Database and Map of Quaternary faults and folds of Ecuador and its offshore regions

By **Arturo Eguez, Alexandra Alvarado, Hugo Yepes, Michael N. Machette, Carlos Costa *and* Richard L. Dart**

Open-File Report 03-289

2003

USGS
science for a changing world

Database and Map of Quaternary Faults and Folds of Ecuador and its offshore regions

A project of the International Lithosphere Program Task Group II-2, Major Active Faults of the World

Data and map compiled by

[1] ARTURO EGUEZ, [1] ALEXANDRA ALVARADO, [1] HUGO YEPES,
[2] MICHAEL N. MACHETTE, [3] CARLOS COSTA, [2] RICHARD L. DART, and [2] LEE-ANN BRADLEY

[1] Escuela Politécnica Nacional
Departamento Geología & Instituto Geofísico
Casilla 17-01-2759
Quito, Ecuador

[2] U.S. Geological Survey
Central Geologic Hazards Team
Denver, Colorado, USA

[3] Universidad Nacional de San Luis
Departamento de Geología
Casilla de Correo 320
San Luis, Argentina

Regional Coordinator for Central America

CARLOS COSTA
Universidad Nacional de San Luis
Departamento de Geología
Casilla de Correo 320
San Luis, Argentina

International Lithosphere Program
Task Group II-2 Co-Chairman (Western Hemisphere)

MICHAEL MACHETTE
U.S. Geological Survey
Central Geologic Hazards Team, MS 966
P.O. Box 25046
Denver, Colorado, USA

USGS
science for a changing world

May 2003 Version

International Lithosphere Program

TABLE OF CONTENTS

LIST OF TABLES

Page

INTRODUCTION

The U.S. Geological Survey (USGS) is assisting in the compilation of a series of digital maps of Quaternary faults and folds in Western Hemisphere countries as part of the International Lithosphere Program's (ILP) Task Group II-2 project entitled "World Map of Major Active Faults." The maps from this project show the locations, ages, and activity rates of major earthquake-related features such as faults and fault-related folds. They are accompanied by databases that describe these features and document current information on their activity in the Quaternary. To date, the project has published fault and fold maps for Costa Rica (Montero and others, 1998), Panama (Cowan and others, 1998), Venezuela (Audemard and others, 2000), Bolovia and Chile (Lavenu, and others, 2000), Argentina (Costa and others, 2000), Colombia (Paris and others, 2000), the Managua region of Nicaragua (Cowan and others, 2000) and Brazil (Saadi and others, 2002). The project is a key part of the Global Seismic Hazards Assessment Program (ILP Project II-0) for the International Decade for Natural Hazard Disaster Reduction.

The project is sponsored by the International Lithosphere Program and funded by the USGS's National Earthquake Hazards Reduction Program. The primary elements of the project are general supervision and interpretation of geologic/tectonic information (Michael N. Machette, Project Chief), data compilation and entry for fault catalog (all personnel), database design and management (Kathleen M. Haller), and digitization and editing of fault and fold traces (Richard L. Dart) in [†]ARCINFO. For the compilation of data, we engaged experts in Quaternary faulting, neotectonics, paleoseismology, and seismology. These experts (i.e., Eguez, Alvarado, and Yepes) are the primary authors of this report and questions about individual fault descriptions should be directed to them. Questions about the project, its status, and the GIS map should be directed to the USGS authors.

Prior to initiating this project, no modern or digital map of active or Quaternary faults existed for Ecuador or any other country within South America, even though understanding the extent and character of active and older Quaternary faults are critical elements of seismic hazards analysis. Creation of this map and the accompanying database will help extend the relatively short record of instrumental and felt seismicity in Ecuador by creating a paleoseismic record of surface deformation associated with large (M>6.5) earthquakes. This database can be used to identify both well and poorly studied faults, and can be used as a guide for improving the geologic input to seismic hazard assessments.

Although fault data are available for most of the country, the degree of completeness varies greatly and often is a function of the degree of remoteness and vegetation cover, such as east of the Ecuadorian Andes. A few faults have been the subject of recent investigations involving modern paleoseismic techniques, but most have not. Some regions and faults have been studied in moderate detail, usually in association with concerns about hazards to urban areas or the safety of critical facilities such as lifelines, oil-and-gas pipelines, or power-generating facilities. Thus, considerable effort was required from the primary authors in order to compile information from a wide variety of sources and insure that the national product is up to date and provides fairly uniform coverage for the entire country. Nevertheless, the general state of knowledge for faulting in Ecuador is probably best described as being of a reconnaissance nature. Little is known in a collective sense about the overall rates of fault activity and fault chronology—information that is difficult to acquire, but critical to seismic-hazard assessments. Hopefully, additional paleoseismic studies will help augment this map and database.

STRATEGY AND PURPOSE

For the map of Ecuador, we relied on known, productive experts with strong local or regional knowledge of Ecuador who were willing to participate in this international project. The main compilers were Arturo Eguez and Hugo Yepes, with help from Alexandra Alvarado. Given the limited time Task Group II-2 was given to produce the map, the project was restricted to compilation of just those elements needed for ILP's Global Seismic Hazards Assessment Program (see database). We anticipate that the project will point out the shortcomings of past and current research on Quaternary faulting in Ecuador in terms of quantity, quality, scope, and regional

[†] Any use of trade names (such as this and others in the report) does not imply endorsement by the U.S. Geological Survey.

coverage and should help promote new efforts to collect paleoseismological data in previously neglected or known critical areas.

In many cases, seismicity is used to define potentially active faults, especially along active plate margins. However, recent faulting events in the Western Hemisphere have shown that much of the faulting away from active plate margins occurs along faults with no significant level of seismicity and that only a fraction of active faults are characterized by ongoing seismicity. Thus, the information on Quaternary faulting included within this database should help extend the modern (past several hundred years) record of seismicity into prehistoric time, and allow better assessments of active and potentially active faults in Ecuador and other Western Hemisphere countries.

TECTONIC SETTING

Ecuador comprises three main morphostructural regions: the coastal plain, the Andean range consisting of the Cordillera Occidental (western) and Cordillera Real or Oriental (eastern), and the upper Amazon basin (see index map on map). They represent the fore-arc, volcanic arc and back-arc zones (respectively), all related to the active subduction of the oceanic Nazca Plate beneath the continental South America Plate. The general geologic and tectonic framework is a product of a complex geologic history involving several accretionary processes that have produced spatial and temporal overlay of different geotectonic terranes (Eguez and Aspen, 1993; Litherland and others, 1994).

The Andean uplift and the present distribution of terrains are related to active subduction, but they probably started being formed in Mesozoic time and perhaps much earlier. In fact, the above morph-structural regions appear to be controlled by conspicuous NNE-SSW trending fault systems acting partially along regional suture zones.

The Eastern region of Ecuador consists of the Upper Amazon basin formed by dominant sedimentary series floored by the Guyana craton (not exposed). The Subandean zone (Napo and Cutucu foothills) appears at the margin of the Andean range: this zone includes folded Mesozoic sedimentary rocks and is bounded by thrust systems on the east that show significant Neogene motion. The Andean Range is formed by the Cordilleras Real and Occidental (western), which are separated by the Interandean Valley. The Cordillera Real includes metamorphic sequences and Triassic granitoids that are intruded into Paleozoic(?) pelagic sediments and Jurassic volcanic and sedimentary suites assigned to oceanic and continental arc environments (Litherland and others, 1994). The western structural margin of the Real Cordillera outlines the Peltetec suture, which seems to coincide partially with the southern extension of the Romeral system in Colombia. The Cordillera Occidental and the Coastal plain represent the extension of the same morphostructural regions as in Colombia. They comprise allochtonous, unmetamorphosed oceanic rocks as young as Eocene age, confirming that the last accretionary event occurred before the Pacific Plate was reorganization at 26 Ma (Hey, 1977). The eastern structural limit of this oceanic terrain follows the Calacali-Pujili suture zone extended along the western border of the Interandean Valley. It seems to correspond to the southern extension of the Cauca-Patia fault zone reported in Colombia and which is part of the Romeral fault system.

According to Pennington (1981), Ecuador represents a portion of the Northern Andes where the Nazca Plate (slab) dips at 35°E. Nevertheless, a more detailed analysis of the different seismicity profiles shows a more complex behavior of the slab (Gutscher and others, 1999). Thus, Gutscher and others (1999) concluded that Ecuadorian subduction system appears highly controlled by the subduction of the Carnegie Ridge and by the lithospheric tears within the Nazca Plate. The most recent devastating earthquake in Ecuador occured on August 5, 1949. It is not known if this earthquake caused surface rupturing, but it caused nearly 6,000 deaths in north-central Ecuador. The epicentral location is 1.2°S and 78.5°W, near Ambato about 115 km south of Quito. The most recent large subduction zone interface earthquake (Mw 8.8) to strike Ecuador occurred on January 31, 1906 and killed 1,000 people. The epicenter of this subduction zone earthquake was located at 1°N and 81.5°W, about 150 km offshore of an area of northern Ecuador that was not densely populated at the time (nearly 100 years ago).

MAJOR STRUCTURAL ELEMENTS

Preliminary studies suggest that mega faults control the boundaries of the Northern Andes. Campbell (1974) defined the Dolores-Guayaquil Megashear along the Andean ranges, and Pennington (1981) proposed the Eastern Andean Frontal fault zone as the limit of the North Andean block along the Subandean region.

In fact, the North Andean block appears limited by an active NNE-trending dextral strike-slip fault system. These observations suggest that the dextral motion along the NNE regional faults changes to compressional motion where the faults have a N-S trend; all accommodating E-W compressional stress produced by the convergence of the South American and Nazca plates (see tectonic inset map on plate). Field observations show that the main fault systems are oblique to the Ecuadorian Andes, starting at the Gulf of Guayaquil (Pallatanga fault, EC-50) and cutting across the ranges toward the eastern border of the Cordillera Real (Chingual fault, EC-54) in northern Ecuador (Soulas and others, 1991). These two main NE-SW faults show significant strike-slip morphology and kinematic features and they are probably responsible for the main historic earthquakes in Ecuador.

Between these faults, the slip motion is accommodated by minor NE-SW oblique faults and by N-S fault zones along the Interandean Valley, where folds, flexures, and related reverse faults (including the Quito fault, EC-31) have been identified. Also, a transpressional NNE-SSW fault system along the Subandean zone partially accommodates E-W compression.

The tectonic regime of the coastal region appears highly controlled by subduction of the Carnegie Ridge and by the oblique convergence of the Nazca Plate. Thus, normal and reverse faults bound small blocks in front of the Carnegie Ridge and a main transpressional fault system limits the northern coastal ranges, thus defining active fore-arc basin filled by alluvial fans on the piedmont of the Cordillera Occidental.

PREPARATION OF MAP AND DATABASE

This compilation shows evidence for activity on Quaternary faults and folds in Ecuador and offshore regions in the Pacific Ocean. The data were compiled during 1994-97 from the available published literature (through 1998), recent geological investigations, and from interpretation of aerial photographs by the senior authors. Arturo Eguez mainly compiled the surface traces of the Quaternary faults and folds. Offshore traces are based primarily on marine geophysical studies and bathymetric maps; these traces are inherently less well defined and located, and should be considered approximate. Michael Machette edited most of the text and map data and provided guidance for the project under the International Lithosphere Program's Task Group II-2 "Major Active Faults and Folds of the World," for which he is the Co-chairman (Western Hemisphere).

Richard Dart used GIS (Geographic Information System) technology to produce the fault and fold maps. The traces of Quaternary faults and fold were digitized, attributed for age, sense of slip, and line type (continuous, discontinuous, and concealed or inferred), and reprocessed using a Mercator projection. The maps were prepared with ARC/INFO version 7.1.2 running under Solaris version 2.5.1 on a Unix workstation. Data for the fault length and average strike were generated from the ARC/INFO files.

The base-map information was taken from the Digital Chart of the World, which was created for use with ARC/INFO (copyright 1993 by the Environmental Systems Research Institute, Inc.). The Digital Chart of the World was compiled at a scale of 1:1,000,000, but is reasonably detailed at the printed scale of the map (1:750,000). It was originally developed for the United States Defense Mapping Agency (DMA) and is primarily derived from the DMA Operational Navigation Chart (ONC) Series.

MAP

The map of Quaternary faults and folds of Ecuador was compiled on an overlay using the Ecuador geologic map as a base; the faults were digitized at a scale of 1:1,250,000. The GIS data is scale independent but should not be used at scales greater (more detailed) than 1:750,000 (about twice as detailed as the original scale). The GIS data allows output as a single-country map (1:1,000,000 to 1:2,000,000 scale) or provincial and regional maps (about 1:750,000 scale) while retaining all significant digital information. In addition to fault location and style, the map shows time of most recent movement and estimates of slip rate (as a proxy for fault activity).

Although as many as five categories of Quaternary faults can be depicted on the Western Hemisphere maps, only three categories were used in Ecuador:

Historic (generally <300 years depending on location),

Holocene and latest Pleistocene (<15,000 years or <15 ka),

Quaternary (<1,600,000 years or <1.6 Ma).

Categories for differentiating late Quaternary (<130 ka) and late and middle Quaternary (<750 ka) ruptures were not used owing to the general lack of stratigraphic and chronological control needed to make these age differentiations. Nevertheless, this categorical time scheme allows some flexibility in reporting between countries owing to the differing levels of investigation and abilities to date prehistoric faulting.

Three ranges of slip rates depicted by differing line thicknesses are shown on the map in order to differentiate known rates of fault activity:

>5 mm/yr—Plate-boundary faults and subduction zones,

1-5 mm/yr—Lesser strike-slip and major extensional or transpressional faults,

<1 mm/yr—Most extensional and intraplate faults.

Most faults in Ecuador with "unknown slip rates" are drawn with the <1 mm/yr line thickness.

DATABASE

The purpose of the database is to provide fault data that can be readily accessed using a variety of search parameters. For this database, we anticipate that the user would want search-and-retrieve capabilities from a personal computer. The user may want to sort the data by such parameters as fault name, time of most recent movement (one of three categories), slip rate (one of four categories), sense of movement, or by multiple parameters.

The process of data compilation starts with data acquisition and synthesis. In the case of faults, the compiler must determine if the structure is a simple one, or if it qualifies as having sections (increased complexity of geometry or fault history). Then using the appropriate form, the compiler tabulates information on the fault's parameters.

After this report is released, we will incorporate suggested changes and additions; then import the data to the computer database. Each of the fields is a potential search object. The use of a computer database program allows us to custom format the reporting of data and to collapse unused fields or notes. The basic fields are restricted to 256 characters, but we use the note option for more explanatory information (shown under comments in this report).

The fault and fold data will be released in several forms. This open-file report constitutes a traditional hard-copy catalog (database and map) for Ecuador. The Ecuador data will eventually be part of a larger relational computer database for the Western Hemisphere that should be available on the World Wide Web (WWW). This interactive WWW product allows the user to browse, sort, and print the data. However, we do not anticipate allowing the database to be altered using only the run-time WWW version of the database program.

DEFINITION OF DATABASE TERMS

The following terms,provide data for specialized fields, most of which will be searchable when the computer database is released. In addition specialized fields, more detailed information is provided in the "Comments" section that follows some fields. If a field is empty, marked unknown, or has been deleted, no pertinent information was found in the published literature. The following description provides definitions of fields (in alphabetic order) and indicates where various data, if known, can be found. Citations of references are in a traditional (USGS) format, although foreign language citations are as provided by the compilers.

Average dip General down-dip direction of the structure, where known.

Average strike The length-weighted average strike of the trace of the structure is reported in the northwest and northeast quadrants of the compass (i.e., N30°W, versus S30°E). The error limits that follow the strike are for all vectors contained with the trace of that particular fault or collection of faults. These values are included only

to provide a general impression of the sinuosity or variability in strike of the mapped structures. Some fault zones include a number of faults with a wide variety of strikes, and thus the error limits are not meaningful.

Compiler, affiliation and date of compilation The name and affiliation of the person(s) primarily responsible for compilation or update of data presented for the structure. Also shown is the date when data were compiled for this project (*e.g.*, January 1997).

Fault geometry This heading includes geographic information pertinent to the fault or fold being described. The data include length, average strike, average dip, and sense of movement.

Fault/fold name (see Name)

Fault/fold number (see Number)

Geomorphic expression General description of the structure's geomorphic expression including information on the presence or absence of fault scarps, offset streams, monoclines, shutter ridges, associated landslides, etc.

Historical surface faulting When the timing of most recent movement on a fault is historic, then this field(s) describes evidence for surface faulting associated with historical earthquakes. Also included is seismological information for the historical earthquake.

Length This field specifies the end-to-end length of the Quaternary-age fault as measured from the most distal ends of the trace. The ends of overlapping or echelon traces are projected to a line defined by the average strike and the length is then determined from those projected end points. Also shown (in parentheses) is the cumulative length of all surface traces included in the fault, fault zone, or collection of faults.

Name (**Fault name** or **Section name**) The earliest referenced name for a structure or fault section (where appropriate) generally is given preference, except in cases where a more commonly accepted name is widely used in the recent literature. "Comments" may also contain other names and references in which they are used, the geographic limits of the structure, north to south or west to east, as shown in this compilation; various geographic limits that are different than in other studies are also included. Minor changes in original name may have been made for reasons of clarity or consistency (such as segment to section) where appropriate. We have found no faults in Ecuador that justify using the term "segment", owing to a lack of precise timing information.

Number

Structure number The structure (fault or fold) is assigned a number that is preceded by a two character abbreviation (Ecuador fault number 1 is EC-01) that is unique to each of the countries in the Western Hemisphere. References to the same structure shown in other compilations, such as CO-01 or PE-01 are included in "Comments".

Section number An alpha character is assigned to the northernmost or westernmost section of a fault (*e.g.*, fault EC-02 has two sections: EC-02A and EC-02B).

Number of sections (only used for faults with sections) Numeric value for number of sections (*e.g.*, 2) defined in studies that do not meet the minimum requirements for segments established for this compilation. "Comments" include reference in which sections are discussed; if the term "segment" is used in the literature, an explanation of why "section" is used in the database is provided.

Recurrence interval Time interval in yr (based on historic data, calendar or calibrated radiocarbon dates), in ^{14}C yr (based on uncalibrated radiocarbon dates), or in k.y. (thousand years, based on less precise dating methods, stratigraphy, or geomorphology). Unknown is shown if there is no published recurrence interval value. Alternative published recurrence intervals, starting with that which applies to the most recent time interval, are included in "Comments." Very few faults in Ecuador have established recurrence intervals.

References A bibliographic citation is included for all references pertinent to each structure. Papers published in Spanish are cited in Spanish, and may not conform to USGS style.

Section A geographic, geometric, structural portion of a fault or collection of faults that appear(s) to have a different character than adjacent portions of the fault (or fold). Typically, not enough information exists to show that this portion of the fault acts independently of adjacent portions, and thus does not qualify as a bona fide "segment" of a fault in a paleoseismic sense. There are no known faults with proven segments in Ecuador, although several faults are described as having sections. Further research is needed to document additional faults with sections or those with sections that may in fact be segments.

Sense of movement Includes thrust, less than 45° dip; reverse, greater than 45° dip; right-lateral strike-slip (dextral); left-lateral strike slip (sinistral); or normal faults. For oblique slip, the principle sense of movement is followed by secondary sense (*i.e.*, dextral, normal).

Slip rate The primary field shows an actual value or one of several slip-rate categories used for the map part of this compilation: <1 mm/yr, 1-5 mm/yr, or >5 mm/yr. Very few faults in Ecuador have established slip rates. “Unknown" precedes the suspected slip-rate or slip rate category if no published slip rate is known. "Comments" may include a synopsis of published slip rates and pertinent documentation. Generally speaking, there are two types of slip rates. The first type is termed a “Geologic slip rate” and is derived from the age and amount of offset of surficial geologic deposits. These rates are not precise, but allow one to place broad limits on possible slip rates, and hence characterize the fault in one of the above-mentioned categories. Most slip rates from Ecuador are geologically determined. The second type of slip rate is termed a “Paleoseismic slip rate” and is derived from times of faulting events and amounts of offset of geologic datums or piercing points. This type of slip rate is more precise, but is rare owing to the extensive amount of work involved (*i.e.*, detailed paleoseismologic studies involving trenching and numeric dating).

Synopsis and geologic setting This field provides a short summary that describes the level of study, provides a snapshot of the scope of data that follows in the database and provides a generalized perspective of the fault in terms of its regional geologic setting, amount of total offset, and general age of offset strata. Not all faults in the database have a synopsis and discussion of geologic setting.

Timing of most recent event (faulting or folding event) The primary field shows one of the two prehistoric time categories: latest Quaternary (Holocene and latest Pleistocene, <15 ka) or Quaternary (<1.6 Ma). This field may document historic surface faulting, although details of the earthquake related to the faulting will follow.

Type of studies This field briefly summarizes the types of studies conducted on the fault.

ACKNOWLEDGEMENTS

This project was supported by the USGS’s National Earthquake Hazards Reduction Program (NEHRP) and by the International Lithosphere Program (ILP) under the direction of Task Group II-2 (World Map of Major Active Faults). Carlos Costa provided coordination of the ILP efforts in South America. The Geology Department and Geophysical Institute of the National Polytechnic School (Departamento Geología y Instituto Geofísico, Escuela Politécnica Nacional), Quito, Ecuador, provided space, facilities, time, and technical assistance in order for the senior authors to complete this effort. In addition, they also provided meeting space for a previous ILP Task Group II-2 coordination meeting. We appreciate the thorough and constructive comments of Hans Diederix (formerly of International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands) who reviewed the manuscript and map.

REFERENCES CITED

Audemard, F.A., Machette, M.N., Dart, R.L., and Haller, K.M., 2000, Map and Database of Quaternary Faults in Venezuela and its Offshore Regions: U.S. Geological Survey Open-File Report 00-018, 76 p., 1 plate (1:2M scale).

Campbell, C.J., 1974, Ecuadorian Andes *in* Mesozoic-Cenozoic orogenic belt, data for orogenic studies: Geological Society of London Special Publication 4, p. 725-732.

Costa, C., Machette, M.N, Dart, R.L., Bastias, H.E., Paredes, J.D., Perucca, L.P., Tello, G.I., and Haller, K.M., 2000, Map and Database of Quaternary Faults and Folds in Argentina: U.S. Geological Survey Open-File Report 00-0108, 76 p., 90 p., 1 plate (1:4,000,000 scale).

Cowan, H., Machette, M.N., Haller, K.M., and Dart, R.L., 1998, Map and database of Quaternary faults and folds in Panama and its offshore regions: U.S. Geological Survey Open-File Report 98-779, 41 p., 1 plate (1:500,000 scale).

Cowan, Hugh, Machette, M.N., Amador, Xavier, Morgan, Karen S., Dart, R.L., and Bradley, Lee-Ann, 2000, Map and Database of Quaternary Faults and Folds in the Vicinity of Managua, Nicaragua: U.S. Geological Survey Open-File Report 00-0437, 61 p., 1 plate (1:750,000 scale).

Eguez, A., and Aspden, J., 1993, The Mesozoic-Cenozoic evolution of the Ecuadorian Andes: Second ISAG, Oxford (UK), p 179-182.

Gutscher, M.A., Malavieille, J., Lallemand, S., and Collot, J.Y., 1999, Tectonic segmentations of the North Andean margin—An impact of the Carnegie Ridge collision: Earth and Planetary Science Letters, v. 168, p. 255-270.

Haller, K.M., Machette, M.N., and Dart, R.L., 1993, Maps of Major Active Faults, Western Hemisphere; International Lithosphere Program (ILP) Project II-2: Guidelines for U.S. Database and Map: U.S. Geological Survey Open-File Report 93-338, 45 p.

Hey, R., 1977, Tectonic evolution of the Cocos-Nazca spreading center: Geological Society of America Bulletin, v. 88, p. 1404-1420.

Lavenu, A., Thiele, R., Machette, M.N., Dart, R.L., and Haller, K.M., 2000, Map and Database of Quaternary Faults and Folds in Bolovia and Chile: U.S. Geological Survey Open-File Report 00-0283, 38 p., 2 plates

Litherland, M., Aspden, J.A., and Jemielita, R.A., 1994, The metamorphic belts of Ecuador: Overseas Memoir of the British Geological Survey, No. 11.

Montero, W., Denyer, P., Barquero, R., Alvarado, G.E., Cowan, H., Machette, M.N., Haller, K.M., and Dart, R.L., 1998, Map and database of Quaternary faults and folds in Costa Rica and its offshore regions: U.S. Geological Survey Open-File Report 98-481, 63 p., 1 plate (1:750,000 scale).

Paris, Gabriel, Machette, M.N., Dart, R.L., and Haller, K.M., 2000, Map and Database of Quaternary Faults and Folds in Colombia and its Offshore Regions: U.S. Geological Survey Open-File Report 00-0284, 61 p., 1 plate (1:2,500,000 scale).

Pennington, W.D., 1981, Subduction of the eastern Panama basin and seismotectonics of northwestern South America: Journal of Geophysical Research, v. 86, p. 10753-10770.

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Boletin Geologia Ecuatoriano, v. 2, no. 1, p. 3-11.

DATABASE OF FAULTS AND FOLDS

EC-01, SAN LORENZO LINEAMENT

FAULT NUMBER: EC-01

FAULT NAME: San Lorenzo (lineament)

SYNOPSIS AND GEOLOGIC SETTING: This lineament appears to control the shoreline around the mouths of the Cayapas and Santiago rivers. The lineament is likely a fault in bedrock, although Quaternary movement is not proven.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 21.9 km (21.9 km)
AVERAGE STRIKE: N31°E±0°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Linear morphology of the shore line.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

Comments: Quaternary movement is not proven.

EC-02, ESMERALDAS FAULT

FAULT NUMBER: EC-02

FAULT NAME: Esmeraldas

SYNOPSIS AND GEOLOGIC SETTING: This structure controls the linear drainage of the Esmeraldas River. Previously, it was inferred to be a major structure that crosses the Andean chain.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and local field control.

FAULT GEOMETRY:

LENGTH: 58.4 km (63.6 km)
AVERAGE STRIKE: N26°W±13°

NUMBER OF SECTIONS: 2

EC-02A, NORTHERN SECTION

SECTION NUMBER: EC-02a

SECTION NAME: Northern

SECTION GEOMETRY

LENGTH: 21.3 km (21.6 km)
AVERAGE STRIKE: N34°W±12°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Linear control of the main drainage.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-02B, SOUTHERN SECTION

SECTION NUMBER: EC-02b

SECTION NAME: Southern

SECTION GEOMETRY

LENGTH: 41.1 km (42.0 km)
AVERAGE STRIKE: N22°W±13°
AVERAGE DIP: Unknown angle, dips east
SENSE OF MOVEMENT: Transpressional with probable left-lateral (sinistral) and reverse movements.

GEOMORPHIC EXPRESSION: Irregular curved scarps and control of drainages. The asymmetric development of alluvial terraces suggests uplift of the eastern block.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-03, RÍO CANANDÉ

FAULT NUMBER: EC-03

FAULT NAME: Río Canandé

SYNOPSIS AND GEOLOGIC SETTING: This fault partially forms the northern boundary of the main fore-arc basin in Ecuador. The structure cuts an anomalous arm of the Cordillera Oriental (Western) and towards the north it seems to control the limit of the Borbón basin and the Andean foothills (Pérez and others, 1994; Alvarado, 19980

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images.

FAULT GEOMETRY

LENGTH: 59.6 km (62.3 km)
AVERAGE STRIKE: N74°E±19°

NUMBER OF SECTIONS: 3

REFERENCES

Alvarado, A., 1998, Variation du champs de contrainte et de deformation et quantification des deformations actives du bloc Côtiere de l'Equateur: DEA, Paris Sud Orsay, Unpublished report, 54 p.

Pérez, V.H., Hibsch, C., Alvarado, A. and Yepes H., 1994, Paleosismicidad de la ciudad de Quito (Ecuador) a través del análisis de la paleolicuación Cuaternaria: Estudios de Geografía, Quito, v. 6, p. 31-46.

EC-03A, WESTERN SECTION

SECTION NUMBER: EC-03a

SECTION NAME: Western

SECTION GEOMETRY

LENGTH: 16.0 km (16.5 km)
AVERAGE STRIKE: N83°W±18°

AVERAGE DIP: Unknown angle, dips to the south
SENSE OF MOVEMENT: Normal with right-lateral (dextral) component.

GEOMORPHIC EXPRESSION: Forms discontinuos scarps with triangular facets along fault trace, which is mostly concealed. The drainages are deflected in same direction as the scarp (right lateral).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma).

EC-03B, CENTRAL SECTION

SECTION NUMBER: EC-03b

SECTION NAME: Central

SECTION GEOMETRY
LENGTH: 25.8 km (26.2 km)
AVERAGE STRIKE: N71°E±10°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Right-lateral (dextral)

GEOMORPHIC EXPRESSION: Offset of drainages and topographic control along most of the fault trace.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-03C, EASTERN SECTION

SECTION NUMBER: EC-03c

SECTION NAME: Eastern

SECTION GEOMETRY
LENGTH: 19.7 km (19.6 km)
AVERAGE STRIKE: N60°E±3°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Probable right-lateral (dextral)

GEOMORPHIC EXPRESSION: Linear control of the topography and drainages along parts of the fault trace, which is mostly concealed.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-04, GALERA FAULT

FAULT NUMBER: EC-04

FAULT NAME: Galera

SYNOPSIS AND GEOLOGIC SETTING: This is a series of subparallel structures that appears to affect mostly Miocene-Pliocene rocks, but the faults appear to deform Quaternary marine terraces as seen on radar images. The easternmost fault trace is shown as a mostly discontinuous structure, whereas the two western faults are shown as mainly concealed or inferred on the map.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
LENGTH: 25.1 km (62.3 km)
AVERAGE STRIKE: N55°E±4°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral with normal component

GEOMORPHIC EXPRESSION: Fault scarps and linear control of topography and drainage is most prominent on the easternmost fault trace.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-05, BUGA FAULT

FAULT NUMBER: EC-05

FAULT NAME: Buga

SYNOPSIS AND GEOLOGIC SETTING: This fault forms has a weak expression (lineament) on radar images. It may represent a northward extension of the Cañaveral fault [EC-07] , which is one of the most important fault systems in NW Ecuador.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politecnica Nacional, Departmento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: N13°E ±13°
AVERAGE STRIKE: 24.6 km (24.9 km)
AVERAGE DIP: Unknown angle to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Unknown

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-06, MACHE LINEAMENT

FAULT NUMBER: EC-06

FAULT NAME: Mache (lineament)

SYNOPSIS AND GEOLOGIC SETTING: This lineament is only inferred from radar images, and Quaternary faulting is not proven.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images.

FAULT GEOMETRY
LENGTH: 57.5 km (66.7 km)
AVERAGE STRIKE: N39°E±15°

AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms a weak lineament on radar images.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-07, CAÑAVERAL FAULT

FAULT NUMBER: EC-07

FAULT NAME: Cañaveral

SYNOPSIS AND GEOLOGIC SETTING: The structure belongs to the most important fault system in NW Ecuador. It controls the uplift of basement rocks and the formation of the coastal mountains. The southern section of the Cañaveral fault system [EC-07c] is separated from the central section by a 20 km gap. It has previously been named the Jama fault, but is considered herein to be a discontinuous extension of the Cañaveral fault.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Radar and photo interpretation and field studies.

FAULT GEOMETRY
LENGTH: 137.7 km (173.8 km)
AVERAGE STRIKE: N37°E±16°

NUMBER OF SECTION: 3

EC-07A, NORTHERN SECTION

SECTION NUMBER: EC-07a

SECTION NAME: Northern

SECTION GEOMETRY
LENGTH: 37.5 km (52.7 km)
AVERAGE STRIKE: N31°E±19°
AVERAGE DIP: Probable high angle, dips to the west.
SENSE OF MOVEMENT: Reverse with dextral component

GEOMORPHIC EXPRESSION: Forms discontinuos scarps and controls the course of rivers. Trace shown as mainly concealed owing to discontinuos nature of expression.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-07B, CENTRAL SECTION

SECTION NUMBER: EC-07b

SECTION NAME: Central

SECTION GEOMETRY
LENGTH: 34.2 km (34.5 km)
AVERAGE STRIKE: N53°E±10°

AVERAGE DIP: Unknown angle, down to southeast
SENSE OF MOVEMENT: Transtensional; right lateral and normal components.

GEOMORPHIC EXPRESSION: Streams flow along the trace of the fault suggesting major structural control owing to transtensional motion. Topography along a large portion of the fault shows a pronounced scarp and fault defines an extensional basin.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma).

EC-07C, JAMA SECTION

SECTION NUMBER: EC-07c

SECTION NAME: Southern

SECTION GEOMETRY
LENGTH: 46.7 km (71.2 km)
AVERAGE STRIKE: N37°E±12°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: This fault forms a well defined lineament (on radar images) that controls the drainage of El Venado River. Elongated hills along the lineament may be shutter ridges related to transpressional movement, although this sense of movement is not well documented.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-07D, SAN ISIDRO SECTION

SECTION NUMBER: EC-07d

SECTION NAME: San Isidro

SECTION GEOMETRY
LENGTH: 15.1 km (15.4 km)
AVERAGE STRIKE: N18°E±11°
AVERAGE DIP: Unknown, dips to west
SENSE OF MOVEMENT: Normal with dextral component

GEOMORPHIC EXPRESSION: The fault along Estero Hondo Creek affects Quaternary terraces that show meter-size displacements.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-08, QUININDÉ FAULT

FAULT NUMBER: EC-08

FAULT NAME: Quinindé

SYNOPSIS AND GEOLOGIC SETTING: This structure borders the Quaternary continental sedimentary Santo Domingo basin of the fore-arc coastal zone. The coastal mountains (including their core of basement rock) appears to be uplifted and is limited by this structure. Thus, this fault probably has an ancient heritage.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
LENGTH: 78.2 km (101.2 km)
AVERAGE STRIKE: N25°E±15°
AVERAGE DIP: Unknown angle, dips to the west
SENSE OF MOVEMENT: Probable reverse transpressive.

GEOMORPHIC EXPRESSION: The Quinindé River flows along the trace of the fault. It forms the western limit of the Santo Domingo basin.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-10, BAHÍA FAULT

FAULT NUMBER: EC-10

FAULT NAME: Bahía

SYNOPSIS AND GEOLOGIC SETTING: Tertiary sediments appear uplifted to the east of the fault. Elongated marine terraces are also involved with this structure.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Radar and photo interpretation

FAULT GEOMETRY
LENGTH: 43.4 km (46.2 km)
AVERAGE STRIKE: N11°W±20°

NUMBER OF SECTIONS 2

EC-10A, NORTHERN SECTION

SECTION NUMBER: EC-10a

SECTION NAME: Northern

SECTION GEOMETRY
LENGTH: 22.2 km (22.4 km)
AVERAGE STRIKE: N24°W±10°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Possible left-lateral

GEOMORPHIC EXPRESSION: It controls the shoreline and forms well developed scarps with triangular facets along the beach.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-10B, SOUTHERN SECTION

SECTION NUMBER: EC-10b

SECTION NAME: Southern

SECTION GEOMETRY
- LENGTH: 22.2 km (23.8 km)
- AVERAGE STRIKE: N1E°±23°
- AVERAGE DIP: Unknown, dips to the west
- SENSE OF MOVEMENT: Possible reverse to transpressive

GEOMORPHIC EXPRESSION: It forms a weak irregular fault trace suggesting reverse movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-11, CALCETA FAULT

FAULT NUMBER: EC-11

FAULT NAME: Calceta

SYNOPSIS AND GEOLOGIC SETTING: The structure forms the west boundary of the coastal mountains. It affects mainly Tertiary sedimentary rocks, but morphologic features along the fault suggest Quaternary activity. The trace of the fault is shown as mainly inferred or concealed.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
- LENGTH: 50.3 km (51.7 km)
- AVERAGE STRIKE: N29°E±15°
- AVERAGE DIP: Unknown
- SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: The structure forms a lineament along the west margin of the Coastal Range. Unnamed morphologic features along the fault suggest Quaternary activity.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-12, DAULE FAULT

FAULT NUMBER: EC-12

FAULT NAME: Daule

SYNOPSIS AND GEOLOGIC SETTING: The structure constitutes the eastern boundary of the coastal mountains. It probably extends toward the north and may be associated with the Quinindé fault [EC-08]. Although most of the trace of the Daule fault is concealed, there is some seismicity associated with it.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images.

FAULT GEOMETRY
LENGTH: 77.9 km (79.9 km)
AVERAGE STRIKE: N32°E±14°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: The Daule River appears to be controlled by this fault where it borders the Quaternary Daule Basin.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-13, BUENA FE FAULT

FAULT NUMBER: EC-13

FAULT NAME: Buena Fe

SYNOPSIS AND GEOLOGIC SETTING: This structure probably controls alluvial sedimentation along the Quevedo-Babahoyo Basin. The fault's expression is not clear because river erosion has destroyed all morphologic evidence of recent movement.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
LENGTH: 61.1 km (62.9 km)
AVERAGE STRIKE: N38°E±15°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms a weak lineament on radar images . However, the fault's expression is not clear because river erosion has destroyed all morphologic evidence of recent movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-14, JIPIJAPA FAULT

FAULT NUMBER: EC-14

FAULT NAME: Jipijapa

SYNOPSIS AND GEOLOGIC SETTING: The structure borders the coastal hills toward the west, where oceanic basement rock appears uplifted suggesting an ancient activity to the fault. Collision of the Carnegie Ridge (Nazca Plate) with the South American Plate could be related to the kinematics of this fault. The Julcuy fault constitutes the southern section of the Jipijapa fault.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
LENGTH: 43.0 km (39.8 km)
AVERAGE STRIKE: N18°E±11°
NUMBER OF SECTIONS: 2

EC-14A, JIPIJAPA SECTION

SECTION NUMBER: EC-14A

SECTION NAME: Jipijapa

SECTION GEOMETRY
LENGTH: 23.6 km (23.8 km)
AVERAGE STRIKE: N13°E±10°
AVERAGE DIP: Unknown angle, dips to the west
SENSE OF MOVEMENT: Reverse (inferred)

GEOMORPHIC EXPRESSION: Anomalous border of basin showing irregular escarpment related to inferred reverse fault.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-14B, JULCUY (FAULT) SECTION

SECTION NUMBER: EC-14B

SECTION NAME: Julcuy(fault)

SECTION GEOMETRY
LENGTH: 15.9 km (16.0 km)
AVERAGE STRIKE: N27°E±9°
AVERAGE DIP: Unknown angle, dips to the west
SENSE OF MOVEMENT: Reverse (inferred)

GEOMORPHIC EXPRESSION: Extension of the Jipijapa [EC-14a] section. Forms escarpment related to reverse(?) faulting.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-15, RÍO COLIMES FAULT

FAULT NUMBER: EC-15

FAULT NAME: Río Colimes

SYNOPSIS AND GEOLOGIC SETTING: The structure limits the youngest basin of the continental alluvial deposits of the Daule River.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images.

FAULT GEOMETRY
LENGTH: 27.2 km (27.3 km)
AVERAGE STRIKE: N53°E±6°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Drainages are fault controlled (form straight lineament).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-16, COLONCHE FAULT ZONE

FAULT NUMBER: EC-16

FAULT NAME: Colonche (fault zone)

SYNOPSIS AND GEOLOGIC SETTING: The Colonche fault zone border the Chongón-Colonche Cordillera (Mountains) on the south. It is probably a reactivated fault associated with the formation of the Tertiary Progreso Basin, involving tectonic inversión. Oceanic basement rocks are uplifted on the north. The fault zone has four traces that extend for >100 km in a southeast direction from near the Pacific coast to Guayaquil.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretationof radar images.

FAULT GEOMETRY
LENGTH: 106.4 km (87.9 km)
AVERAGE STRIKE: N59°W±22°

NUMBER OF SECTIONS: 4

EC-16A, NORTHWESTERN SECTION

SECTION NUMBER: EC-16a

SECTION NAME: Northwestern

SECTION GEOMETRY
LENGTH: 10.3 km (10.5 km)
AVERAGE STRIKE: N44°W±13°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Probable reverse

GEOMORPHIC EXPRESSION: It forms a weak curved trace suggesting reverse faulting.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-16B, NORTHERN SECTION

SECTION NUMBER: EC-16b

SECTION NAME: Northern

SECTION GEOMETRY
LENGTH: 22.8 km (24.1 km)
AVERAGE STRIKE: N39°W±21°
AVERAGE DIP: Probably to the northeast.
SENSE OF MOVEMENT: Reverse to transpressional.

GEOMORPHIC EXPRESSION: Foothills uplifted along curved fault trace and offset drainages suggest a reverse to transpressional fault escarpment.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-16C, CENTRAL SECTION

SECTION NUMBER: EC-16c

SECTION NAME: Central

SECTION GEOMETRY
- LENGTH: 20.9 km (20.9 km)
- AVERAGE STRIKE: N58°W±4°
- AVERAGE DIP: Unknown
- SENSE OF MOVEMENT: Probably dominant left lateral (sinistral)

GEOMORPHIC EXPRESSION: The structure forms a weak but conspicuous straight lineament where drainages show left-lateral displacements.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-16D, SOUTHERN SECTION

SECTION NUMBER: EC-16d

SECTION NAME: Southern

SECTION GEOMETRY
- LENGTH: 32.1 km (32.4 km)
- AVERAGE STRIKE: N79°W±9°
- AVERAGE DIP: Unknown, dips to the north
- SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Forms curved trace where the basement is uplifted towards the north. Irregular trace of escarpment suggests dominant reverse faulting.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-17, CARRIZAL FAULT

FAULT NUMBER: EC-17

FAULT NAME: Carrizal

SYNOPSIS AND GEOLOGIC SETTING: This fault constitutes an old reactivated structure related to the Progreso basin development (Toro, 1994). It affects Neogene rocks (Benítes, 1995), but Quaternary movement is suspected from the linear control of stream drainages. The trace of the fault is shown as concealed for its entire length.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images and seismic records.

FAULT GEOMETRY
- LENGTH: 66.0 km (67.9 km)
- AVERAGE STRIKE: N53°W±15°
- AVERAGE DIP: Unknown
- SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Linear control of the drainages suggests Quaternary activity of this structure.

RECURRENCE INTERVAL: Unknown

SLIP RATE: <1 mm/yr

Comments: Placed in the <1 mm/yr category, but a slip rate of <0.2 mm/yr was determined from a vertical offset of 1,000 m since Paleogene times (Benítes, 1995). This rate may not apply to the Quaternary.

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Benítes, S., 1995, Evolution geodynamique de la province Cotiere sur-equatorienne au Cretace superieur-Teriaire: Grenoble, France, Université Joseph Fournier-Grenoble 1, 221 p.

Toro, J., 1994, Geodinámica de la cuenca sedimentaria Progreso, Provincia de Guayas: Quito, Ecuador, Escuela Politécnica Nacional, thesis, 428 p.

EC-18, LA CRUZ FAULT

FAULT NAME: La Cruz

SYNOPSIS AND GEOLOGIC SETTING: Recognized as a Neogene fault related to the formationa of the Progreso basin, with possible reactivation during Pleistocene time.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images, seismic records, and microtectonic studies.

FAULT GEOMETRY

LENGTH: 47.8 km (47.8 km)
AVERAGE STRIKE: N50°W±0°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral
Comments: Determined from geophysical studies.

GEOMORPHIC EXPRESSION: Forms a nearly straight lineament which is shown as a concealed or inferred fault on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: <1 mm/yr

Comments: Placed in the <1 mm/yr category, but a slip rate of <0.2 mm/yr was determined from vertical offset of 3,000 m since Oligocene time (Benítes, 1995); rate may not be applicable for the Quaternary.

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

Comments: This fault shows evidence of microseismic activity.

REFERENCES

Benítes, S., 1995, Evolution geodynamique de la province Cotiere sur-equatorienne au Cretace superieur-Teriaire: Grenoble, France, Université Joseph Fournier-Grenoble 1, thesis, 221 p.

Toro, J., 1994, Geodinámica de la cuenca sedimentaria Progreso, Provincia de Guayas: Quito, Ecuador, Escuela Politécnica Nacional, thesis, 428 p.

EC-19, CHANDUY FAULT

FAULT NUMBER: EC-19

FAULT NAME: Chanduy

SYNOPSIS AND GEOLOGIC SETTING: This northwest-trending fault parallels the northern coast of the Gulf of Guayaquil and may be similar to the Posorja fault [EC-19], which is a normal fault system within the Jambelí basin. Marine terraces appear to be defored by this fault.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images.

FAULT GEOMETRY
LENGTH: 34.4 km (34.7 km)
AVERAGE STRIKE: N45°W±9°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Fault forms a straight shoreline and controls drainages as they approach the beach (coast). Shown as a concealed or inferred fault on the map

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-20, POSORJA FAULT

FAULT NUMBER: EC-20

FAULT NAME: Posorja

SYNOPSIS AND GEOLOGIC SETTING: This northwest-trending structure is related to the normal fault system within the Jambelí basin. This fault system allows the opening of Guayaquil Gulf and is probably associated to the Pallatanga fault zone [EC-50].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Bathymetric and seismic studies (Benites, 1995; Lions, 1995).

FAULT GEOMETRY
LENGTH: 73.5 km (75.0 km)
AVERAGE STRIKE: N74°W±15°
AVERAGE DIP: Unknown angle, dips to the south
SENSE OF MOVEMENT: Normal

GEOMORPHIC EXPRESSION: Although everywhere submerged, it forms submarine scarps.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Benites, S., 1995, Evolution geodynamique de la province Cotiere sur-equatorienne au Cretace superieur-Teriaire: Grenoble, France, Université Joseph Fournier-Grenoble 1, thesis, 221 p.

Lions, R., 1995, Evolution geodynamique de un bassin d´avant-arc neogene en contexte décrochant—L'ouverture du Golfe de Guayaquil: Nice, France, Université de Nice-Sophia Antipolis, thesis DEA, p. 35

EC-21, JAMBELÍ FAULT

FAULT NUMBER: EC-21

FAULT NAME: Jambelí

SYNOPSIS AND GEOLOGIC SETTING: The fault is probably a branch of the Pallatanga fault zone [EC-50].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Bathymetric and seismic studies.

FAULT GEOMETRY
LENGTH: 16.9 km (16.9km)
AVERAGE STRIKE: N58°E±0°

AVERAGE DIP: Unknown angle, dips to the south
SENSE OF MOVEMENT: Normal

GEOMORPHIC EXPRESSION: Although everywhere submerged, it forms submarine scarps.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Benites, S., 1995, Evolution geodynamique de la province Cotiere sur-equatorienne au Cretace superieur-Teriaire: Grenoble, France, Université Joseph Fournier-Grenoble 1, thesis, 221 p.

EC-22, PUNÁ FAULT

FAULT NUMBER: EC-22

FAULT NAME: Puná

SYNOPSIS AND GEOLOGIC SETTING: This northeast-trending fault has been interpreted by Iglesias and others (1991) as part of the Puná-Milagro-Chazo Juan fault system. It bisects the Zambapala Ridge, which is formed by older reverse faults. The Puná fault juxtaposes sediment of the Tablazo Formation (Pleistocene?) against sediment of the Puná Formation (Pleistocene) (Benites, 1995). Interestingly, there is a pull-apart basin on the top of ridge suggesting a sequence of transtensional and transpressional events (Lions, 1995).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Radar and satellite images.

FAULT GEOMETRY
LENGTH: 43.9 km (43.9 km)
AVERAGE STRIKE: N46°E±0°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: It forms an elongated ridge (Zambapala), fault scarps, and a pull-apart basin on top of the ridge.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Benites, S., 1995, Evolution geodynamique de la province Cotiere sur-equatorienne au Cretace superieur-Teriaire: Grenoble, France, Université Joseph Fournier-Grenoble 1, thesis, 221 p.

Lions, R., 1995, Evolution geodynamique de un bassin d´avant-arc neogene en contexte décrochant—L'ouverture du Golfe de Guayaquil: Nice, France, Université de Nice-Sophia Antipolis, thesis DEA, p. 30.

EC-23, SAN ISIDRO FAULT

FAULT NUMBER: EC-23

FAULT NAME: San Isidro

SYNOPSIS AND GEOLOGIC SETTING: This northeast-trending fault has been interpreted by Soulas and others (1991) as a prolongation of the Colombian Cauca-Patía fault system, which is part of the Romeral fault system [CO-15] in Colombia. The San Isidro fault displaces late Pleistocene glacial moraines and other Quaternary deposits. It may be associated with El Angel fault [EC-24], although they are separated by a 15-km-long gap in faulting.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and field studies.

FAULT GEOMETRY

LENGTH: 11.7 km (11.7 km)
AVERAGE STRIKE: N36°E±5°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Probable strike slip (dextral)
Comments: Faults to the north and south with the same orientation are known to be dextral.

GEOMORPHIC EXPRESSION: The fault is described as having benches, offset drainages and shutter ridges, all along a clear trace of fault.

RECURRENCE INTERVAL: 1,000-2,000 years

Comments: The above interval has been defined for the whole fault, and this recurrence is believed to be associated with an earthquake having a maximum Ms of 6.9 (Soulas and others, 1991).

SLIP RATE: 0.2-1.0 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: It displaces late Pleistocene glacial moraines and other Quaternary deposits.

REFERENCES

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuat., v. 2, no. 1, p. 3-11.

EC-24, EL ANGEL FAULT

FAULT NUMBER: EC-24

FAULT NAME: El Angel

SYNOPSIS AND GEOLOGIC SETTING: This northeast-trending fault has been interpreted by Soulas and others (1991) as a prolongation of the Colombian Cauca-Patía fault system. It displaces late Pleistocene glacial glacial moraines and other Quaternary deposits. It may be associated with San Isidro fault [EC-23], although they are separated by a 15-km-long gap in faulting.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and field control.

SECTION GEOMETRY

LENGTH: 26.3 km (26.3 km)
AVERAGE STRIKE: N43°E±3°
AVERAGE DIP: Unknown angle, dips to the northwest
SENSE OF MOVEMENT: Reverse, strike slip(?) dextral
Comments: Faults to the north and south with the same orientation are known to be dextral.

GEOMORPHIC EXPRESSION: Northeast of El Angel (village), the fault forms some sag ponds, offset hills, and confined (closed) depressions, all of which suggest young (Holocene) movement with a component of dextral motion.

RECURRENCE INTERVAL: 1,000-2,000 years

Comments: The above interval has been indicated for the whole fault, and is believed to be associated with the maximum earthquake magnitude of 6.9 Ms (Soulas and others, 1991).

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: It displaces late Pleistocene glacial glacial moraines and other Quaternary deposits.

REFERENCES

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuat., v. 2, no. 1, p. 3-11.

EC-25, RÍO AMBI FAULT

FAULT NUMBER: EC-25

FAULT NAME: Río Ambi

SYNOPSIS AND GEOLOGIC SETTING: This northeast-trending structure controls the western boundary of the sedimentary Pliocene Chota basin. It mainly affects Pliocene-Quaternary volcanic deposits.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation.

FAULT GEOMETRY

LENGTH: 15.6 km (15.9 km)
AVERAGE STRIKE: N31°E±15°
AVERAGE DIP: Unknown angle, dips to the WNW
SENSE OF MOVEMENT: Reverse, strike-slip(?) dextral
Comments: Faults to the north and south with the same orientation are known to be dextral.

GEOMORPHIC EXPRESSION: The fault forms scarps and elongated hills along the Río Ambi Valley.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-26, OTAVALO FAULT

FAULT NUMBER: EC-26

FAULT NAME: Otavalo

SYNOPSIS AND GEOLOGIC SETTING: Reported and mapped by Soulas (1988) on the west side of Otavalo (village). Its trend is NE-SW. At the north end, this fault continues to Atuntaqui (village), which suggests a left step with the San Isidro fault [EC-24] farther north. At the south end, this fault probably ends at a small transpressive basin near the Chavezpamba fault zone (Eguez and Yepes, 1993).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and field control.

FAULT GEOMETRY

LENGTH: 21.3 km (21.3 km)
AVERAGE STRIKE: N42°E±4°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: Benches and shutter ridges have been described along the fault.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., Yepes, H., 1993, Estudio sismotectónico y de peligro sísmico para el proyecto hidroléctrico Chespi: Escuela Politécnica Nacional, Instituto Geofísico (inédito).

Soulas, J.P., 1988, Informe de misión en el Ecuador., Proyecto UNDRO-EPN: Programa de prevención y planificación para desastres en el Ecuador y países vecinos: Geneve, Switzerland, UNDRO. p. 21.

EC-27, BILLECOCHA-HUYRAPUNGO FAULT

FAULT NUMBER: EC-27

FAULT NAME: Billecocha-Huyrapungo

SYNOPSIS AND GEOLOGIC SETTING: The Billecocha-Huyrapungo fault has two sections, each with different apparent sense of movement. The Billecocha section is observed on an eroded plateau that is underlain (formed) by late Miocene and Pliocene volcanic deposits. This plateau is located east of an asymmetric anticline (fold). It is partially covered by Quaternary lava flows and volcanic material from the Cotacachi and Yanaurcu volcanoes. The morphology of the plateau was shaped by the last glaciation (ca. 15 ka) and subsequently smoothed by deposition of Holocene volcanic deposits (Ego and others, 1995).

The Huayrapungo section has been described as a prolongation of the Billecocha section by Eguez and others (1993). This section extends from the Cambugán River on the south to the Muyurcu volcanic domes (probably Pleistocene) on the north, thus having a length of about 30 km. At the south end, traces of this fault section form a horse-tail rupture pattern, with a N-S reverse secondary fault (motion determined from kinematics; Eguez and others, 1993).

Ego and others (1995) interpreted the Billecocha section as a normal fault caused by gravitational effects. Conversely, Eguez and others (1993) interpret the Huayrapungo section as a strike-slip fault of tectonic origin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Inspection of SPOT images, photo interpretation, as well as fieldwork and microtectonic studies.

FAULT GEOMETRY
LENGTH: 33.2 km (21.9 km)
AVERAGE STRIKE: N33°E±8°

NUMBER OF SECTIONS: 2

EC-27A, BILLECOCHA SECTION

SECTION NUMBER: EC-27a

SECTION NAME: Billecocha

SECTION GEOMETRY
LENGTH: 7.0 km (7.0 km)
AVERAGE STRIKE: N25°E±4°
AVERAGE DIP: Unknown, dips to southeast
SENSE OF MOVEMENT: Normal(?)
Comments: Ego and others (1995) interpreted the Billecocha section as a normal fault caused by gravitational effects (landsliding). The geomorphology, structural setting, and southern (Huayrapungo) section suggest that the fault could have strike-slip movement.

GEOMORPHIC EXPRESSION: The fault forms scarps, sag ponds, and offset drainages. The latter features are suggestive of strike slip movement, but this may be an artifact of terminalogy (sag pond versus ponded drainage) rather than origin.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comentarios: On the basis of the morphology of the fault scarp, Ego and others (1995) suggested only one movement, which was dated between 5,700 and 10,000 yrs B.P.

EC-27B, HUAYRAPUNGO SECTION

SECTION NUMBER: EC-27b

SECTION NAME: Huayrapungo

SECTION GEOMETRY

LENGTH: 14.9 km (14.9 km)
AVERAGE STRIKE: N37°E±4°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral
Comments: The faults kinematics have been determined by microtectonic analysis (Eguez and others, 1993) and its structural setting within a larger system of dextral faults.

GEOMORPHIC EXPRESSION: Fault is characterized by scarps showing triangular facets along linear valleys. Although triangular facets are not entirely diagnostic of faulting, they are believed to be the result of strike slip movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Ego, F., Sebrier, M., Carey-Gailhardis, E., Beate, B., 1995, Are the Billecocha normal faults revealing of extension due to lithospheric body forces in northern Andes (Ecuador)?: Orsay, France, Université de Paris-Sud, thesis, p. 209

Eguez, A., y Yepes, H., 1993, Estudios sismotectónicos y de peligro sísmico para el proyecto hidroléctrico Chespi: Escuela Politécnica Nacional, Instituto Geofísico (inédito).

EC-28, APUELA FAULT

FAULT NUMBER: EC-28

FAULT NAME: Apuela

SYNOPSIS AND GEOLOGIC SETTING: This fault partially disturbs the contact between Miocene Apuela intrusive rocks and the Eocene Macuchi and Unacota formations. However, the Apuela fault affects Pleistocene alluvial and glacial deposits. This fault has a sinuous pattern along the Apuela and Intag River valleys. Southward, the fault terminates 7 km west of the Nanegalito fault [EC-29].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 53.8 km (75.0 km)
AVERAGE STRIKE: N48°E±11°

NUMBER OF SECTIONS: 3

EC-28A, NORTHEASTERN SECTION

SECTION NUMBER: EC-28a

SECTION NAME: Northeastern

SECTION GEOMETRY

LENGTH: 25.4 km (25.5 km)

AVERAGE STRIKE: N50°E±12°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: Fault offsets and blocks drainages. Fault trace shown as discontinuos.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-28B, CENTRAL SECTION

SECTION NUMBER: EC-28b

SECTION NAME: Central

SECTION GEOMETRY
LENGTH: 20.4 km (20.4 km)
AVERAGE STRIKE: N49°E±7°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral
Comments: Determined from offset drainages.

GEOMORPHIC EXPRESSION: Fault offsets and blocks drainages along most of its trace. Shown as mostly continuous trace on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-28C, SOUTHERN SECTION

SECTION NUMBER: EC-28c

SECTION NAME: Southern

SECTION GEOMETRY
LENGTH: 28.4 km (29.1 km)
AVERAGE STRIKE: N46°E±14°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: Poorly expressed, shown as concealed along its trace.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., Yepes, H., 1993, Estudios sismotectónicos y de peligro sísmico para el proyecto hidroléctrico Chespi: Escuela Politécnica Nacional, Instituto Geofísico (inédito).

EC-29, NANEGALITO FAULT ZONE

FAULT NUMBER: EC-29

FAULT NAME: Nanegalito (zone)

SYNOPSIS AND GEOLOGIC SETTING: This fault zone is observed from the Guayllabamba River in the north, to Mindo (village) in the south and is generally about 1.5 km wide. To the north, it continues to near the Quinde

and Azabí Rivers, where some evidence of fault control can be observed. Near Nanegalito (village), this fault has caused 2 km of dextral offset of the Alambi River. It also affects the contact of the Nanegalito intrusive body with surrounding rocks. Colluvial deposits of Pliocene-Pleistocene age are faulted.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation, fieldwork, and microtectonic studies.

FAULT GEOMETRY
LENGTH: 43.6 km (49.1 km)
AVERAGE STRIKE: N37°E±8°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral
Comments: Determined from 2 km of long-term offset of the Alambi River.

GEOMORPHIC EXPRESSION: Fault forms trenches, ridges, and triangular facets; all are indicators of young movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: 1-5 mm/yr
Comments: Inferred from estimated offset of drainages (basis of age is not stated).

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)
Comments: Inferred from young geomorphic expression and high estimated rate of slip.

REFERENCES

Eguez, A., Yepes, H., 1993, Estudios sismotectónicos y de peligro sísmico para el proyecto hidroléctrico Chespi: Escuela Politécnica Nacional, Instituto Geofísico (inédito).

EC-30, EL CINTO FAULT

FAULT NUMBER: EC-30

FAULT NAME: El Cinto

SYNOPSIS AND GEOLOGIC SETTING: The structure affects volcanic deposits of the Quaternary Pichincha and Atacazo volcanoes.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and field studies.

FAULT GEOMETRY
LENGTH: 24.4 km (20.4 km)
AVERAGE STRIKE: N43°W±13°

NUMBER OF SECTIONS: 2

EC-30A, GUAYACÁN SECTION

SECTION NUMBER: EC-30a

SECTION NAME: Guayacán

SECTION GEOMETRY
LENGTH: 12.2 km (12.4 km)
AVERAGE STRIKE: N38°W±11°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Probable left lateral (sinistral)

GEOMORPHIC EXPRESSION: It forms a straight lineament almost 8 km long related to scarps and shutter ridges along the deeper valleys. The fault is shown as mostly discontinuous on the basis of its geomorphic expresión.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-30B, RÍO CINTO SECTION

SECTION NUMBER: EC-30b

SECTION NAME: Río Cinto

SECTION GEOMETRY

LENGTH: 8.0 km (8.0 km)
AVERAGE STRIKE: N51°W±9°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Left-lateral (sinistral)

GEOMORPHIC EXPRESSION: The fault controls the drainages of the Cinto and Tandacazo rivers (Eguez and Yepes, 1994).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-31, QUITO FAULT

FAULT NUMBER: EC-31

FAULT NAME: Quito

Comments: Named the Quito-Ilumbisí fault by Soulas and others (1991). The simpler name Quito fault is used here. These faults extend along the eastern margin of a high (uplifted) basin that the city of Quito is built on.

SYNOPSIS AND GEOLOGIC SETTING: These reverse faults limit and produce the elongated ridges that border the eastern side of the Pliocene-Quaternary Quito basin. These en echelon ridges are underlain by fluvial and pyroclastic deposits and form a broad flexure covered by deposits of the Cangahua formation (loess). This structure (plateau) has been described as a fold related to a blind thrust. Gravity-induced normal faults appear on the top and the flanks of the flexure (Soulas and others, 1991; Ego and others, 1995).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 30.5 km (34.2 km)
AVERAGE STRIKE: N9°E±21°

NUMBER OF SECTIONS: 2

Comments: Sections defined by right step between two parallel strands (sections).

EC-31A, NORTHERN SECTION

SECTION NUMBER: EC-31a

SECTION NAME: Northern

Comments: Northern of two sections. South section is more eastward.

SECTION GEOMETRY

LENGTH: 17.5 km (18.5 km)

AVERAGE STRIKE: N4°E±22°

AVERAGE DIP: 60° to the west.

Comments: The dip was determined from a composite focal mechanism calculated by Bonilla and others (1992) and Guiller (personal communication to compilers).

SENSE OF MOVEMENT: Reverse, with dextral component.

GEOMORPHIC EXPRESSION: This fault section forms a broad asymmetric flexure with a steep eastern limb. The Quito Basin is separated from and about 400 m above the adjacent Interandean Valley (Cumbaya Basin) by the flexural ridge. Other morphological features include disturbed drainages. Scarps involving many landslides are located at the eastern limit of the Quito Basin.

RECURRENCE INTERVAL: 1.5-4.0 k.y.

Comments: Calculated from slip rate reported by Soulas and others (1991)

SLIP RATE: 0.2-1.0 mm/yr

Comments: Determined from offset of Quaternary terraces of the Monjas River (Soulas and others, 1991)

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Inferred from slip rate reported above.

EC-31B, SOUTHERN SECTION

SECTION NUMBER: EC-31b

SECTION NAME: Southern

Comments: Southern of two sections. Northern section is more westward.

SECTION GEOMETRY

LENGTH: 15.0 km (15.7 km)

AVERAGE STRIKE: N16°E±19°

AVERAGE DIP: 60° to west.

Comments: The dip was determined from a composite focal mechanisms calculated by Bonilla and others (1992) and by Guiller (personal communication to compilers). This historic earthquake is thought to have been associated with this section of the Quito fault, although no historic surface deformation has been documented.

SENSE OF MOVEMENT: Reverse dextral

GEOMORPHIC EXPRESSION: This section forms a broad flexure with a steep eastern limb. Numerous landslides located at the eastern limit of the Quito basin affect the steep eastern limb of the flexure. Also, there is as much as 400 m altitude difference between adjacent basins., which has caused entrenchment of streams that drain east across the flexure.

RECURRENCE INTERVAL: 1.5-4.0 k.y.

Comments: Calculated from slip rate reported by Soulas and others (1991)

SLIP RATE: 0.2-1.0 mm/yr

Comments: Determined from offset of Quaternary terraces of the Monjas River (Soulas and others, 1991)

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Inferred from slip rate reported above.

REFERENCES

Bonilla, F., Pérez, V.H., Sánchez, A., Ruiz, M., Yepes H., Chatelain J.L., 1992, Análisis preliminar de la microsismicidad de la zona de Quito-Ecuador período 1988-1992: Memorias Segundas Jornadas en Ciencias de la Tierra, Facultad de Geología Minas y Petróleos, Quito, p. 12-14.

Ego, F., 1995, The Ecuadorian Inter-Andean Valley—A major and complex both restraining bend and compressive graben since upper Miocene time: Orsay, France, Université de Paris-Sud, thesis, 209 p.

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

EC-32, TANDAPI FAULT

FAULT NUMBER: EC-32

FAULT NAME: Tandapi

SYNOPSIS AND GEOLOGIC SETTING: This fault controls the relatively straight course of the Pilatón River along which four levels of alluvial terraces and a pyroclastic flow of the Ninahuilca volcano have been preserved. The alluvial terraces seem to be cut by the fault; the oldest one is thought to be Pliocene. Some minor strands (Reidel shears?) with a N-S orientation and probable reverse sense of movement characterize the northern part of the fault. The southern part of the fault is limited by the Chisinche lineament (Eguez and Yepes, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 15.9 km (16.1 km)
AVERAGE STRIKE: N37°W±8°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Left lateral (sinistral)

GEOMORPHIC EXPRESSION: The fault forms scarps and sag ponds on alluvial terraces. It cuts the fluvial terraces and controls stream drainages (Eguez and Yepes, 1994).

RECURRENCE INTERVAL: Unknown

Comments: Interval probably measured in thousands of years or less on basis of high calculated slip rate (see below).

SLIP RATE: 1-5 mm/yr

Comments: The general rate of movement was calculated at 3-5 mm/year, but there are no dates available to make a more accurate determination (Eguez and Yepes, 1994).

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Young movement is inferred from the high slip rate.

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-33, PAPALLACTA FAULT

FAULT NUMBER: EC-33

FAULT NAME: Papallacta

SYNOPSIS AND GEOLOGIC SETTING: The fault zone controls the course of the Papallacta River, although glaciation erased morphological evidence of this activity, the fault is still characterized by strong lineaments (Yepes and others, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 16.1 km (17.8 km)

AVERAGE STRIKE: N39°E±26°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral
Comments: This fault is probably dextral (Yepes and others, 1994).

GEOMORPHIC EXPRESSION: The fault deforms late Pleistocene glacial moraines, offsets other Quaternary deposits, forms scarps and elongated ridges, and less commonly displaces stream drainages (Yepes and others, 1990, 1994).

RECURRENCE INTERVAL: Unknown

SLIP RATE: <1 mm/yr
Comments: Placed in the <1 mm/yr category, but a slip rate of <0.2 mm/yr was determined for this fault (Yepes and others, 1994).

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Yepes, H., Bonilla, F., Eguez, A., Ruiz, M., Fernández, J., 1994, Evaluación del Peligro Sísmico para el proyecto hidroeléctrico Quijos: Escuela Politécnica Nacional-Empresa Eléctrica Quito (inédito).

Yepes, H., Ramón P., Fernández, J., Eguez, A., 1990, Estudio preliminar del Riesgo Sísmico para la Fase Ampliatoria del Proyecto Papallacta: Quito, Ecuador, Empresa de Agua Potable-Quito (inédito), 50 p.

EC-34, RÍO BABA FAULT

FAULT NUMBER: EC-34

FAULT NAME: Río Baba

SYNOPSIS AND GEOLOGIC SETTING: This fault disturbs not only the Santo Domingo alluvial-fan deposits (Pliocene), but also other minor Pleistocene alluvial fans and river terraces (Eguez and Yepes, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY
LENGTH: 27.0km (27.5 km)
AVERAGE STRIKE: N3°E±12°
AVERAGE DIP: East
Comments: However, the fault plane near Julio Moreno town is quite high and dips west.
SENSE OF MOVEMENT: Reverse dextral
Comments: The fault is predominately reverse, but a dextral component was identified near Julio Moreno (Eguez and Yepes, 1994).

GEOMORPHIC EXPRESSION: Fault controls stream drainages and deforms (to a minor extent) Pleistocene alluvial fans and river terraces (Eguez and Yepes, 1994).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-35, MACHACHI FAULT

FAULT NUMBER: EC-35

FAULT NAME: Machachi

SYNOPSIS AND GEOLOGIC SETTING: Soulas and others (1991) identified the fault for the first time and referred to it as a part of the Chingual-Pallatanga system. However, this fault system (which includes EC-54 and EC-50) lies at least 50 to the east of the Machachi fault. The Machachi fault disturbs deposits of late(¿) Pleistocene cangahua (loess), and Quaternary pumice and ash falls from Cotopaxi Volcano. This fault is clearly observed on the NW flank of Ruminahui Volcano: it trends to the SW in the direction of Illiniza Volcano (Eguez and Yepes, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 32.8km (33.4 km)
AVERAGE STRIKE: N60°E±12°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: Dextral motion along the fault forms pressure ridges and associated minor and secondary reverse and normal faults.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el Extremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

EC-36, POALÓ FAULT

FAULT NUMBER: EC-36

FAULT NAME: Poaló Comments: Previously named the Jachauangu-Guanbaló-Mollepamba fault by Dávila (1990) and Lavenu and others (1995).

SYNOPSIS AND GEOLOGIC SETTING: This fault affects the sedimentary units that fill the Pliocene-Pleistocene Latacunga basin. Some aligned ridges are expressions of open folds. The Poaló fault produces a non-symmetric flexure with a slight westward vergence (Dávila, 1990; Lavenu and others, 1995) and several N-S trending folds to the east of the larger flexure (EC-37 and EC-38).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation, studies of microtectonics and fieldwork.

FAULT GEOMETRY

LENGTH: 20.3 km (22.6 km)
AVERAGE STRIKE: N5°E±28°
AVERAGE DIP: Unknown angle to east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The Poaló fault forms a long aligned ridge (west-verging anticlinal flexure) with a steeply sloping western flank and a gently sloping eastern flank. The Poaló fault is believed to be an east-dipping structure.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Dávila, F., 1990, Geodinámica Plio-Cuaternaria de la cuenca de Latacunga-Ambato, Callejón Interandino—sector entre Salcedo and Pillaro: Quito, Ecuador, Escuela Politecnica Nacional, tesis inédita, 192 p.

Lavenu A., Winter, T., and Dávila, F., 1995 A Pliocene-Quaternary compressional basin in the Inter-Andean Depression, Central Ecuador: Geophys. Journal International, v. 121, p. 279-300.

EC-37, NAGSICHE ANTICLINE

FOLD NUMBER: EC-92

FOLD NAME: Nagsiche

SYNOPSIS AND GEOLOGIC SETTING: These two north-south trending anticlinal flexures are related to blind reverse faults that form the main compressional system within the Latucunga-Ambato Basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

GEOMETRIA DEL PLIEGUE/FOLD GEOMETRY
LENGTH OF FOLD AXIS: 28.3 km (25.3 km)
AVERAGE STRIKE OF FOLD AXIS: N4°W±4°
DIP OF LIMBS: Unknown
PLUNGE: Unknown

GEOMORPHIC EXPRESSION: Scarps and elongated ridges related to east-dipping (?) blind reverse fault (Davíla, 1990).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Davíla, F., 1990, Geodinamica Plio-Cuaternaria de la cuenca de Latacunga-Ambato, Callejon, Interandino—Sector entre Salcedo y Pillaro: Quito, Escuela Politécnica Nacional, tesis inedita, p. 192.

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-38, LATACUNGA ANTICLINE

FOLD NUMBER: EC-33

FOLD NAME: Latacunga
Comments: Also refered to as the Alaques-Colata-San Martin flexure by Davíla (1990).

SYNOPSIS AND GEOLOGIC SETTING: This anticlinal flexure and underlying blind reverse fault affects Pliocene lahars that form elongated flexural scarps along the Cutuchi River. In addition, the anticline controls the deposition of young lahar related to the Cotopaxi eruptions.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

GEOMETRIA DEL PLIEGUE/FOLD GEOMETRY
LENGTH OF FOLD AXIS: 13.9 km (14.1 km)

AVERAGE STRIKE OF FOLD AXIS: N5°E±10°
DIP OF LIMBS: West facing (monocline)
PLUNGE: Unknown

GEOMORPHIC EXPRESSION: Forms a flexural scarp. The underlying blind reverse fault forms a large monocline with scarps and folded layers (flexure) at the surface (Davíla, 1990).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Davíla, F., 1990, Geodinamica Plio-Cuaternaria de la cuenca de Latacunga-Ambato, Callejon, Interandino—Sector entre Salcedo y Pillaro: Quito, Escuela Politécnica Nacional, tesis inedita, p. 192.

EC-39, YANAYACU ANTICLINE

FOLD NUMBER: EC-39

FOLD NAME: Yanayacu

SYNOPSIS AND GEOLOGIC SETTING: The Yanayacu anticline is related to a buried fault that affects sedimentary rocks of the Latacunga basin. At the surface, the east-dipping fault produces a long monoclinal flexure (flexural scarp) with a westward vergence (Dávila, 1990; Lavenu and others, 1995). Their are two folds, the northern of which is the more pronounced feature.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FOLD GEOMETRY
LENGTH OF FOLD AXIS: 50.1 km (48.2 km)
AVERAGE STRIKE OF FOLD AXIS: N2°W±11°
DIP OF LIMBS: West facing (monocline)
PLUNGE: Unknown

GEOMORPHIC EXPRESSION: The Yanayacu anticline is marked by west-facing elongated hills that rise 100-200 m above the Interandean valley. Where these hills are dissected it is possible to see deformation (folding) of the underlying sedimentary layers (Dávila, 1990).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Dávila, F., 1990, Geodinámica Plio-Cuaternaria de la cuenca de Latacunga-Ambato. Callejón Interandino: Sector entre Salcedo y Pillaro., EPN Quito, tesis inédita, p. 192.

Lavenu A., Winter, T., and Dávila, F., 1995 A Pliocene-quaternary compressional basin in the Inter-Andean Depression, Central Ecuador: Geophysical Journal International, v. 121, p. 279-300.

EC-40, GUANGAJE FAULT

FAULT NUMBER: EC-40

FAULT NAME: Guangaje

SYNOPSIS AND GEOLOGIC SETTING: This fault has a NE-SW trend and has been observed in the Guangaje area. As viewed from the SW direction, the fault does not affect ash-fall layers of the Quilotoa Volcano (Eguez and Yepes, 1994). (The last eruption of Quilotoa Volcano has been dated at about 800 yrs B.P. by Hall and Mothes, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 25.9 km (33.2 km)
AVERAGE STRIKE: N37°E±18°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown, possibly strike-slip

GEOMORPHIC EXPRESSION: The fault forms pressure ridges (elongate hills resulting from transpressive motion?) and grabens (fault trenches) according to Eguez and Yepes (1994). The fault branches into two strands along its northern half.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

Hall, M., and Mothes, P., 1994, Tefroestratigrafía Holocénica de los volcanes principales del Valle Interandino, Ecuador: Corporación Editora Nacional, Quito, v. 6, p. 67

EC-41, CHUGCHILAN-SIGCHOS FAULT

FAULT NUMBER: EC-41

FAULT NAME: Chugchilan-Sigchos

SYNOPSIS AND GEOLOGIC SETTING: This reverse fault affects the oceanic basement of the Cordillera Occidental. It has two strands with opposing dips.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 57.9 km (54.2 km)
AVERAGE STRIKE: N21°E±19°

NUMBER OF SECTIONS: 2

EC-41A, SIGCHOS SECTION

SECTION NUMBER: EC-41a

SECTION NAME: Sigchos

SECTION GEOMETRY

LENGTH: 29.2 km (30.6 km)

AVERAGE STRIKE: N28°E±19°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Transpressive, probably dextral

GEOMORPHIC EXPRESSION: Scarps (Eguez and Yepes, 1994).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-41B, CHUGCHILAN SECTION

SECTION NUMBER: EC-41b

SECTION NAME: Chugchilan

SECTION GEOMETRY
LENGTH: 23.0 km (23.7 km)
AVERAGE STRIKE: N13°E±15°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Scarps (Eguez and Yepes, 1994).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Eguez, A., and Yepes, H., 1994, Estudio neotectónico y de peligro sísmico para el Proyecto Hidroeléctrico Toachi: INECEL (inédito), 63 p.

EC-42, PUCAYACU FAULT

FAULT NUMBER: EC-42

FAULT NAME: Pucayacu

SYNOPSIS AND GEOLOGIC SETTING: The structure seems related to uplift of the Cordillera Occidental. It delineates the eastern boundary of the fore-arc basin and forms the contact between the oceanic basement of the foothills and the continental sediments of the basin. This fault belongs to the larger dextral and reverse fault Calacali-Pujili suture zone of the western Andean foothills (see tectonic setting).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 32.9 km (31.9 km)
AVERAGE STRIKE: N12°E±18°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault has two convex to the east traces that abut one another in a north-south direction. The west-facing scarps are related to sharp topographic relief.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-43, VALENCIA LA-MANÁ FAULT

FAULT NUMBER: EC-43

FAULT NAME: Valencia La-Maná

SYNOPSIS AND GEOLOGIC SETTING: This fault appears related to the western border of the Cordillera Occidental. It limits the oceanic basement towards the east and the Babahoyo fore–arc basin. The fault has two discrete sections as described herein.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 65.0 km (56.7 km)
AVERAGE STRIKE: N28°E±14°

NUMBER OF SECTIONS: 2

EC-43A, VALENCIA SECTION

SECTION NUMBER: EC-43a

SECTION NAME: Valencia

SECTION GEOMETRY
LENGTH: 40.3 km (41.1 km)
AVERAGE STRIKE: N29°E±12°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms a weakly defined lineament on aerial photographs. Shown as a concealed structure on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-43B, LA MANÁ SECTION

SECTION NUMBER: EC-43b

SECTION NAME: La Maná

SECTION GEOMETRY
LENGTH: 15.0 km (15.7 km)
AVERAGE STRIKE: N25°E±19°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms a weakly expressed lineament on aerial photographs, with uplift on the western block. Shown as a concealed structure on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-44, QUINSALOMA FAULT

FAULT NUMBER: EC-44

FAULT NAME: Quinsaloma

SYNOPSIS AND GEOLOGIC SETTING: This fault seems to control the uplift of the western Andean foothills.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 24.3 km (25.6 km)
AVERAGE STRIKE: N26°E±21°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms a curved scarp on the western edge of the Andean Range, locally limiting the fore-arc basin with uplift on the western block. Shown as a concealed structure on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-45, CALABÍ FAULT

FAULT NUMBER: EC-45

FAULT NAME: Calabí

SYNOPSIS AND GEOLOGIC SETTING: This fault controls Quaternarysedimentation in the Babahoyo fore-arc basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation.

FAULT GEOMETRY
LENGTH: 37.5 km (38.0 km)
AVERAGE STRIKE: N37°E±11°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms a weakly expressed lineament on aerial photographs. Shown as a concealed structure on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-46, SALINAS FAULT

FAULT NUMBER: EC-46

FAULT NAME: Salinas

SYNOPSIS AND GEOLOGIC SETTING: This fault seems to control the Guaranda Basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 36.2 km (37.5 km)
AVERAGE STRIKE: N21°E±21°

NUMBER OF SECTIONS: 2

EC-46A, RÍO SALINAS SECTION

SECTION NUMBER: EC-46a

SECTION NAME: Río Salinas

SECTION GEOMETRY
LENGTH: 15.7 km (15.9 km)
AVERAGE STRIKE: N30°E ±11°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms straight scarps and controls the drainage of the Río Salinas.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-46B, SOUTHERN SECTION

SECTION NUMBER: EC-46b

SECTION NAME: Southern

SECTION GEOMETRY
LENGTH: 19.8 km (21.6 km)
AVERAGE STRIKE: N15°E±25°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse(?)

GEOMORPHIC EXPRESSION: It forms a highly curved scarp suggesting reverse fault (thrust) geometry.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-47, GUARANDA FAULT

FAULT NUMBER: EC-47

FAULT NAME: Guaranda

SYNOPSIS AND GEOLOGIC SETTING: This fault belongs to the reverse fault system that forms the Guaranda Basin. It is similar to the Salinas fault [EC-46], which is located about 5-10 km to the west.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation.

FAULT GEOMETRY
LENGTH: 21.9 km (24.2 km)
AVERAGE STRIKE: N1°E±14°

AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse, dextral(?)

GEOMORPHIC EXPRESSION: The fault forms scarps and controls drainages. This fault probably has a dextral component of slip, but the principal movement seems to be reverse.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-48, MONTALVO FAULT

FAULT NUMBER: EC-48

FAULT NAME: Montalvo

SYNOPSIS AND GEOLOGIC SETTING: This structure appears to control the uplift of the Cordillera Occidental and borders the fore-arc Babahoyo Basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 50.6 km (57.5 km)
AVERAGE STRIKE: N8°W±18°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms a scalloped fault trace (four strands) owing to reverse geometry. The fault is shown as a discontinuous structure on the map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-49, CHILLANES FAULT

FAULT NUMBER: EC-49

FAULT NAME: Chillanes

SYNOPSIS AND GEOLOGIC SETTING: The fault appears related to the Río Chimbo lineament along to the eastern margin of the Cordillera Occidental.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 36.4 km (46.3 km)
AVERAGE STRIKE: N30°E±17°
AVERAGE DIP: Unknown, dips to the northwest
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault has scarps that form an irregular pattern, suggesting reverse movement. The fault trace is only partially preserved, so the fault is shown as mostly concealed or inferred.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-50, PALLATANGA FAULT ZONE

FAULT NUMBER: EC-50

FAULT NAME: Pallatanga (fault zone)

SYNOPSIS AND GEOLOGIC SETTING: This fault zone belongs to the main dextral Chingual-Pallatangna fault system as defined by Soulas and others (1991). It is seen clearly in the Pangor River valley. It affects late Pleistocene glacial moraines and other Quaternary deposits.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo geologic interpretation, geomorphology, and microtectonic studies.

FAULT GEOMETRY

LENGTH: 56.8 km (68.7 km)
AVERAGE STRIKE: N23°E±12°

NUMBER OF SECTIONS: 3

REFERENCES

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

EC-50A, PALLATANGA SECTION

SECTION NUMBER: EC-50a

SECTION NAME: Pallatanga

SECTION GEOMETRY

LENGTH: 38.6 km (38.9 km)
AVERAGE STRIKE: N28°E±8°
AVERAGE DIP: 75° W
SENSE OF MOVEMENT: Dextral, reverse
Comments: The sense of fault movement was determined on the basis of morphological evidence; furthermore, microtectonic studies show evidence of right strike-slip (dextral) movement within a tensional regime (Winter and Lavenu, 1989). Winter and Lavenu (1989) concluded that the morphological data result from a σ_3 stress, whereas there is little confidence in the microtectonic information. The west fault dip was defined using topographic profiles (Winter, 1990).

GEOMORPHIC EXPRESSION: The Pallatanga section follows the general trend of the Pangor River valley where offset drainages, offset hills, and fault trenches,and benches are observed. Southward, the climatic conditions result in poorer preservation of tectonic-geomorphological features; however, hanging valleys as well as dammed and displaced stream drainages are present in this area.

RECURRENCE INTERVAL: 600-1,200 years

Comments: This fault could be related to the large earthquake of 1797, which totally destroyed the village of Cajabamba (Winter and Lavenu, 1989), although surface deformation of historic age has not been docuemented. Soulas and others (1991) cited a probable maximum earthquake of Ms 7.4 associated with this recurrence for the fault.

SLIP RATE: 1-5 mm/yr

Comments: The Holocene slip rate has been estimated at 2.8 mm/yr (Winter, 1990) and 4±1 mm/yr (Winter and Lavenu, 1989). The latter estimate is the more accepted having been calculated from a maximum of 9 km of dextral displacement since the beginning of Pleistocene time (1.8 Ma; Winter and Lavenu, 1989). This displacement value was defined by comparing topographic profiles on both sides of Pangor River valley and the Pallatanga valley (a pull-apart basin).

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Affects late Pleistocene glacial deposits dated at 10,000 to 12,000 yrs B.P.

REFERENCES

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

Winter, T., y Lavenu, A., 1988, Evidencias morfológicas y microtectónicas de una falla de rumbo activa en la parte central del Ecuador: Memorias V Congreso Ecuatoirano de Geología, Minas, Petróleos y Ciencias Afines, Loja, p. 13

Winter, T., y Lavenu, A., 1989, Morphological and microtectonic evidence for a major active right-lateral strike -slip fault across central Ecuador (South America): Annales Tectonica, v. 3, no. 2, p. 123-139.

Winter, T., 1990, Mecanismes des deformations recentes dans les Andes Equatoriennes: Orsay, France, Université de Paris-Sud Orsay, Tesis, 205 p.

EC-50B, CENTRAL SECTION

SECTION NUMBER: EC-50b

SECTION NAME: Central

SECTION GEOMETRY

LENGTH: 17.0 km (17.5 km)

AVERAGE STRIKE: N16°E±16°

AVERAGE DIP: Unknown

SENSE OF MOVEMENT: Unknown, probably dextral

GEOMORPHIC EXPRESSION: There are scarps along this section of the fault and evidence of drainage control.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

|Comments: Slip rate may be higher based on long term rate of 4±1 mm/yr measured on the Pallatanga section [EC-50] to the north.

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-50C, SOUTHERN SECTION

SECTION NUMBER: EC-50c

SECTION NAME: Southern

SECTION GEOMETRY

LENGTH: 12.2 km (12.4 km)

AVERAGE STRIKE: N18°E±11°

AVERAGE DIP: Unknown, dips to the west

SENSE OF MOVEMENT: Reverse, dextral(?)

Comments: May have a strong component of dextral slip as seen on the on the Pallatanga section [EC-50a] to the north.

GEOMORPHIC EXPRESSION: No information available

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

|Comments: Slip rate may be higher based on long term rate of 4±1 mm/yr measured on the Pallatanga section [EC-50] to the north.

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-51, PANCHO NEGRO FAULT

FAULT NUMBER: EC-51

FAULT NAME: Pancho Negro

SYNOPSIS AND GEOLOGIC SETTING: This fault is related to the Pallatanga fault zone [EC-50].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 24.0 km (24.0 km)
AVERAGE STRIKE: N56°E±5°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown, probably dextral(?)
Comments: Movement in not documented, but geomorphology and association with the Pallatanga fault zone [EC-50] suggests dextral motion.

GEOMORPHIC EXPRESSION: The fault forms scarps along the anomalous and isolated ridges on the fore arc basin close to the Cordillera Occidental.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-52, NARANJAL FAULT

FAULT NUMBER: EC-52

FAULT NAME: Naranjal

SYNOPSIS AND GEOLOGIC SETTING: The structure is part of a broader system of faults that control the uplift of the Cordillera Occidental.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 25.9 km (26.2 km)
AVERAGE STRIKE: N23°E±12°
AVERAGE DIP: Unknown, dip to the southeast
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: No information available

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-53, PONCE ENRÍQUEZ FAULT

FAULT NUMBER: EC-53

FAULT NAME: Ponce Enríquez

SYNOPSIS AND GEOLOGIC SETTING: The structure appears en echelon with the Naranjal fault [EC-52] and is part of a broader system of faults that control the uplift of the Cordillera Occidental.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 56.9 km (58.3 km)
AVERAGE STRIKE: N36°E±14°
AVERAGE DIP: Unknown, dips to the southeast
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: No information available

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-54, CHINGUAL FAULT

FAULT NUMBER: EC-54

FAULT NAME: Chingual

SYNOPSIS AND GEOLOGIC SETTING: This fault disturbed lava flows, pyroclastic flows, and lahars of the Soche Volcano (Quaternary). The fault connects northward with the Afiladores section [CO-29m] of the Eastern Frontal fault system in Colombia.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 70.3 km (73.8 km)
AVERAGE STRIKE: N33°E±12°
AVERAGE DIP: 90° (vertical)
SENSE OF MOVEMENT: Dextral
Comments: Determined from dextral offset of the Chingual River and pyroclastic flow deposits of the Soche Volcano (Soulas and others, 1991).

GEOMORPHIC EXPRESSION: Fault offsets drainages on pyroclastic flows, forms scarps and triangular facets, and has active landslides; all of these features suggest young fault movement. The fault makes a slight right step where it is intersected by the a northward strand of the Reventador fault [EC-55].

RECURRENCE INTERVAL: 200 to 500 yr.

Comments: This interval was determined on the basis of a maximum earthquake of Ms 7 (Soulas and others, 1991).

SLIP RATE: >5 mm/yr

Comments: The average of movements reported by Ego and others (1996) is 7±3 mm/yr. These determinations are from 270-344 m of dextral offset of pyroclastic-flow deposits dated at 37,220±630 yr B.P. (7-9 mm/yr). Another measurement was made in a lahar deposit (8,600±60 yr. B.P) that is offset 36-64 m (4-7 mm/yr).

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Toward the south end of the fault, the fault cuts glacial moraines dated at 10-12 ka (Tibaldi and Ferrari, 1992). These is no documentation of historic movement, but the slip rate and estimated recurrence interval suggests that this fault may be very young.

REFERENCES

Ego, F., 1993, Risques sismiques et Neotectonique en Equateur: Pangea, v. 19, p. 16-21.

Ego, F., Sebrier, M., Lavenu, A., Yepes, H., and Eguez, A., 1993, Quaternary state of stress in the Northern Andes and the restraining bend model for the Ecuadorian Andes: Memior, Second Andean Geodynamics Symposium, Oxford University, extended abstract, p. 89-92.

Ego, F., Sebrier, M., Lavenu, A., Yepes, H., and Eguez, A., 1996, Quaternary state of stress in the northern Andes and the restraining bend model for the Ecuadorian Andes: Tectonophysics, v. 259, p. 101-116.

Ferrari, L., and Tibaldi, A., 1992, Recent and active Tectonics of the North-Eastern Ecuadorian Andes: Journal of Geodynamics, v. 15, no. 1/2, p. 39-58.

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el extremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

Tibaldi, A., and Ferrari, L., 1992, Late Pleistocene-Holocene tectonics of the Ecuadorian Andes: Tectonophysics 205, p. 109-125.

EC-55, REVENTADOR FAULT

FAULT NUMBER: EC-55

FAULT NAME: Reventador

SYNOPSIS AND GEOLOGIC SETTING: The Reventador fault defines a transpressive zone related to the main Chingual-Pallatanga fault system. The fault has two section, each with different directions of movement.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY
LENGTH: 56.8 km (68.7 km)
AVERAGE STRIKE: N23°E±12°

NUMBER OF SECTIONS: 2

EC-55A, NORTHERN SECTION

SECTION NUMBER: EC-55a

SECTION NAME: Northern

SECTION GEOMETRY
LENGTH: 51.5 km (71.9 km)
AVERAGE STRIKE: N30°E±23°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The faults form west-facing scarps with irregular pattern.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-55B, SOUTHERN SECTION

SECTION NUMBER: EC-55a

SECTION NAME: Southern

SECTION GEOMETRY
LENGTH: 26.4 km (36.9 km)
AVERAGE STRIKE: N22°E±20°
AVERAGE DIP: Vertical
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: The scarps control drainages owing to dextral movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-56, SALADO FAULT

FAULT NUMBER: EC-56

FAULT NAME: Salado

SYNOPSIS AND GEOLOGIC SETTING: This complextranspressive fault partially juxtaposes Mesozoic metamorphic rocks against Cretaceus-Paleogenic sedimentary rocks (Yepes and others, 1994). According to Soulas and others (1991), these structures are part of is part of the larger Chingual-Pallatanga dextral fault system that crosses the Cordillera Real in a north-south direction.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation and fieldwork.

FAULT GEOMETRY

LENGTH: 60.7 km (145.0 km)
AVERAGE STRIKE: N18°E±23°
AVERAGE DIP: The eastern branch dips to the east
SENSE OF MOVEMENT: Reverse, dextral

GEOMORPHIC EXPRESSION: The fault forms imbricate sheets limited by well defined lineaments and frequent landslides (Yepes and others, 1994). It is shown as discontinuous on the map owing to poor exposure and limited mapping.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Holocene or post-glacial (<15 ka)

Comments: Possibly historic, see below.

HISTORICAL SURFACE FAULTING: March 1987 (possible)

Comments: Soulas and others (1991) suggested that the March 1987 earthquake is related to this fault. This interpretation is based upon focal mechanisms, seismic maps, and distribution of aftershocks. There was no documented surface faulting reported.

DATE: 03-06-1987 (UT)

MAGNITUDE OR INTENSITY: 6.9 Ms

MOMENT MAGNITUDE: Unknown

LENGTH OF SURFACE RUPTURE: Unknown

MAXIMUM SLIP AT SURFACE: Unknown

SENSE OF MOVEMENT: Reverse

Comments: On the basis of seismic data, it was proposed that the entire length of the fault moved in the 1987 earthquake. The sense of movement was defined from focal mechanisms. The dip of fault plane it is not well constrained, but it is assumed to be relatively low (Yepes and others, 1994).

REFERENCES

Soulas, J.P., Eguez, A., Yepes, H., y Pérez, V.H., 1991, Tectónica activa y riesgo sísmico en Los Andes Ecuatorianos y el estremo sur de Colombia: Bol. Geol. Ecuatoriano, v. 2, no. 1, p. 3-11.

Yepes, H., Bonilla, F., Eguez, A., Ruiz, M., Fernández, J., 1994, Evaluación del Peligro Sísmico para el proyecto hidroeléctrico Quijos: Escuela Politécnica Nacional-Empresa Eléctrica Quito (inédito).

EC-57, BAEZA-CHACO FAULT

FAULT NUMBER: EC-57

FAULT NAME: Baeza-Chaco

SYNOPSIS AND GEOLOGIC SETTING: This fault is very straight and involves reverse faults in the foothills and transpressive dextral faults that control the Quijos River along its western margin (Yepes and others, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of aerial photos and Landsat and radar images.

FAULT GEOMETRY:

LENGTH: 54.4 km (55.2 km)

AVERAGE STRIKE: N30°E±11°

AVERAGE DIP: Unknown, probably to west

Comments: Although the dip direction is unknown, other faults in this system are west-dipping oblique thrusts with dextral motion.

SENSE OF MOVEMENT: Dextral, reverse

GEOMORPHIC EXPRESSION: The fault forms pronounced escarpments, pressure ridges, sag ponds, and depressed and offset drainages (Yepes and others, 1994). The most important geomorphic expression is an alluvial terrace,with an estimated age of about 16,500 years (INECEL and others, 1992) that has been offset about 40 m.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably 1-5 mm/yr

Comments: The slip rate is probably >2.5 mm/yr (40 m offset in 16.5 k.y.), but is classified as 1-5 mm/yr for this database.

TIME OF MOST RECENT OF MOVEMENT: Holocene or post-glacial (<15 ka)

Comments: Although the fault is known to be Quaternary,its time of most recent movement must be <15 ka based on the high slip rate (>2.5 mm/yr) assigned to the fault.

REFERENCES

INECEL, 1992, Proyecto Hidroeléctrico Coca-Coda Sinclair, Estudio de Factibillidad, Anexo H Sismología y tectoníca: INECEL (TRACTIONEL, RODIO, ASTEC, INELIN, INGECONSULT, CAMINOS Y CANALES).

Yepes, H., Bonilla, F., Eguez, A., Ruiz, M., Fernández, J., 1994, Evaluación del Peligro Sísmico para el proyecto hidroeléctrico Quijos: Escuela Politécnica Nacional-Empresa Eléctrica Quito (inédito).

EC-58, COSANGA FAULT

FAULT NUMBER: EC-58

FAULT NAME: Cosanga

SYNOPSIS AND GEOLOGIC SETTING: This fault extends the Baeza-Chacofault [EC-57] to the south through a left stepover and is part of the larger Chinqual- Pallatanga fault system. Local structures were named the Chonta transpressive fault and the Huacamayos fault. These form a pull-apart basin (Yepes, and others, 1994).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation.

FAULT GEOMETRY

LENGTH: 29.7 km (30.5 km)

AVERAGE STRIKE: N28°E±15°

AVERAGE DIP: Unknown, dips to the northwest.

SENSE OF MOVEMENT: Reverse, dextral

GEOMORPHIC EXPRESSION: The fault forms triangular facets and shutter ridges, which are indicative of strike-slip movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Yepes, H., Bonilla, F., Eguez, A., Ruiz, M., Fernández, J., 1994, Evaluación del Peligro Sísmico para el proyecto hidroeléctrico Quijos: Escuela Politécnica Nacional-Empresa Eléctrica Quito (inédito).

EC-59, HUACAMAYOS FAULT

FAULT NUMBER: EC-59

FAULT NAME: Huacamayos

SYNOPSIS AND GEOLOGIC SETTING: The structure extends the main Subandean system throughout and oblique to the metamorphic rocks of the Real Cordillera.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 39.6 km (41.3 km)
AVERAGE STRIKE: N36°E±21°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: Fault is characterized by a straight trace that is indicative of strike-slip movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-60, PISAYAMBO FAULT

FAULT NUMBER: EC-60

FAULT NAME: Pisayambo

SYNOPSIS AND GEOLOGIC SETTING: This structure belongs to the main dextral Chingual-Pallatanga system, which obliquely crosses the Cordillera Real.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 23.5 km (23.7 km)
AVERAGE STRIKE: N51°E±9°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral

GEOMORPHIC EXPRESSION: The fault controls topography and drainage.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-61, PATATE FAULT

FAULT NUMBER: EC-61

FAULT NAME: Patate

SYNOPSIS AND GEOLOGIC SETTING: This fault probably is the prolongation of the Pisayambo fault [EC-60]. Its is a southern part of the larger Chinqual- Pallatanga fault system.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of Landsat images.

FAULT GEOMETRY

LENGTH: 14.4 km (14.4 km)
AVERAGE STRIKE: N38°E±8°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown, probably dextral
Comments: A normal, dextral sense of movement was obtained from a focal-plane mechanism, but their is no field data. Dextral motion is probable based on the sense of slip in other faults of the larger Chinqual- Pallatanga fault system.

GEOMORPHIC EXPRESSION: Trace is related to landslides that have flowed eastward into Patate village.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-62, CANDELARIA FAULT

FAULT NUMBER: EC-62

FAULT NAME: Candelaria

SYNOPSIS AND GEOLOGIC SETTING: This fault limits the eastern border of the Real Cordillera and follows parallel to the straight course of the Chambo River.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 29.2 km (26.3 km)
AVERAGE STRIKE: N6°E±8°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown, probably strike slip.

GEOMORPHIC EXPRESSION: Fault forms scarps that define a small pull-apart basin owing to strike-slip motion(?).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-63, GUAMOTE FAULT

FAULT NUMBER: EC-63

FAULT NAME: Guamote

SYNOPSIS AND GEOLOGIC SETTING: This structure prolongs the Interandean deformation and defines the Columbe pull-apart basin and the Palmira Pliocene intermountain basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 31.8 km (50.7 km)
AVERAGE STRIKE: N20°E±11°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Dextral.

GEOMORPHIC EXPRESSION: Near the villages of Guamote and Columbe, there are offset drainages and topography, shutter ridges, fault scarps, and lineaments related to the fault.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-64, CASCALES FAULT

FAULT NUMBER: EC-64

FAULT NAME: Cascales

SYNOPSIS AND GEOLOGIC SETTING: The fault limits the Napo uplift to the north and affects Quaternary alluvial deposits of the Oriente Basin (Iglesias and others, 1991).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 68.2 km (72.9 km)
AVERAGE STRIKE: N22°E±28°
AVERAGE DIP: Unknown, dips to the west in northern part

SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault has sinuous trace and well developed scarps (Iglesias and others, 1991).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Iglesias R., Eguez A., Pérez V.H., 1991, Mapa Sismotectónico del Ecuador: Quito, Ecuador, Dirección Nacional de Defensa Civil, Memoria técnica, 177 p.

EC-65, PAYAMINO FAULT

FAULT NUMBER: EC-65

FAULT NAME: Payamino

SYNOPSIS AND GEOLOGIC SETTING: Together with the Sumaco fault [EC-66] this fault forms the eastern thrust border of the Napo uplift. The fault affects Quaternary fluvial sediment (Iglesias and others, 1991).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 48.3 km (49.9 km)
AVERAGE STRIKE: N10°E±16°
AVERAGE DIP: Unknown, probably deps to west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault forms irregular scarps along its sinuous trace (Iglesias and others, 1991).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Iglesias R., Eguez A., Pérez V.H., 1991, Mapa Sismotectónico del Ecuador: Quito, Ecuador, Dirección Nacional de Defensa Civil, Memoria técnica, 177 p.

EC-66, SUMACO FAULT

FAULT NUMBER: EC-66

FAULT NAME: Sumaco

SYNOPSIS AND GEOLOGIC SETTING: This fault forms the eastern border of the Napo uplift and deforms the eastern flank of Sumaco Volcano.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 38.8 km (39.0 km)
AVERAGE STRIKE: N13°E±7°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse, transpressive (dextral?)

GEOMORPHIC EXPRESSION: The fault forms scarps and controls drainages around the eastern flank of Sumaco Volcano shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-67, HOLLÍN FAULT

FAULT NUMBER: EC-67

FAULT NAME: Hollín

SYNOPSIS AND GEOLOGIC SETTING: The structure defines a lineament along the flank of the Sumaco Volcano and deforms Mesozoic sedimentary rocks and Quaternary volcanic rocks.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 32.0 km (32.0 km)
AVERAGE STRIKE: N61°E±4°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown. probably

GEOMORPHIC EXPRESSION: It forms a lineament; shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-68, TENA FAULT

FAULT NUMBER: EC-68

FAULT NAME: Tena

SYNOPSIS AND GEOLOGIC SETTING: The structure deforms Cenozoic marine sedimentary rocks and Jurassic granitoid rocks that are overlapped by Tertiary alluvial fans along the Subandean zone.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 34.8 km (35.0 km)
AVERAGE STRIKE: N6°E±7°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault forms irregular scarps; shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-69, PUSUNO FAULT

FAULT NUMBER: EC-69

FAULT NAME: Pusuno

SYNOPSIS AND GEOLOGIC SETTING: The structure is an extension of the Payamino fault system [EC-65] that limits the eastern flank of the Napo uplift.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 29.3 km (29.5 km)
AVERAGE STRIKE: N37°E±9°
AVERAGE DIP: Unknown, dips to the northwest
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault forms irregular scarps and controls drainages; shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-70, ARAJUNO FAULT

FAULT NUMBER: EC-70

FAULT NAME: Arajuno

SYNOPSIS AND GEOLOGIC SETTING: This structure probably defines the more advanced (eastward) deformation recognized on the Andean front along the back-arc basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 28.1 km (28.8 km)
AVERAGE STRIKE: N30°E±13°
AVERAGE DIP: Unknown, dips to the northwest
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Forms scarps and controls drainage. Continued or accelerated movement on this fault will probably change the direction of drainage on the Arajuno River. Shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-71, ANZU FAULT

FAULT NUMBER: EC-71

FAULT NAME: Anzu

SYNOPSIS AND GEOLOGIC SETTING: The structure is en echelon to the Tena fault [EC-68] is part of a larger system of reverse faults along the Subandean zone that involve Abitaggua granitoid rocks and alluvial-fan deposits related to the uplift of the Real Cordillera.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 31.7 km (32.4 km)
AVERAGE STRIKE: N28°E±16°

AVERAGE DIP: Unknown, dips to the northwest
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault forms irregular scarps and controls drainages; shown as mainly concealed or inferred on map.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-72, MERA FAULT

FAULT NUMBER: EC-72

FAULT NAME: Mera

SYNOPSIS AND GEOLOGIC SETTING: The structure is related to a complex thrust system where Subandean faults change have NNE directions. The Mera fault deforms Pliocene alluvial fans of the Pastaza River. The Puyo [EC-73] and Mera faults are the southerm part of this system

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 12.3 km (12.3 km)
AVERAGE STRIKE: N34°E±4°
AVERAGE DIP: Unknown, dips to the northwest
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault forms small scarps on the Pliocene alluvial fans.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-73, PUYO FAULT

FAULT NUMBER: EC-73

FAULT NAME: Puyo

SYNOPSIS AND GEOLOGIC SETTING: The structure is related to a complex thrust system where Subandean faults change have NNE directions. The Puyo and Mera [EC-72] faults are the southerm part of this system.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 10.8 km (11.2 km)
AVERAGE STRIKE: N13°E±18°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault forms small hills that have irregular scarps.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-74 PASTAZA FAULT

FAULT NUMBER: EC-74

FAULT NAME: Pastaza

SYNOPSIS AND GEOLOGIC SETTING: The northwest-trending sinistral fault controls uplifted sediments of the Oriente basin and Quaternary alluvial deposits of the Pastaza River.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 17.8 km (18.4 km)
AVERAGE STRIKE: N15°W±16°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Sinistral

GEOMORPHIC EXPRESSION: The fault controls drainage and topography.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-75, SANTIAGO-UPANO FAULT

FAULT NUMBER: EC-75

FAULT NAME: Santiago-Upano

SYNOPSIS AND GEOLOGIC SETTING: The structure seems to control uplift of the Cutucu Range, which exposes sedimentary Paleozoic basement of the Subandean zone.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 80.5 km (85.1 km)
AVERAGE STRIKE: N4°W±20°
AVERAGE DIP: Unknown, dips west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault forms large scarps and controls drainages, although geologic evidence (dating) of Quaternary activity has not been reported.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

HISTORICAL SURFACE FAULTING: None reported
Comments: This fault might have been the cause of the 1995 Macas earthquake. This interpretation is based on its focal mechanism and the distribution of aftershocks, although the location data are not precise enough to prove this assertion.

DATE: 10-03–1995 UT)

MAGNITUDE OR INTENSITY: 6.9 Ms

MOMENT MAGNITUDE: Unknown

LENGTH OF SURFACE RUPTURE: Unknown

MAXIMUM SLIP AT SURFACE: Unknown

SENSE OF MOVEMENT: Unknown

EC-76, MACUMA FAULT

FAULT NUMBER: EC-76

FAULT NAME: Macuma

SYNOPSIS AND GEOLOGIC SETTING: The Macuma fault uplifts the hills that extend from the eastern flank of the Cutucu Range in the Subandean zone.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 119.0 km (121.3 km)
AVERAGE STRIKE: N10°E±12°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault forms scarps and controls drainages.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-77, TAISHA FAULT

FAULT NUMBER: EC-77

FAULT NAME: Taisha

SYNOPSIS AND GEOLOGIC SETTING: The Taisha fault appears to control the Pliocene alluvial fans that extend eastward into the Subandean zone.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 53.9 km (55.9 km)
AVERAGE STRIKE: N11°E±16°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms scarps on Quaternary alluvial deposits.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-78, PAUTE FAULT

FAULT NUMBER: EC-78

FAULT NAME: Paute

SYNOPSIS AND GEOLOGIC SETTING: The structure appears to border the eastern margin of the Real Cordillera along the Paute River.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 46.5 km (46.9 km)
AVERAGE STRIKE: N28°E±8°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: The fault controls drainages and topography. The fault is shown as discontinuous since the only information is from photo interpretation, not field studies.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-79, GUALACEO FAULT

FAULT NUMBER: EC-79

FAULT NAME: Gualaceo

SYNOPSIS AND GEOLOGIC SETTING: The structure appears to be the prolongation of the Paute fault [EC-78] towards the south.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 32.6 km (33.1 km)
AVERAGE STRIKE: N32°E±11°
AVERAGE DIP: Unknown, dips to the southeast
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms a lineament along the Gualaceo River and has irregular scarps.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-80, TARQUI FAULT

FAULT NUMBER: EC-80

FAULT NAME: Tarqui

SYNOPSIS AND GEOLOGIC SETTING: This structure is related to the southward extension of the Cuenca intramontane basin. It appears en echelon of the Girón fault [EC-81], and affects Pliocene volcano sediments.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 17.8 km (17.9 km)
AVERAGE STRIKE: N43°E±7°
AVERAGE DIP: Unknown
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: It forms fault scarps and controls drainages.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-81, GIRÓN FAULT

FAULT NUMBER: EC-81

FAULT NAME: Girón

SYNOPSIS AND GEOLOGIC SETTING: The fault is related to reactivation of faults that formed the Neogene intramontane Santa Isabel basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation, morphological, and microtectonic studies.

FAULT GEOMETRY
LENGTH: 44.7 km (42.2 km)
AVERAGE STRIKE: N42°E±10°

NUMBER OF SECTIONS: 2

EC-81A, NORTHEASTERN SECTION

SECTION NUMBER: EC-81a

SECTION NAME: Northeastern

SECTION GEOMETRY
LENGTH: 23.7 km (24.1 km)
AVERAGE STRIKE: N37°E±12°
AVERAGE DIP: Unknown, dips to the northwest.
SENSE OF MOVEMENT: Normal

GEOMORPHIC EXPRESSION: The fault, which forms pronounced northwest-facing scarps, has slickensides. Other young fault-related features include three continuous sets of triangular facets, convexity of the basin's escarpment, perturbed drainage systems, wine glass-shaped valleys, and drag folds (Winter, 1990; Winter and others, 1990). Nevertheless, many of these these features appear related to gravitational forces and are secondary to the uplift produced by the reverse fault.

RECURRENCE INTERVAL: Unknown

SLIP RATE: <1 mm/yr

Comments: Slip rate is 0.2-1.0 mm/yr, but placed in the <1.0 mm/yr category for this compilation.

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)
Comments: Young movement infered from strong geomorphic expression (for example, wine glass-shaped valleys).

REFERENCES

Winter, T., 1990, Mecanismes des deformations recentes dans les Andes Equatoriennes: Orsay, France, Université de Paris-Sud Orsay, tesis, 205 p.

Winter, T., Iglesias, R., y Lavenu, A., 1990, Presencia de un sistema de fallas activas en el sur del Ecuador: Bol. Geol. Ecuat., v. 1, no. 1, p. 53-67.

EC-81B, SOUTHWESTERN SECTION

SECTION NUMBER: EC-81b

SECTION NAME: Southwestern

SECTION GEOMETRY

LENGTH: 23.7 km (24.1 km)
AVERAGE STRIKE: N37°E±12°
AVERAGE DIP: 80° NW
SENSE OF MOVEMENT: Normal, dextral
Comments: Normal kinematics is proposed based on morphological and structural evidence, such as en echelon ruptures in a minor 30-m-wide graben, which shows right-slip movement (Winter, 1990; Winter and others, 1990)

GEOMORPHIC EXPRESSION: Fault mainly characterized by pronounced scarps. Other fault-related features include three continuous sets of triangular facets, convexity of the basin's scarps, perturbed drainage systems, wine glass-shaped valleys, and drag folds (Winter, 1990; Winter and others, 1990). These features correspond to the uplift of the eastern fault block.

RECURRENCE INTERVAL: Unknown

SLIP RATE: <1.0 mm/yr

Comments: Minimum estimated rate is 0.5 mm/yr based on a 1,000 m of displacement since Pliocene time (Winter, 1990; Winter and others, 1990). If this displacement is younger than 1.8 Ma, the slip rate could be greater. Placed in the <1.0 mm/yr category for this compilation.

TIME OF MOST RECENT OF MOVEMENT: Holocene and post glacial (<15 ka)

Comments: Young movement inferred from geomorphic expression.

REFERENCES

Winter, T., 1990, Mecanismes des deformations recentes dans les Andes Equatoriennes: Orsay, France, Université de Paris-Sud Orsay, tesis, 205 p.

Winter, T., Iglesias, R., y Lavenu, A., 1990, Presencia de un sistema de fallas activas en el sur del Ecuador: Bol. Geol. Ecuat., v. 1, no. 1, p. 53-67.

EC-82, CELICA-MACARÁ FAULT

FAULT NUMBER: EC-82

FAULT NAME: Celica-Macará

SYNOPSIS AND GEOLOGIC SETTING: This fault is related to the oceanic basement that forms the Celica Cordillera.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation.

FAULT GEOMETRY:

LENGTH: 73.3 km (110.4 km)
AVERAGE STRIKE: N48°E±20°

NUMBER OF SECTIONS: 2

EC-82A, CELICA SECTION

SECTION NUMBER: EC-82a

SECTION NAME: Celica

SECTION GEOMETRY
- LENGTH: 73.3 km (74.5 km)
- AVERAGE STRIKE: N58°E±12°
- AVERAGE DIP: Unknown
- SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: This fault section forms a lineament; most of the fault is concealed or obscured along its length.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-82B, MACARÁ SECTION

SECTION NUMBER: EC-82b

SECTION NAME: Macará

SECTION GEOMETRY
- LENGTH: 35.3 km (36.0 km)
- AVERAGE STRIKE: N27°E±13°
- AVERAGE DIP: Unknown, dips to northwest
- SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: This fault section has an irregular trace suggesting reverse movement.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-83, LA TOMA FAULT

FAULT NUMBER: EC-83

FAULT NAME: La Toma

SYNOPSIS AND GEOLOGIC SETTING: This fault is related to the formation of the Catamayo Basin and forms its western border. Neogene volcanic rocks appear to be uplifted on the west side.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Interpretation of radar images and fieldwork.

FAULT GEOMETRY
- LENGTH: 21.4 km (21.7 km)
- AVERAGE STRIKE: N3°E±11°
- AVERAGE DIP: Unknown, dips to the west
- SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault has irregular scarps and truncates drainages and sedimentation at its southern extremity.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-84, CATAMAYO FAULT

FAULT NUMBER: EC-84

FAULT NAME: Catamayo

SYNOPSIS AND GEOLOGIC SETTING: The Catamayo fault juxtaposes Neogene sediment against metamorphic basement (Pratt and others, 1997). The structure appears as a east-verging reverse fault in the Catamayo-Loja road. Farther north, the fault is steeply west-dipping and more like a normal, fault graben boundary (Pratt and others, 1997).

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 18.2 km (18.4 km)
AVERAGE STRIKE: N7°E±11°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms irregular scarps and elongated ridges.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

REFERENCES

Pratt W., Figueroa J., and Flores F., 1997, Geology of the Cordillera Occidental of Ecuador between 3° N and 3° S: CODIGEM-British Geological Survey.

EC-85, LAS PITAS FAULT

FAULT NUMBER: EC-85

FAULT NAME: Las Pitas

SYNOPSIS AND GEOLOGIC SETTING: The fault forms the eastern border of the Tertiary Loja basin. It appears en echelon to the Loja fault [EC-87].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 11.5 km (11.7 km)
AVERAGE STRIKE: N14°W±13°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It develops irregular scarps that are mostly discontinuous.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-86, EL TAMBO FAULT

FAULT NUMBER: EC-86

FAULT NAME: El Tambo

SYNOPSIS AND GEOLOGIC SETTING: The fault is related to the formation of the Tertiary Malacatus–Vilcabamba basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 17.9 km (18.7 km)
AVERAGE STRIKE: N28°W±19°
AVERAGE DIP: Unknown, dips to the northeast
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It shows irregular scarps. Most of the faults trace is concealed by alluvium.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-87, LOJA FAULT

FAULT NUMBER: EC-87

FAULT NAME: Loja

SYNOPSIS AND GEOLOGIC SETTING: The Loja fault uplifts the metamorphic basement to form the eastern border of the Tertiary Malacatus–Vilcabamba basin. It controls the main drainages and the border of the Loja basin. It appears en echelon to the Las Pitas fault [EC-85].

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 34.7 km (43.9 km)
AVERAGE STRIKE: N14°W±21°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms irregular but pronounced scarps and controls most of drainages. Most of the faults trace is concealed by alluvium.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-88, SOLANDA FAULT

FAULT NUMBER: EC-88

FAULT NAME: Solanda

SYNOPSIS AND GEOLOGIC SETTING: This fault forms the western border of the Tertiary Vilcabamba intramontane basin.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 21.0 km (24.1 km)
AVERAGE STRIKE: N41°W±22°
AVERAGE DIP: Unknown
Comments: Northern part dips to the west.
SENSE OF MOVEMENT: Unknown

GEOMORPHIC EXPRESSION: The fault forms irregular scarps.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-89, LAS ARADAS FAULT

FAULT NUMBER: EC-89

FAULT NAME: Las Aradas

SYNOPSIS AND GEOLOGIC SETTING: The structure borders the eastern margin of the Real Cordillera. It is related to an ancient fault, where some associated ophiolitic sheets could represent an old suture zone.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY
LENGTH: 47.5 km (48.8 km)
AVERAGE STRIKE: N4°E±14°
AVERAGE DIP: Unknown, dips to the east
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: It forms scarps and controls drainages.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-90, NUMBALA FAULT

FAULT NUMBER: EC-90

FAULT NAME: Numbala

SYNOPSIS AND GEOLOGIC SETTING: The structure juxtaposes the metamorphic belt to the west against non-metamorphosed volcanic and sedimentary rocks to the east.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES Photo interpretation

FAULT GEOMETRY
LENGTH: (DETERMINED FROM GIS)
AVERAGE STRIKE:

NUMBER OF SECTIONS: 2

EC-90A, NORTHERN SECTION

SECTION NUMBER: EC-90a

SECTION NAME: Northern

SECTION GEOMETRY

LENGTH: 97.1 km (96.3 km)
AVERAGE STRIKE: N17°E±13°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: The fault is locally marked by en echelon strands (scarps).

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-90B, SOUTHERN SECTION

SECTION NUMBER: EC-90b

SECTION NAME: Southern

SECTION GEOMETRY

LENGTH: 42.9 km (43.5 km)
AVERAGE STRIKE: N22°E±11°
AVERAGE DIP: Unknown, dips to the west
SENSE OF MOVEMENT: Reverse

GEOMORPHIC EXPRESSION: Fault forms scarps and controls drainages.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-91, NANGARITZA FAULT

FAULT NUMBER: EC-91

FAULT NAME: Nangaritza

SYNOPSIS AND GEOLOGIC SETTING: The structure controls the development of the Nangaritza Valley between the Nambija and El Condor cordilleras. Faulted Plio-Quaternary alluvial terraces are 100 m above the young level of the river and show some abandoned sinuous courses.

COMPILER, AFFILIATION, & DATE OF COMPILATION: A. Eguez, A. Alvarado, and H. Yepes; Escuela Politécnica Nacional, Departamento Geología and Instituto Geofísico; March 1997.

TYPE OF STUDIES: Photo interpretation

FAULT GEOMETRY

LENGTH: 57.4 km (64.0 km)
AVERAGE STRIKE: N7°W±20°
AVERAGE DIP: Unknown
Comments: Dips to the west in northern part, but dips east at the southern end.
SENSE OF MOVEMENT: Transcurrent, reverse

GEOMORPHIC EXPRESSION: Fault forms scarps on alluvial terraces and older uplifted terraces.

RECURRENCE INTERVAL: Unknown

SLIP RATE: Unknown, probably <1 mm/yr

TIME OF MOST RECENT OF MOVEMENT: Quaternary (<1.6 Ma)

EC-92, COLOMBIA-ECUADOR TRENCH

FAULT NUMBER: EC-93

Comments: Represents northward continuation of subduction zone (Peru-Chile trench) [PE-32] in Perú and Chile, and southward continuation of the Colombia trench [CO-48] into Ecuador. All of these features represent the subduction zone interface between the nazca and South American tectonic plates.

FAULT NAME: Colombia-Ecuador trench

SYNOPSIS AND GEOLOGIC SETTING: The Colombia-Ecuador trench and associated subduction zone is located offshore, about 100-200 km west of Ecuador's Pacific coast. It extends well to the north and south of the map area (see plate) along the entire west coast of South America as a continental-scale plate interface zone. This subduction zone is responsible for most of the great (M > 8) earthquakes and tsunamis that have struck the western coast of South America, both north and south of Ecuador.

COMPILER, AFFILIATION, & DATE OF COMPILATION: Michael Machette, U.S. Geological Survey, 2002.

TIPO DE ESTUDIOS/TYPE OF STUDIES: All studies are offshore, including seismic-refraction surveys.

GEOMETRY OF THE FAULT:

LENGTH: 910.2 km (953.1 km)

Comments: Subduction zone continues well south and north of Ecuador, about 100-200 km west of the coast of South America. Length offshore of Ecuador is only a portion of total length of subduction zone..

STRIKE: N6°E±56°

DIP: 35°E

Comments: The Nazca Plate is being subducted at a dip of about 35° beneath western Ecuador (Pennington, 1981).

SENSE OF MOVEMENT: Underthrusting to the east (landward)

Comments: This is the main subduction interface.

GEOMORPHIC EXPRESSION: The trench is well expresed in ocean-bottom bathymetry. Subduction typically causes subsidence or uplift along the coastal regions depending on distance from the interface, as in the 1906 Colombia-Ecuador earthquake (M 8) and 1960 Chile earthquake (M 9.5). According to Pennington (1981), Ecuador represents a portion of the Northern Andes where the Nazca Plate (slab) dips at a normal angle of 35°E. A more detailed analysis of the different seismicity profiles shows a more complex behavior of the slab; Gutscher and others (1999) concluded that Ecuadorian subduction system appears highly controlled by the subduction of the Carnegie Ridge and by the lithospheric tears within the Nazca Plate.

RECURRENCE INTERVAL: Unknown

Comments: Although unknown, the extremely high-plate convergence rates suggest that large interface earthquakes (with several meters of slip) must occur over time intervals of many tens to hundreds of years in Ecuador (see comments below).

SLIP RATE: >5 mm/yr

Comments: Convergence of Nazca plate (on the west) and South American plate (on the east) is at about 70 mm/yr (WSW; 260°) across the subduction interface as determined from Nuvel 1A plate motion solutions (DeMets and others, 1994; see http://www.ldeo.columbia.edu/users/menke/plates2.html).

TIME OF MOST RECENT MOVEMENT: Historic (1906)

Comments: A very large subduction-zone earthquake (Mw 8.8) struck Ecuador on January 31, 1906 and killed 1,000 people. The epicenter of this subduction zone earthquake was located at 1°N and 81.5°W, about 150 km offshore of an area of northern Ecuador that was not densely populated at the time (nearly 100 years ago).

NAME OF EARTHQUAKE: Colombia-Ecuador

DATE/FECHA: 01/31/1906

Comments: Source is NEIC (http://earthquakes.usgs.gov/docs/020204mag_signeq.html).

TIME: 00:41 GMT

Comments: Source is NEIC (http://earthquakes.usgs.gov/docs/020204mag_signeq.html).

MAGNITUDE OR INTENSITY: M 8.8

Comments: Moment magnitude estimated by NEIC (http://earthquakes.usgs.gov/docs/020204mag_signeq.html). Location is shown as 1°N and 81.5°W.

REFERENCES

DeMets, C., Gordon, R.G., Argus, D.G., and Stein, S., 1994, Effect of recent revisions to the geomagnetic reversal time scale on estimates of current plate motions, Geophyical Research Letters, v. 21, no. 20, p. 2191-2194.

Gutscher, M.A., Malavieille, J., Lallemand, S., and Collot, J.Y., 1999, Tectonic segmentations of the North Andean margin—An impact of the Carnegie Ridge collision: Earth and Planetary Science Letters, v. 168, p. 255-270.

Pennington, W.D., 1981, Subduction of the eastern Panama basin and seismotectonics of northwestern South America: Journal of Geophysical Research, v. 86, p. 10753-10770.

TABLE 1. QUATERNARY FAULTS AND FOLDS IN ECUADOR

Number	Name of structure	Sense of movement	Time of most recent faulting	Slip rate (mm/yr)
EC-01	San Lorenzo lineament	Unknown	<1.6 Ma	<1 (unknown)
EC-02	Esmeraldas fault			
EC-02a	Northern section	Unknown	<1.6 Ma	<1 (unknown)
EC-02b	Southern section	Sinistral, reverse	<1.6 Ma	<1 (unknown)
EC-03	Río Canandé fault			
EC-03a	Western section	Normal, dextral	<1.6 Ma	<1 (unknown)
EC-03b	Central section	Dextral	<1.6 Ma	<1 (unknown)
EC-03c	Eastern section	Dextral	<1.6 Ma	<1 (unknown)
EC-04	Galera fault	Dextral, normal	<1.6 Ma	<1 (unknown)
EC-05	Buga fault	Reverse	<1.6 Ma	<1 (unknown)
EC-06	Mache lineament	Unknown	<1.6 Ma	<1 (unknown)
EC-07	Cañaveral fault			
EC-07a	Northern section	Reverse, dextral	<1.6 Ma	<1 (unknown)
EC-07b	Central section	Dextral, normal	<1.6 Ma	<1 (unknown)
EC-07c	Jama section	Unknown	<1.6 Ma	<1 (unknown)
EC-07d	San Isidro section	Normal, dextral	<1.6 Ma	<1 (unknown)
EC-08	Quinindé fault	Reverse, transpressive	<1.6 Ma	<1 (unknown)
EC-10	Bahía fault			
EC-10a	Northern section	Sinistral (?)	<1.6 Ma	<1 (unknown)
EC-10b	Southern section	Reverse, transpressive (?)	<1.6 Ma	<1 (unknown)
EC-11	Calceta fault	Unknown	<1.6 Ma	<1 (unknown)
EC-12	Daule fault	Unknown	<1.6 Ma	<1 (unknown)
EC-13	Buena Fe fault	Unknown	<1.6 Ma	<1 (unknown)
EC-14	Jipijapa fault			
EC-14a	Jipijapa section	Reverse(?)	<1.6 Ma	<1 (unknown)
EC-14b	Julcuy (fault) section	Reverse(?)	<1.6 Ma	<1 (unknown)
EC-15	Río Colimes fault	Unknown	<1.6 Ma	<1 (unknown)
EC-16	Colonche fault			
EC-16a	Northwestern section	Reverse(?)	<1.6 Ma	<1 (unknown)
EC-16b	Northern section	Reverse, transpressive	<1.6 Ma	<1 (unknown)
EC-16c	Central section	Sinistral	<1.6 Ma	<1 (unknown)
EC-16d	Southeastern section	Reverse	<1.6 Ma	<1 (unknown)
EC-17	Carrizal fault	Unknown	<1.6 Ma	<1
EC-18	La Cruz fault	Dextral	<1.6 Ma	<1
EC-19	Chanduy fault	Unknown	<1.6 Ma	<1 (unknown)
EC-20	Posorja fault	Normal	<1.6 Ma	<1 (unknown)
EC-21	Jambelí fault	Normal	<1.6 Ma	<1 (unknown)
EC-22	Puná fault	Dextral	<1.6 Ma	<1 (unknown)
EC-23	San Isidro fault	Dextral(?)	<15 ka	0.2-1.0
EC-24	El Angel fault	Reverse, dextral(?)	<15 ka	<1 (unknown)
EC-25	Río Ambi fault	Reverse, dextral(?)	<1.6 Ma	<1 (unknown)
EC-26	Otavalo fault	Dextral	<1.6 Ma	<1 (unknown)

TABLE 1—CONTINUED. QUATERNARY FAULTS AND FOLDS IN ECUADOR

Number	Name of structure	Sense of movement	Time of most recent faulting	Slip rate (mm/yr)
EC-27	Billecocha-Huyrapungo fault			
EC-27a	Billecocha section	Normal	<15 ka	<1 (unknown)
EC-27b	Huyrapungo section	Dextral	<1.6 Ma	<1 (unknown)
EC-28	Apuela fault			
EC-28a	Northeastern section	Dextral	<1.6 Ma	<1 (unknown)
EC-28b	Central section	Dextral	<1.6 Ma	<1 (unknown)
EC-28c	Southern section	Unknown	<1.6 Ma	<1 (unknown)
EC-29	Nanegalito fault zone	Dextral	<15 ka	1-5
EC-30	El Cinto fault			
EC-30a	Guayacán section	Sinistral (?)	<1.6 Ma	<1 (unknown)
EC-30b	Río Cinto section	Sinistral	<1.6 Ma	<1 (unknown)
EC-31	Quito fault			
EC-31a	Northern section	Reverse, dextral	<15 ka	0.2-1.0
EC-31b	Southern section	Reverse, dextral	<15 ka	0.2-1.0
EC-32	Tandapi fault	Sinistral	<15 ka	1-5
EC-33	Papallacta fault	Dextral	<1.6 Ma	<1
EC-34	Río Baba fault	Reverse, dextral	<1.6 Ma	<1 (unknown)
EC-35	Machachi fault	Dextral	<1.6 Ma	<1 (unknown)
EC-36	Poaló fault	Reverse	<1.6 Ma	<1 (unknown)
EC-37	Nagsiche anticline	Reverse	<1.6 Ma	<1 (unknown)
EC-38	Latacunga anticline	Reverse	<1.6 Ma	<1 (unknown)
EC-39	Yanayacu anticline	Reverse	<1.6 Ma	<1 (unknown)
EC-40	Guangaje fault	Strike slip(?)	<1.6 Ma	<1 (unknown)
EC-41	Chugchilan-Sigchos fault			
EC-41a	Sigchos section	Transpressive, dextral(?)	<1.6 Ma	<1 (unknown)
EC-41b	Chugchilan section	Reverse	<1.6 Ma	<1 (unknown)
EC-42	Pucayacu fault	Reverse	<1.6 Ma	<1 (unknown)
EC-43	Valencia-La Maná fault			
EC-43a	Valencia section	Unknown	<1.6 Ma	<1 (unknown)
EC-43b	La Maná section	Reverse	<1.6 Ma	<1 (unknown)
EC-44	Quinsaloma fault	Reverse	<1.6 Ma	<1 (unknown)
EC-45	Calabí fault	Unknown	<1.6 Ma	<1 (unknown)
EC-46	Río Salinas fault			
EC-46a	Salinas section	Unknown	<1.6 Ma	<1 (unknown)
EC-46b	Southern section	Reverse(?)	<1.6 Ma	<1 (unknown)
EC-47	Guaranda fault	Reverse, dextral(?)	<1.6 Ma	<1 (unknown)
EC-48	Montalvo fault	Reverse	<1.6 Ma	<1 (unknown)
EC-49	Chillanes fault	Reverse	<1.6 Ma	<1 (unknown)
EC-50	Pallatanga fault zone			
EC-50a	Pallatanga section	Dextral, reverse	<15 ka	1-5
EC-50b	Central section	Dextral(?)	<1.6 Ma	<1 (unknown)
EC-50c	Southern section	Reverse, dextral(?)	<1.6 Ma	<1 (unknown)

TABLE 1—CONTINUED. QUATERNARY FAULTS AND FOLDS IN ECUADOR

Number	Name of structure	Sense of movement	Time of most recent faulting	Slip rate (mm/yr)
EC-51	Pancho Negro fault	Dextral (?)	<1.6 Ma	<1 (unknown)
EC-52	Naranjal fault	Reverse	<1.6 Ma	<1 (unknown)
EC-53	Ponce Enríquez fault	Reverse	<1.6 Ma	<1 (unknown)
EC-54	Chingual fault	Dextral	<15 ka	>5
EC-55	Reventador fault			
EC-55a	Northern section	Reverse	<1.6 Ma	<1 (unknown)
EC-55b	Southern section	Dextral	<1.6 Ma	<1 (unknown)
EC-56	Salado fault	Reverse, dextral	<15 ka (possibly historic, 1987)	<1 (unknown)
EC-57	Baeza-Chaco fault	Dextral, reverse,	<15 ka(?)	1-5
EC-58	Cosanga fault	Reverse, dextral	<1.6 Ma	<1 (unknown)
EC-59	Huacamayos fault	Dextral	<1.6 Ma	<1 (unknown)
EC-60	Pisayambo fault	Dextral	<1.6 Ma	<1 (unknown)
EC-61	Patate fault	Dextral(?)	<1.6 Ma	<1 (unknown)
EC-62	Candelaria fault	Strike-slip(?)	<1.6 Ma	<1 (unknown)
EC-63	Guamote fault	Dextral	<1.6 Ma	<1 (unknown)
EC-64	Cascales fault	Reverse	<1.6 Ma	<1 (unknown)
EC-65	Payamino fault	Reverse	<1.6 Ma	<1 (unknown)
EC-66	Sumaco fault	Reverse, transpressive (dextral?)	<1.6 Ma	<1 (unknown)
EC-67	Hollín fault	Reverse(?)	<1.6 Ma	<1 (unknown)
EC-68	Tena fault	Reverse	<1.6 Ma	<1 (unknown)
EC-69	Pusuno fault	Reverse	<1.6 Ma	<1 (unknown)
EC-70	Arajuno fault	Reverse	<1.6 Ma	<1 (unknown)
EC-71	Anzu fault	Reverse	<1.6 Ma	<1 (unknown)
EC-72	Mera fault	Reverse	<1.6 Ma	<1 (unknown)
EC-73	Puyo fault	Reverse	<1.6 Ma	<1 (unknown)
EC-74	Pastaza fault	Sinistral	<1.6 Ma	<1 (unknown)
EC-75	Santiago-Upano fault	Reverse	<15 ka	<1 (unknown)
EC-76	Macuma fault	Reverse	<1.6 Ma	<1 (unknown)
EC-77	Taisha fault	Reverse	<1.6 Ma	<1 (unknown)
EC-78	Paute fault	Unknown	<1.6 Ma	<1 (unknown)
EC-79	Gualaceo fault	Reverse	<1.6 Ma	<1 (unknown)
EC-80	Tarqui fault	Unknown	<1.6 Ma	<1 (unknown)
EC-81	Girón fault			
EC-81a	Northeastern section	Normal	<15 ka	<1.0
EC-81b	Southwestern section	Normal, dextral	<15 ka	<1.0
EC-82	Celica-Macará fault			
EC-82a	Celica section	Unknown	<1.6 Ma	<1 (unknown)
EC-82b	Macará section	Reverse	<1.6 Ma	<1 (unknown)
EC-83	La Toma fault	Reverse	<1.6 Ma	<1 (unknown)

TABLE 1—CONTINUED. QUATERNARY FAULTS AND FOLDS IN ECUADOR

Number	Name of structure	Sense of movement	Time of most recent faulting	Slip rate (mm/yr)
EC-84	Catamayo fault	Reverse	<1.6 Ma	<1 (unknown)
EC-85	Las Pitas fault	Unknown	<1.6 Ma	<1 (unknown)
EC-86	El Tambo fault	Reverse	<1.6 Ma	<1 (unknown)
EC-87	Loja fault	Reverse	<1.6 Ma	<1 (unknown)
EC-88	Solanda fault	Unknown	<1.6 Ma	<1 (unknown)
EC-89	Las Aradas fault	Reverse	<1.6 Ma	<1 (unknown)
EC-90	Numbala fault			
EC-90a	Northern section	Reverse	<1.6 Ma	<1 (unknown)
EC-90b	Southern section	Reverse	<1.6 Ma	<1 (unknown)
EC-91	Nangaritza fault	Transcurrent, reverse	<1.6 Ma	<1 (unknown)
EC-92	Colombia-Ecuador trench (subduction zone)	Reverse	Historic (1906)	>5 (ca. 70)