

1

00:00:01,106 --> 00:00:08,109

This series presents information based in part on theory and conjecture.

2

00:00:08,109 --> 00:00:19,114

The producer's purpose is to suggest some possible explanations, but not necessarily the only ones to the mysteries we will examine.

3

00:00:19,114 --> 00:00:27,117

In 1964, two crewmen aboard an Alaskan freighter captured on film the eruption of a giant earthquake.

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00:00:28,118 --> 00:00:31,119

While taking shots of the dock below, it struck.

5

00:00:35,121 --> 00:00:38,122

As the earth trembled, the harbor was sucked dry.

6

00:00:41,123 --> 00:00:43,124

Chasm opened beside the ship.

7

00:00:46,126 --> 00:00:48,126

A huge tidal wave smashed in.

8

00:00:49,127 --> 00:00:51,128

Much of Alaska was shaken apart.

9

00:00:58,131 --> 00:01:04,133

Since man first walked this planet, earthquakes have inspired both terror and awe.

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00:01:04,133 --> 00:01:09,136

Ancient Greeks believed that earthquakes were caused by the dead fighting among themselves.

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00:01:09,136 --> 00:01:17,139

Japanese folklore tells us that earthquakes result from the movements of a great spider which carries the earth on its back.

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00:01:17,139 --> 00:01:21,141

Today, we accept more scientific explanations.

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00:01:21,141 --> 00:01:26,143

Yet, giant tremors can still strike suddenly and without warning.

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00:01:35,147 --> 00:01:39,149

On April 18, 1906, an earthquake shattered San Francisco.

15

00:01:41,149 --> 00:01:45,151

It was caused by a huge rupture in the fault line that runs below the city.

16

00:01:45,151 --> 00:01:48,152

A Hollywood film recreated that disaster.

17

00:01:52,154 --> 00:01:59,157

A pioneer news cameraman recorded the aftermath of the earthquake.

18

00:01:59,157 --> 00:02:04,159

The quake and resulting fires destroyed 28,000 buildings.

19

00:02:04,159 --> 00:02:08,161

Over 150,000 people were left homeless.

20

00:02:08,161 --> 00:02:10,162

450 died.

21

00:02:10,162 --> 00:02:17,165

Slowly, the dazed city pulled itself together to begin the awesome task of rebuilding.

22

00:02:18,165 --> 00:02:23,168

Today, the legacy of 1906 still haunts this beautiful city.

23

00:02:24,168 --> 00:02:30,171

Like the restless clouds of a gathering storm, the earth itself is alive and ever changing.

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00:02:33,172 --> 00:02:37,174

Steering deep inside are dynamic forces of immeasurable strength.

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00:02:38,174 --> 00:02:43,176

The earthquake is a major part of the world's history.

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00:02:46,178 --> 00:02:53,181

Science has learned only recently that the earth's crust is divided into a dozen gigantic blocks or plates.

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00:02:53,181 --> 00:02:58,183

Most of the world's earthquakes strike along the seams of these plates.

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00:02:58,183 --> 00:03:02,185

Together, they form a huge mosaic on the earth's surface.

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00:03:03,185 --> 00:03:08,187

Nearly all of North America, plus a large part of the Atlantic Ocean,

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00:03:08,187 --> 00:03:11,188

make up a block called the North American Plate.

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00:03:14,190 --> 00:03:18,192

The volcanically active floor of the Pacific Ocean, from Japan to California,

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00:03:18,192 --> 00:03:22,193

is another giant slab known as the North Pacific Plate.

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00:03:24,194 --> 00:03:29,196

About 80 miles thick, each plate is under constant pressure to move.

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00:03:30,197 --> 00:03:34,198

Driven by enormous forces that we know very little about,

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00:03:34,198 --> 00:03:37,200

they float like rafts on the earth's soft mantle.

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00:03:37,200 --> 00:03:40,201

Yet they do not float freely.

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00:03:40,201 --> 00:03:44,203

Where they touch, there is constant strain and pressure.

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00:03:44,203 --> 00:03:49,205

Each plate struggles to push, bump, and drive past the other.

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00:03:50,205 --> 00:03:55,208

Cutting through California like a giant scar is a major fracture in the earth's crust.

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00:03:55,208 --> 00:03:58,209

It is known as the San Andreas Fault.

41

00:04:09,214 --> 00:04:11,215

At about the speed that fingernails grow,

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00:04:11,215 --> 00:04:15,216

each plate is grinding against the other in opposite directions.

43

00:04:16,217 --> 00:04:21,219

Over thousands of years, the Fault's slow movement has displaced the course of riverbeds.

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00:04:24,220 --> 00:04:27,221

In the city of Hollister in central California,

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00:04:27,221 --> 00:04:32,224

the earth on either side of the San Andreas Fault moves freely and relatively quickly.

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00:04:32,224 --> 00:04:36,225

Curb stones and sidewalks throughout the city are warped and displaced

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00:04:36,225 --> 00:04:39,227

by the gradual slippage along the Fault.

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00:04:39,227 --> 00:04:44,229

The continuous movement of the ground leaves fences bent and twisted.

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00:04:46,230 --> 00:04:51,232

At a nearby winery, solid block concrete walls are creeping away from their supports.

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00:04:51,232 --> 00:04:54,233

It is dramatic evidence of an active fault.

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00:04:59,235 --> 00:05:05,238

In Southern California, near Los Angeles, the San Andreas Fault looks like a rocky ravine.

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00:05:08,239 --> 00:05:12,241

For the last hundred years, this section of the Fault has been locked in place.

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00:05:12,241 --> 00:05:16,243

Eventually, it must catch up with the movement of other sections.

54

00:05:18,244 --> 00:05:21,245

When rock resists a constant pressure to move,

55

00:05:21,245 --> 00:05:26,247

it bends and distorts until finally, it fractures.

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00:05:27,248 --> 00:05:29,248

That is an earthquake.

57

00:05:33,250 --> 00:05:36,251

Friday, March 10, 1933.

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00:05:36,251 --> 00:05:39,253

Hollywood's film studios are bustling with activity.

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00:05:39,253 --> 00:05:44,255

On a sound stage at Paramount Studios, WC Fields has just begun a scene.

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00:05:44,255 --> 00:05:47,256

Young family saved my life. Now what can I do for you?

61

00:05:47,256 --> 00:05:48,257

Take us to Shanghai.

62

00:05:48,257 --> 00:05:49,257

Shanghai?

63

00:05:49,257 --> 00:05:50,258

Yeah.

64

00:05:54,259 --> 00:05:55,260

What's the matter?

65

00:05:55,260 --> 00:05:56,260

Earthquake.

66

00:05:58,261 --> 00:06:00,262

Take your time. Everybody walk.

67

00:06:00,262 --> 00:06:01,262

It's all right now.

68

00:06:01,262 --> 00:06:02,263

It's all right.

69

00:06:10,266 --> 00:06:12,267

Hollywood is heavily shaken,

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00:06:12,267 --> 00:06:17,269

but the earthquake's power is centered in the city of Long Beach, 40 miles away.

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00:06:28,274 --> 00:06:30,275

115 people were killed.

72

00:06:30,275 --> 00:06:32,276

Thousands injured.

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00:06:32,276 --> 00:06:36,277

The toll would have been even worse if the quake had occurred two hours earlier,

74

00:06:36,277 --> 00:06:39,279

while the schools were still in session.

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00:06:40,279 --> 00:06:44,281

The city's schools took the heaviest damage of any class of building.

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00:06:44,281 --> 00:06:48,283

Most of the building still standing had to be demolished.

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00:06:56,286 --> 00:06:58,287

Though its effect was devastating,

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00:06:58,287 --> 00:07:02,289

the tremor that jolted Long Beach was only of moderate power.

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00:07:03,289 --> 00:07:09,292

Computer technology is now being used to help record and analyze changes in the Earth.

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00:07:09,292 --> 00:07:13,294

Much of the San Andreas Fault is now under close surveillance.

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00:07:13,294 --> 00:07:17,295

It is booked with a network of ultra-sensitive instruments.

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00:07:17,295 --> 00:07:22,297

Each detects subtle movements and changes in magnetic fields which might precede a quake.

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00:07:22,297 --> 00:07:31,301

Dr. Peter Ward is chief of the Mechanics and Prediction Branch of the National Center for Earthquake Research in Menlo Park in California.

84

00:07:31,301 --> 00:07:34,303

We know that stress is building in California,

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00:07:34,303 --> 00:07:38,304

and we know that stress will be primarily relieved in a major earthquake.

86

00:07:38,304 --> 00:07:42,306

When that earthquake will occur, we're not sure of, but we know that it will occur.

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00:07:43,307 --> 00:07:48,309

Using the knowledge that certain physical changes occur in the Earth before some tremors,

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00:07:48,309 --> 00:07:53,311

scientists have accurately predicted small, localized earthquakes.

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00:07:53,311 --> 00:07:58,313

A tilt meter detects tiny variations in the Earth's level.

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00:07:58,313 --> 00:08:03,315

Slight movements are sometimes a signal that an earthquake will take place.

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00:08:03,315 --> 00:08:09,318

Powerful laser beams measure the movements of Earth along the fault line, checking for sudden changes.

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00:08:09,318 --> 00:08:13,320

Much of the San Andreas Fault is highly active.

93

00:08:13,320 --> 00:08:18,322

In Central California, about 10 earthquakes are recorded every day.

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00:08:22,324 --> 00:08:26,325

The Mojave Desert, just north of Los Angeles.

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00:08:26,325 --> 00:08:32,328

A striking landscape lies on the center of a little understood and controversial geological event.

96

00:08:32,328 --> 00:08:35,329

It has come to be known as the Vulge.

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00:08:35,329 --> 00:08:40,331

It is a phenomenon that has preceded some major earthquakes.

98

00:08:40,331 --> 00:08:52,337

Music

99

00:08:52,337 --> 00:08:59,340

For 15 years, a vast area along the San Andreas Fault has been forced upward a full 10 inches.

100

00:08:59,340 --> 00:09:03,341

It may be a signal of a giant quake to come.

101

00:09:04,342 --> 00:09:09,344

We know that a major catastrophic earthquake is inevitable in California,

102

00:09:09,344 --> 00:09:11,345

certainly in the Los Angeles area.

103

00:09:11,345 --> 00:09:16,347

We know from detailed studies of the Los Angeles area and what the effects of this earthquake might

be.

104

00:09:16,347 --> 00:09:21,349

If the earthquake occurs during the day, perhaps 12,000 people will be killed.

105

00:09:21,349 --> 00:09:24,350

If it occurs in the middle of the night, maybe only 3,000 people will be killed.

106

00:09:24,350 --> 00:09:28,352

But if one dam were to fail, perhaps tens of thousands of people will be killed

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00:09:28,352 --> 00:09:31,353

and hundreds of thousands of people will be homeless.

108

00:09:32,354 --> 00:09:35,355

The threat of earthquakes is much too real.

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00:09:35,355 --> 00:09:38,357

There may be warnings of a giant quake to come.

110

00:09:40,357 --> 00:09:44,359

If not a day passes without earthquakes striking somewhere in the world,

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00:09:44,359 --> 00:09:46,360

often they are too slight to be felt.

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00:09:46,360 --> 00:09:54,363

Inevitably, however, a giant quake occurs, convulsing with such magnitude, it shakes the entire planet.

113

00:09:57,365 --> 00:09:59,366

The port of Valdez, Alaska.

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00:09:59,366 --> 00:10:02,367

It is Good Friday, 1964.

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00:10:02,367 --> 00:10:07,369

The China, the first freighter of the spring, has just come into dock.

116

00:10:07,369 --> 00:10:12,371

Standing on deck, two sailors begin taking 8mm movies.

117

00:10:13,372 --> 00:10:16,373

They film the people and dogs on the dock below.

118

00:10:21,375 --> 00:10:25,377

At 5.36pm, the earth begins to rumble.

119

00:10:26,377 --> 00:10:29,379

The sailors hold on and keep filming.

120

00:10:32,380 --> 00:10:35,381

Suddenly, the water in Valdez Harbor begins to drain away.

121

00:10:55,390 --> 00:10:57,391

The ship is ready to sail.

122

00:11:05,394 --> 00:11:10,396

Formed 20 miles in sea, a 50-foot tidal wave smashes into Valdez Harbor.

123

00:11:12,397 --> 00:11:15,399

Anchorage, Homer, and Seward,

124

00:11:15,399 --> 00:11:19,400

jolted with a force equal to thousands of atomic bombs.

125

00:11:20,401 --> 00:11:23,402

Tidal waves sweep Kodiak and Cordova.

126

00:11:23,402 --> 00:11:26,403

A half-million square miles feel the effect.

127

00:11:31,406 --> 00:11:35,407

Downed power lines explode oil tanks, which blaze uncontrolled.

128

00:11:37,408 --> 00:11:40,409

Broken gas mains set houses aflame.

129

00:11:41,410 --> 00:11:45,412

In Anchorage, the central business district is all but demolished.

130

00:11:45,412 --> 00:11:48,413

Large areas of ground turned liquid during the quake,

131

00:11:48,413 --> 00:11:51,414

dropping the streets and buildings as much as 30 feet.

132

00:11:52,415 --> 00:11:56,416

The Alaska quake was the largest to strike North America in this century.

133

00:11:56,416 --> 00:11:59,418

114 people were killed.

134

00:11:59,418 --> 00:12:02,419

Nearly 5,000 were left homeless.

135

00:12:02,419 --> 00:12:05,420

Valdez Harbor was destroyed.

136

00:12:09,422 --> 00:12:14,424

Scientists are looking in many directions for new ways to predict Valdez Harbor.

137

00:12:15,425 --> 00:12:18,426

And they are looking at violent quakes.

138

00:12:23,428 --> 00:12:27,430

Up to 12 billion light-years away, like fixed beacons in space,

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00:12:27,430 --> 00:12:30,431

are points of light called quasars.

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00:12:30,431 --> 00:12:34,433

They emit regular bursts of high-frequency radio energy.

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00:12:35,433 --> 00:12:38,435

Radio antennas on opposite sides of the San Andreas fault

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00:12:38,435 --> 00:12:41,436

receive and measure signals from a quasar.

143

00:12:41,436 --> 00:12:44,437

By comparing the arrival times of these signals,

144

00:12:44,437 --> 00:12:47,439

minute movements of the Earth's crust can be detected.

145

00:12:49,439 --> 00:12:54,442

Subtle changes in the San Andreas fault now reveal themselves in three dimensions.

146

00:12:54,442 --> 00:12:58,443

A sudden variation may be an early signal of a forming earthquake.

147

00:13:00,444 --> 00:13:05,446

Unusual animal behavior before earthquakes has been reported for hundreds of years.

148

00:13:06,447 --> 00:13:11,449

Zookeepers have noticed monkeys and chimps act strangely just before quakes.

149

00:13:11,449 --> 00:13:15,451

They stay low to the ground and will not enter their shelters.

150

00:13:16,451 --> 00:13:20,453

Many household dogs have also seemed to know that a tremor is coming.

151

00:13:20,453 --> 00:13:24,455

They often bark for no reason or wander nervously around a room.

152

00:13:25,455 --> 00:13:31,458

On November 27, 1974, horses near Hollister, California became nervous and skittish.

153

00:13:31,458 --> 00:13:35,459

The next day, a moderate quake struck the area.

154

00:13:37,460 --> 00:13:42,462

A unique experiment is testing the idea that animals can predict earthquakes.

155

00:13:42,462 --> 00:13:45,464

The subjects are common cockroaches.

156

00:13:45,464 --> 00:13:49,465

A sensitive monitor continually records their level of activity,

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00:13:49,465 --> 00:13:51,466

looking for sudden changes.

158

00:13:52,467 --> 00:13:57,469

It seems almost funny that a nervous cockroach may herald a major catastrophe,

159

00:13:57,469 --> 00:14:00,470

but it could turn out that the Earth's oldest living inhabitant

160

00:14:00,470 --> 00:14:03,472

could tell us something about our planet.

161

00:14:04,472 --> 00:14:09,474

At the University of California, scientists create their own earthquakes.

162

00:14:13,476 --> 00:14:18,478

Scale models and buildings shake under the impact of an earthquake simulator machine.

163

00:14:18,478 --> 00:14:23,480

Hydraulic arms slam a 45-ton concrete block in two directions at once,

164

00:14:23,480 --> 00:14:27,482

duplicating the ground motion of the most severe quakes.

165

00:14:28,482 --> 00:14:32,484

Information gained from such tests may lead to new building standards

166

00:14:32,484 --> 00:14:35,485

and possibly save countless lives.

167

00:14:40,488 --> 00:14:45,490

In 1982, a rare and perhaps ominous event will take place in our solar system.

168

00:14:46,490 --> 00:14:53,493

For the first time in nearly 200 years, all nine planets will form a straight line on one side of the sun.

169

00:14:56,495 --> 00:14:59,496

Two British astronomers believe that this unusual alignment

170

00:14:59,496 --> 00:15:02,497

will cause an epidemic of giant earthquakes.

171

00:15:03,498 --> 00:15:07,499

Their theory states that the combined gravitational fields of the planets

172

00:15:07,499 --> 00:15:11,501

will create an enormous increase in the number of earthquakes in the world.

173

00:15:11,501 --> 00:15:17,504

The combined gravitational fields of the planets will create an enormous increase in the sun's magnetic activity.

174

00:15:22,506 --> 00:15:26,508

Huge storms of sunspots and solar flares will explode into space.

175

00:15:34,511 --> 00:15:39,513

Radiation from the turbulent surface of the sun will severely affect the Earth's atmosphere.

176

00:15:41,514 --> 00:15:45,516

The phenomenon like the northern lights will be greatly intensified.

177

00:16:01,523 --> 00:16:05,525

Prevailing patterns of world weather will be radically altered.

178

00:16:06,525 --> 00:16:10,527

Changes in high altitude winds will slow the rotation of the Earth.

179

00:16:11,527 --> 00:16:16,529

Predictably, the sudden strain will cause swarms of earthquakes along the world's active faults.

180

00:16:17,530 --> 00:16:22,532

If this theory holds up, the strained fault line near San Francisco would be highly vulnerable.

181

00:16:25,533 --> 00:16:30,535

Ten miles south of San Francisco, hundreds of houses stand on unstable ground

182

00:16:30,535 --> 00:16:33,537

directly above the San Andreas Fault.

183

00:16:34,537 --> 00:16:38,539

In the last several years, the backyards of numerous homes have eroded away.

184

00:16:39,539 --> 00:16:41,540

They've dropped into the fault.

185

00:16:42,541 --> 00:16:46,542

A large tremor on this area would have a devastating effect.

186

00:16:56,547 --> 00:16:59,548

In San Francisco, the project of the Earth's largest earthquake

187

00:16:59,548 --> 00:17:01,549

is frightening and grim.

188

00:17:03,550 --> 00:17:06,551

Every morning, as thousands of commuters swell its population,

189

00:17:07,551 --> 00:17:10,553

San Francisco becomes a setting for potential disaster.

190

00:17:11,553 --> 00:17:15,555

That a great quake will jolt this city is to scientists inevitable.

191

00:17:16,555 --> 00:17:19,557

Many seismologists believe it is already overdue.

192

00:17:21,558 --> 00:17:24,559

Several detailed studies of the city have been made.

193

00:17:25,559 --> 00:17:28,561

They project what would happen if a tremor the same size as the earthquake.

194

00:17:29,561 --> 00:17:32,562

The same size of the 1906 quake occurred again.

195

00:17:33,563 --> 00:17:35,564

It is a bleak scenario.

196

00:17:36,564 --> 00:17:39,565

Suddenly, the Earth begins to tremble and sway.

197

00:17:40,566 --> 00:17:45,568

In the crowded financial district, high-rise buildings shiver and sway like blades of grass.

198

00:17:46,568 --> 00:17:49,570

Inside, people have flung across rooms.

199

00:17:50,570 --> 00:17:54,572

Fires break out, elevators jam, walls crack and collapse.

200

00:17:55,572 --> 00:17:58,574

Plate glass windows pop out of their frames.

201

00:17:59,574 --> 00:18:02,575

Shards of broken glass sail through the city's streets.

202

00:18:04,576 --> 00:18:07,577

Most of this area stands on unstable landfills.

203

00:18:08,578 --> 00:18:12,580

As the Earth continues to shake, much of the soil turns to liquid.

204

00:18:13,580 --> 00:18:15,581

The street level drops instantly.

205

00:18:18,582 --> 00:18:21,584

Earthquake-proof skyscrapers fall into the void.

206

00:18:24,585 --> 00:18:28,587

Along Chinatown's famed Grant Street, the shaking is severe.

207

00:18:29,587 --> 00:18:34,589

Built almost entirely of unreinforced brick, it is especially susceptible to tremors.

208

00:18:35,590 --> 00:18:38,591

Virtually all of Chinatown collapses in on itself.

209

00:18:39,591 --> 00:18:41,592

It becomes a mass graveyard.

210

00:18:42,593 --> 00:18:45,594

Loose bricks and balconies are the first to go.

211

00:18:49,596 --> 00:18:55,598

Throughout the city, parapets, ornamental sculpture and facades smash down on the people below.

212

00:18:59,600 --> 00:19:01,601

The city's city is a city of the city.

213

00:19:08,604 --> 00:19:11,605

Everywhere, there are exploding fires from ruptured gas mains.

214

00:19:17,608 --> 00:19:20,609

Cars on the freeways are tossed about like little toys.

215

00:19:22,610 --> 00:19:25,611

Sections of asphalt break away in huge chunks.

216

00:19:25,611 --> 00:19:28,613

The elevated highways slither, then fall.

217

00:19:29,613 --> 00:19:31,614

The cars below are crushed.

218

00:19:32,614 --> 00:19:37,617

The stench of raw sewage mixes with smoke from hundreds of houses that burn uncontrolled.

219

00:19:40,618 --> 00:19:42,619

The approaches to the Golden Gate Bridge have collapsed.

220

00:19:43,619 --> 00:19:46,620

The ground beneath them has liquefied and run off.

221

00:19:47,621 --> 00:19:50,622

The bridge itself whips back and forth like a giant snake.

222

00:19:51,623 --> 00:19:53,624

Cars are hurled into the water below.

223

00:19:56,625 --> 00:19:58,626

The human toll is enormous.

224

00:19:59,626 --> 00:20:01,627

At least 10,000 are dead.

225

00:20:02,627 --> 00:20:03,628

300,000 are injured.

226

00:20:04,628 --> 00:20:05,629

Nearly everyone is homeless.

227

00:20:07,630 --> 00:20:10,631

This is the projection for a disaster that probably will occur.

228

00:20:11,631 --> 00:20:12,632

We just don't know when.

229

00:20:13,632 --> 00:20:17,634

Perhaps one day we will predict and control our planet's violent quakes.

230

00:20:19,635 --> 00:20:22,636

Until then, the world will be in a state of chaos.

231

00:20:23,637 --> 00:20:27,638

Until then, we are well advised to look for warnings in any form

232

00:20:28,639 --> 00:20:30,640

and heed them if there's time.

233

00:20:35,642 --> 00:20:40,644

For over four billion years, earthquakes have shaken and reshaped the Earth's surface.

234

00:20:41,644 --> 00:20:44,646

They are a violent expression of our planet's continuing evolution.

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00:20:45,646 --> 00:20:49,648

In California, along the San Andreas Fault, the frequency of earthquakes is high.

236

00:20:49,648 --> 00:20:54,650

Yet an active fault line cut through New York City at 125th Street

237

00:20:54,650 --> 00:20:56,651

between the Hudson and East Rivers.

238

00:20:57,651 --> 00:21:00,653

The regions around Boston and Charleston, South Carolina

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have as high a seismic risk as Los Angeles or San Francisco.

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In fact, the U.S. Coast and Geodetic Survey has determined

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that one-third of our nation's population lives in areas of high earthquake probability.

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00:21:14,659 --> 00:21:16,660

So l...