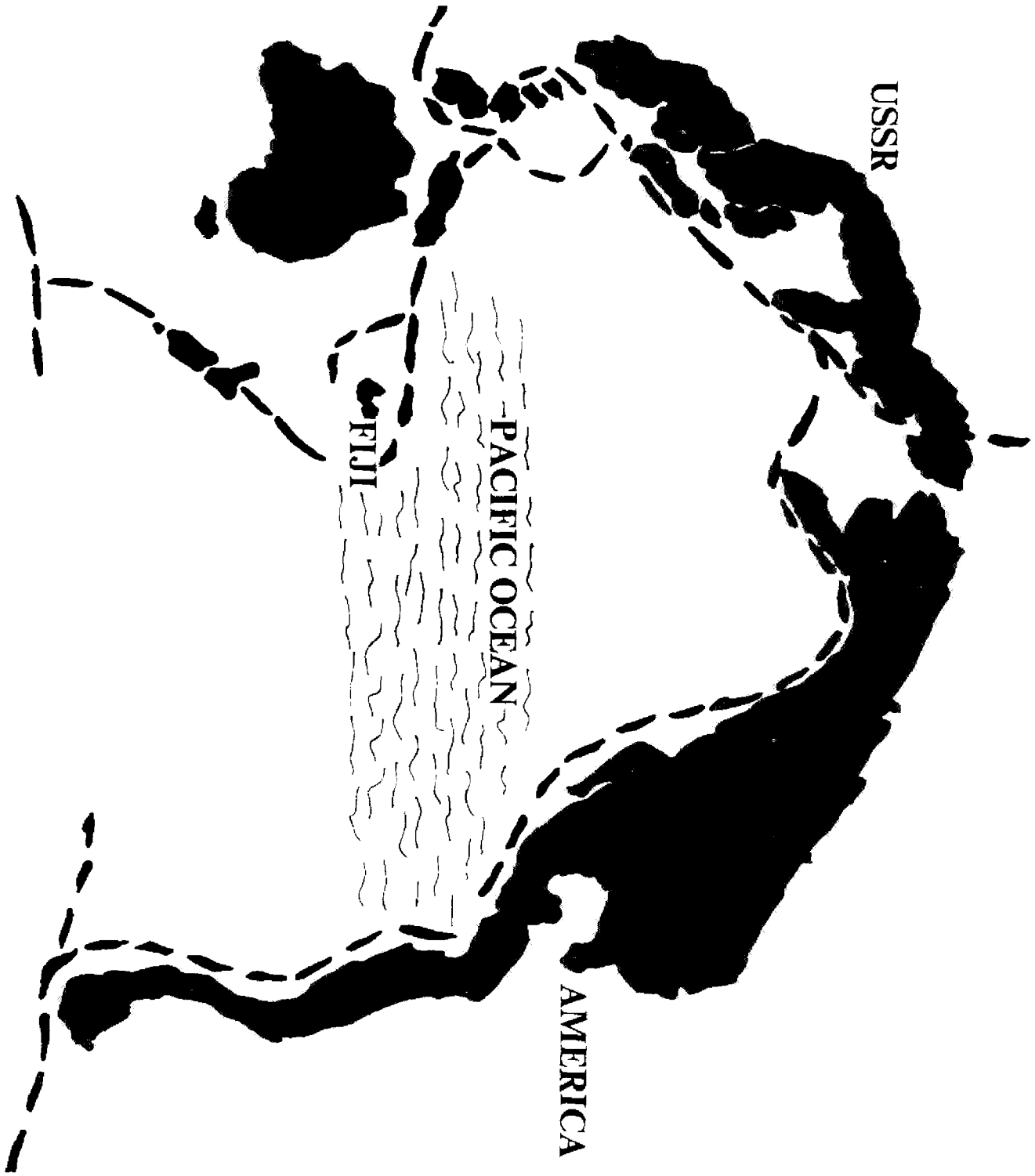
In 1948, a seismic sea wave warning system was established in the Pacific. When tsunami warnings are issued a tsunami exists. NEVER GO DOWN TO THE BEACH TO WATCH A TSUNAMI. When you see the wave you are TOO LATE and TOO CLOSE to escape it.

WHEN YOU SEE A TSUNAMI WAVE COMING IT IS TOO LATE TO DO ANYTHING.

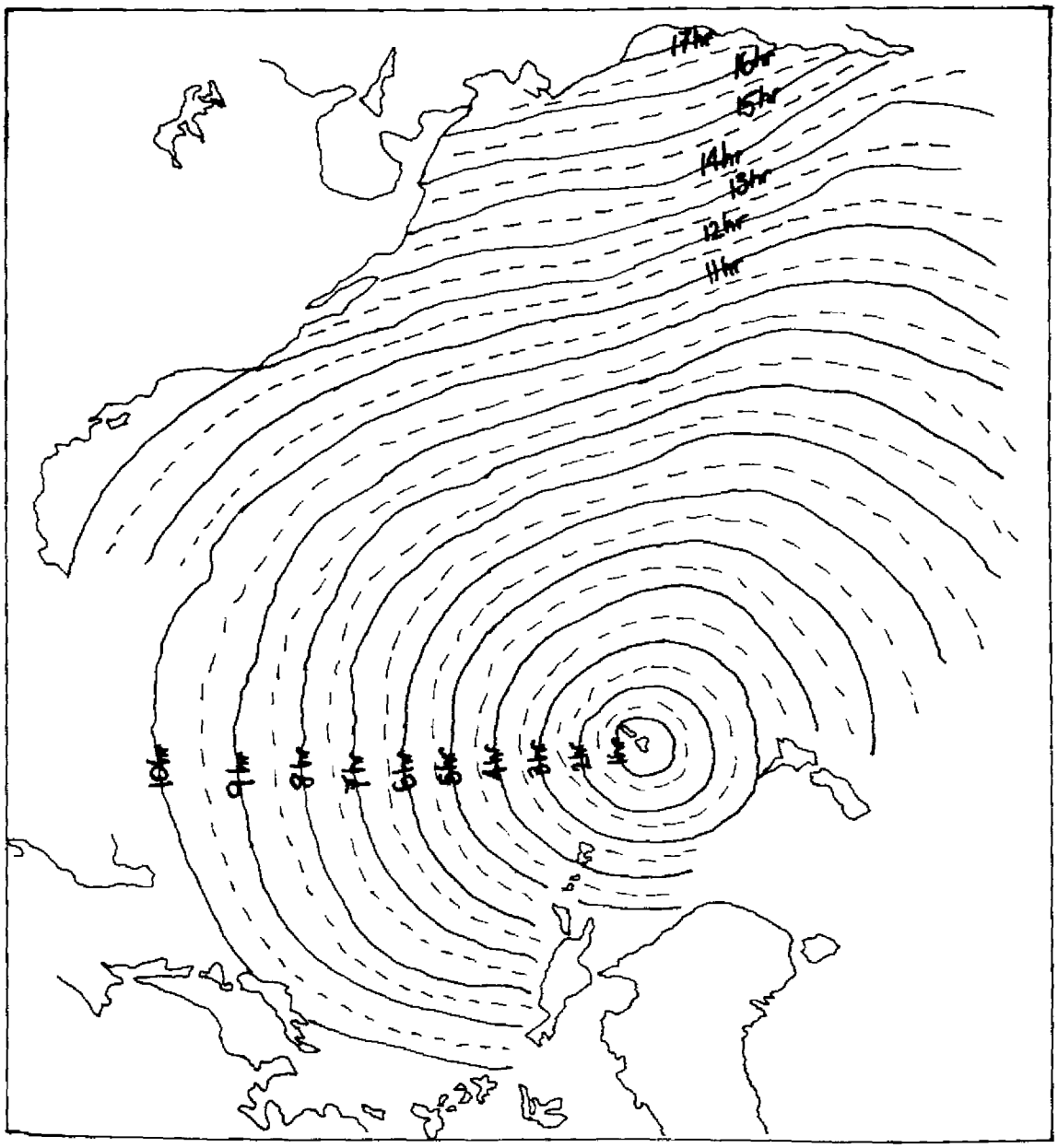
Suggested Activities

1. Discuss how tsunamis are caused by earthquakes or volcanic eruption.
2. Explain why we use the word tsunami rather than tidal wave.
3. Explain how the sea retreats before it returns.
4. Paint a class mural or individual paintings showing people going to a high safe place away from the tsunami.
5. Discuss in general terms the threat tsunamis pose to Fiji. Do the pupils think the public in general takes the threat seriously? Do a survey.
6. If you are in an area of known risk establish a tsunami preparedness plan.

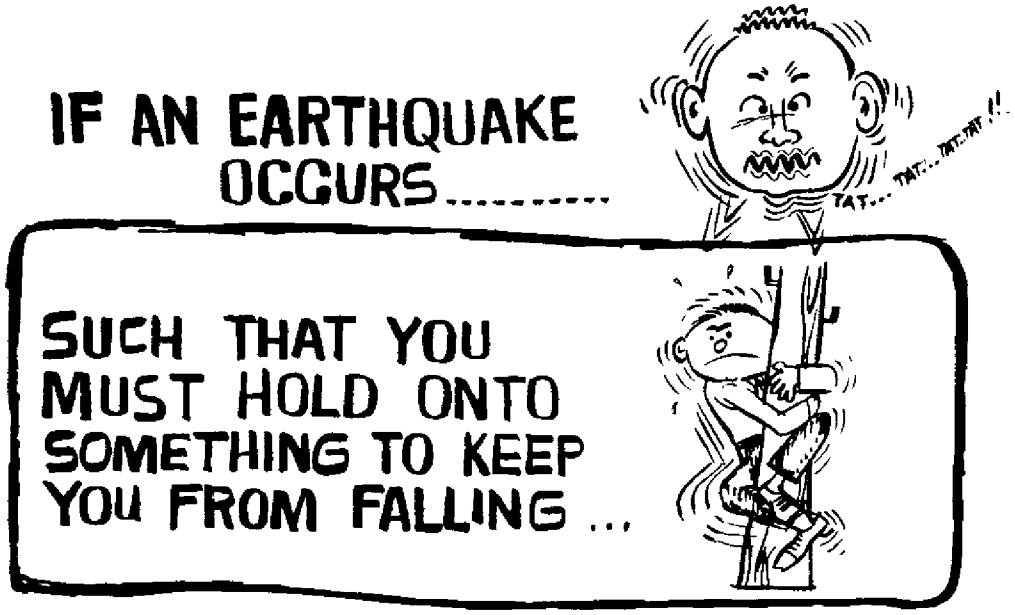
PACIFIC PLATE/BOUNDARIES

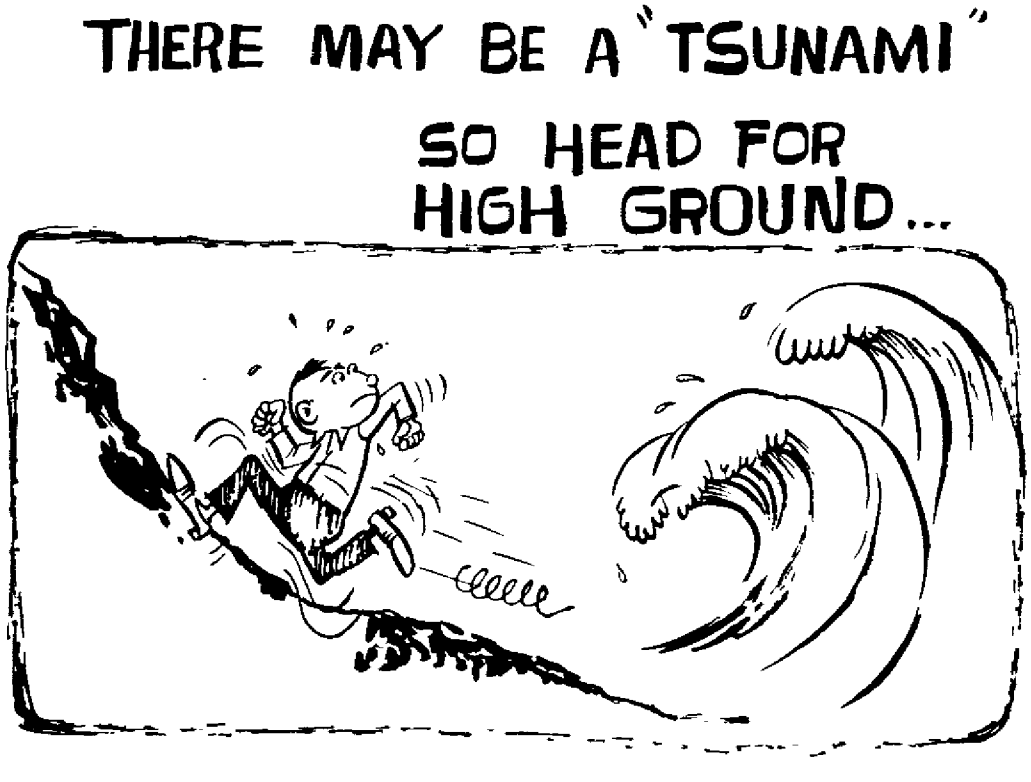


TSUNAMI TRAVEL TIMES TO FIJI



TSUNAMI


IF AN EARTHQUAKE OCCURS.....
TAT... TAT... TAT... TAT !!
SUCH THAT YOU MUST HOLD ONTO SOMETHING TO KEEP YOU FROM FALLING ...


THERE MAY BE A "TSUNAMI"
SO HEAD FOR HIGH GROUND...

FIRE

Source: Fiji Times

CONTENTS

INTRODUCTION

It is essential that pupils learn how to act in the event of a fire. With our classrooms usually restricted in space and sometimes crowded, each child must know what to do if a fire is discovered.