G.R. 74

M.P.C. Group. Murillo ridge.- ? Older Mesozoic to ? Carboniferous.

This group, more than 4000 m thick, lies conformably below the Cretaceous without a distinct boundary. It cannot be satisfactorily correlated either with the Venezuelan older Mesozoic La Quinta Series or with the Permocarboniferous of any of the localities mentioned above. Lithologically, the lower and middle parts show affinities with the Pipiral and the Gachalá, while the upper part, because of its conformity with the Cretaceous, is considered older Mesozoic. If this is true, a considerable change of facies of the Jurassic to Carboniferous series, from the Tierra Negra ridge towards west and to the southwest plunge of the Mérida massif must be supposed.

The M£P£C. group has been divided into a lower part, named M.P.C. a) (1200 m. thick) and a thicker upper one, divided into formations from M.P.C. b to M.P.C. i. Lack of fossils prevents the division of the upper part into a Permo-Carboniferous and an older Mesozoic series. A lithological boundary may be traced between formation e and f, because above "e" no red intercalations occur. Possibly this division corresponds to that between P.C. 8 and P.C. 9 of the Tierra negra column.

Indeterminate bivalves were found in the f formation. Plant remains and stems are abundant, but only in one case a plant which might be determinable was found by Zanella.

a) M.P.C. a) Formation. 1200 m.

This oldest formation of the Murillo ridge consists of red sediments, shales and shaly sandstones. It is partly altered into gneisses and mica schists in the upper part; the lower part is completely gneissic, excepting some black schists which might suggest black shales.

Being a thick red shale and sandstone sequence, the upper part of the formation may correspond to P.C. 1 of the Tierra Negra ridge and to the Pipiral and Sabaneta series. Hess determined a similar red formation at the headwaters of rio Cravo Norte, along the trend of the Murillo ridge. This may indicate that the facies of the Pipiral would extend to the Llanos Front in the Arauca zone and that in this direction unconformities must again be expected.

b) M.P.C. b) to i) Formation. M.P.C. b) about 300. m.

M.P.C. b) consists of well bedded to platy, brown olive to yellow brown, silty quartzitic sandstones, (the surface of which is densely covered with white mica), white fine to coarse grained quartzitic sandstones (probably discoloured by contact metamorphism) red sandstones and red, sandy shales.

M.P.C. c) 50 m.

This thin formation is typical. It is composed of black shales, limestones and siliceous, somewhat chertlike sandstones: no fossils could be found. Kehrer mentions cherts from the Carboniferous of Táchira.

M.P.C. d) (Torres sandstone) About 750 m.

This formation does not contain red sediments. It chiefly consists of light (white and yellow), medium to coarse grained, partly fineconglomeratic sandstone with numerous plant remains and stem. This quartz sandstone is frequently medium hard to soft; the quartz pebbles are mostly angular, only at the base rounded quartz pebbles were observed, Grey, dark grey, somewhat carbonaceous shales are interbedded.

M.P.C. e) 800 m or more.

This thick formation contains the same sandstone type as the d) formation, but alternates with red shaly sandstones and red shales. Plant detritus is less frequent than in the formation below.

M.P.C. f) 300 m.

It consists chiefly of shales, of grey, dark grey and greenish colours, mostly altered into hard slates. Plant remains occur rather rarely. One bed contains small concretions with well preserved, but indeterminate micro-bivalves. Interbedded blackish shales and siliceous sandstones were observed in the middle part. The lower shales are considerably micaceous and sandy and are interbedded with highly quartzitic sandstone.

M.P.C. g) 250 m.

This formation is composed of grey to dark grey and olive well bedded shales with plant remains, (including rather well preserved specimen) and of fine to medium grained platy and coarse, micaceous quartz sandstones frequently very micaceous. A thin coal seam occurs in this group.

M.P.C. h) (Concordia shale) 120 m.

This typical member consists of laminated, banded, medium thick bedded grey to dark grey, micaceous shales and shaly partly platy sandstones with a large amount of plant detritus.

M.P.C. i) (provisional top member)

Consists of white and yellow medium to coarse grained and fine conglomeratic quartz sandstones and grey shales. At the topmcarbonaceous and pyritic materials are abundant. Towards the bottom occur interbanded yellowish sandstones and shales highly micaceous on the surface, and thin bedded light green to brown, platy sandstones. Stems are frequent.

Prop. Tambor, cgl. Cagueba, arriba boca Fregena.

Reciente: Aluvión ± 30-150 m Barro, arena, gravillas y cantos fluviátiles.
Pleist. Terraza } 100 m Arenas, gravillas y cantos grandes
Plioc. S. Miguel } Arenisca cgl, arcillas abig., sin fósiles.

Discord.

Mioc. Ospina 500-1000 m Arcillas, en parte aren. abig., intercestrat. con aren. y cgl medio blandas, fluviát. y sin fós.) localm. con yeso

Olig. Orita 1200-2000 m Arcillolita verde gris a gris, muy limosa a arenosa, con nód. de caliza B. Limolita: verde, grisácea, dura, comp, arcillosa Carbón y lignito en capas delgadas. Arenisca: gris, fina, arcillosa

Eoc. Pepino 150-400 m Aren. grujosa y cgl. masiva color canela, con fragm. de horstens granulares a grandes y grujosos. Forman colinas. Arcillolita y limolita gris a roja.

Paleoc. Ranitas 160-450 m Arcillolita blanda, rosada, roja o perda, localm. arenosa, alterna con aren. roja o amb, arcillosa, localm. cglomerática.

Guadalupe-dulcedo Arenisca blanca a gris y negra tierna, friable, porosa y permeable.

"Villeta" 60-170 m Arcilla pizarr. gris clara a negra, calcárea, B, alterna con caliza maciza B y aren. blanda, porosa de horstens y cuarzo

Caballos 105-325 Arenisca blanda, porosa, permeable, de cuarzo, cgl. basal, y grujosa con aren. pizarr. localm. B

Hotonia Arenisca arcillosa, alterna con arc. pizarr. roja o purpura.

Precámbrico.

El Cretácico y el Hotonia se hallan en el macizo de Garzon desde el río Tambor al SE.

GR. 52

2. Ele conglomerate.

The type localities are situated in the upper río Ele and in the Qda. del Potrero.

This very thick series is chiefly composed of massive, hard sandstone beds with numerous intercalations of fine to medium conglomeratic layers. Thin intercalations of shales are frequent.

The sandstones are white to greyish-white, sometimes brown weathering, fine to very coarse grained, frequently crossbedded and banded with dark, coaly, zig-zag lines. On the surface, they show a charatceristic, rough, cavernous aspect with black, coaly skins and numerous carbonised stems of plants (up to 20 cm wide and often several meters long).

The intercalated conglomerate beds are not very thick (0,10 to 0,60 m), the pebbles being fine to medium grained. The prevailing colour of the pebbles is white, the principal constituents being quartzite, secondary light to dark grey sandstone and sometimes hard, black, very fine grained sandstone.

The shale layers are light grey to bluish grey, partly sandy, soft, rarely hard and finely micaceous, 0,05 to 1 m thick, and contain stems of plants and coaly shales with plant detritus.

The section which crops out in the río Ele measures 2500 m; 925 m correspond to the upper part, 375 m to the middle and 1200 m to the lower part.

Divisions

c) Upper part; consists only of fine conglomeratic intercalations in the sandstone. The grey shales show occasionally red-purple splotches.

b) Middle part; is composed of fine to medium conglomeratic intercalations. The shale beds are numerous, composed of soft to hard, finely micaceous material, with plants and plant detritus in the coaly layers. The plant stems are particularly frequent in the shales as well as in the sandstones and conglomerates, often being arranged in the form of layers. This middle part is highly pyritic and contains pyrite concretions.

a) Lower part; composed of fine to medium conglomeratic layers, thin, brilliant coal layers, light grey, soft, finely micaceous shales and plant stems. In the upper part, an intercalation of deep red and green shales was observed.

Llanos Amazónicos

Zona Río Orteguaza, al Sur de Florencia.
Sabanes Petrol. Co. Texas.

Pozo Curvinata N. 1. (río Pescado, arriba confl. con Orteguaza) Al S de Florencia

Pies
0-1400m ± Form. Sarabanda: Olig. Gredita abigarrada, en veces con arenisca grano medio-fino, raros veces grano grueso, guijosa (lidita) y friable. En la parte baja gredita abig. roja con yeso, anhidrita con ẽo y ẽ, algunos bancos carbonáceos y carbón, y arena fina friable, con intrc. arcillas esquistosas.

— — — — (intergradación)

1400-1930 Foram. Bodoguero. - Olig. Gredita gris, algo rojiza y púrpura. Poca arcilla esq., ẽo, anhidrita.

(contacto litol. brusco)

1930-2580 Form. Orteguaza. - Olig. - Arc. esq. gris verdosa, poco veces gris parda, en veces astillosa con ẽo, anhidrita y limolita. En base arcillolita blanca, silícea, arenosa. (gredita)

2580-3112 Form. Pepino. - Paleoc.-Eoc. Arenisca de grano fino hasta grueso, en varios niveles conglom., sobre todo en base (150m), con guijos de lidita y cuarzo; alternando con gredita abig. y arc. esquistosa gris, algo carbonácea.

3112.— =950m ... Basamento: neis duro, verde y rojo.

Río Orteguaza, al E de Curvinata (reducción del Pepino)

Pozo La Reatra No 1. en río Orteguaza, poco abajo confl. río Pescado Orteguaza.

0-1850 = Form. Sarabanda: Olig. Gredita abigarrada, con algo yeso, en veces carbonácea, poca limolita y arenisca dura lenta blanda. En la parte baja gredita abig. y arc. esq. gris osc., en veces carbonácea y calcárea. Frecuentes niveles ~~fosilíferos~~ con ẽo.

1850-2310. = Form. Bodoguero: Olig. Gredita y arc. esquist., local m. carbonácea y calcárea con ẽo frecuentes.

2310-2935 = Form. Orteguaza, Olig. - Arc. esq. gris verdosa, raras veces color marrón, con ẽo parte alta. Poca limolita.

2935-3.088 (940m) Form. Pepino (Paleoc-Eoc.). Arena blanca y gris, friable, arcillosa, de grano grueso hasta cgl. En la parte alta algo gredita blanca lenta gris, a abigarr.

3088 - .... Basamento: Apalita.

Llanos Orientales.

Pozo Solita No 1.
Texas Petrol Co.
Rio Caguetá abajo de Cananguchal (Comis. Caguetá)

| | | Pies |
|---|---|---|
| 0- | Form. Sarabanda Obj. | 0-75' Greda'ita marrón gris, calcárea con poca arenisca blanda, blanca |
| | | 75-115' Aren. gris, fina, calcárea. |
| | | 115-555' Greda'ita abaj., limosa y tal, yesosa con algo arena. blanda y caliza fosil. |
| | | 555-650 Congl. fino, redondeado (lidita y cuarzo) |
| | | 650-1054 Greda'ita abaj. yesosa, localm. calcárea |
| | | 1054-1530. Greda'ita abaj. yesosa, sin cal, localm. limosa y carbonácea, con poca are. esquistosa gris carbonácea. |
| | | 1530-1966. Greda'ita abaj. yesosa, localm. calcárea con la'm. arena fina |
| | | 1966-2030 Greda'ita abaj. yesosa, en parte limosa y carbonácea. Poca arena. esq. y capas fosil. |
| | | 2030-2280 Greda'ita abaj. arenosa. caliza y pedacitos carbon |
| | Form. Badaguero: Obj. | 2280-2720 " " " |
| | Form. Ortegüaza: ~~Obj. 2280-2720~~ | 2720-3040 Arcilla esquistosa gris, yesosa, limosa |
| | | 3040-3365 " " , con greda'ita gris y verdosa. |
| | Form. Pepino Eoceno | |
| | | 3365-3463 Greda'ita muy dura gris verdosa con granos cuarzo, lidita, pocas capas arenisca de lidita y cuarzo y pocha gris de lidita |
| | | 3463-3515 Greda'ita blanda, abaj. limosa y yesosa, sin cal. |
| | | 3515-3535 - Are. esq. y dura, limosa a arenosa, poca arena fina. |
| | | 3535-3675. - Aren. fina a gruesa, grano angoloso, compuesta de cuarzo. |
| | Basamento 3675-3740. - 1130m. | Roca hornblendica, metamorfizada en superficie |

Geol. Rundschau Bd 45, Heft 2, 1956.

Diskontinuitätsfläche
Unstetigkeitsfläche von Mohorovicic Anahme der Longitudinalwellen von 7 auf etwa über 8 km/sec springt = Grenze: Lithosphäre-Asthenosphäre
7-50 km Tiefe (Ozean-Gebirge) Kruste - Mantel,

Nach Benioff Grenze Erdkrustenblock in 700 km Tiefe = Oberfläche in der Beben die Existenz von tekt. Vorgängen beweisen.

Erdkern: Nach Adams: Sial, mit weniger Si als Gabbro u. Basalt, Longit.-wellen 6 km/sec
Ultrasima mit viel grösserem Si-Gehalt als Gabbro, Bas. 8 km/sec
Sima = Gabbro-Basalt = 7 km/sec

Conrad-Diskontinuität, zwischen Granit u. Gabbro in 20-25 km Tiefe bei
" Ellen u. Posadena, in beiden Fällen mit Reflexionen
" der Mohorovicic-Fläche, die etwa 8 km tief liegt

Erdkern: Bisher Nickel-Eisen, Annahme der Meinung, dass die Erde durch allmähliche Anhäufung von kaltem Material entstanden ist u. dass die Erde nie ganz geschmolzen war.

1300 km vom Erdkern beginnt der "innere Kern", der mögliche Festigkeit, während "äusserer Kern" flüssig, da keine Transversalwellen durch den äusseren Kern beobachtet wurden u. die Erde als ganzes nachgiebiger ist, als von einer durchaus festen Kugel zu erwarten ist. Die meisten Geophysiker nehmen an, dass "innerer Kern" aus festem, der "äussere" aus flüssigem Eisen besteht, vielleicht auch ausgeschmolz. Gesteinsmaterial

Langsame Konvektionsströmungen im Erdkern anzunehmen, als Ursache für magnetfeld der Erde anzunehmen.

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Geol. Rundschau Bd. 45, Heft 1, 1956

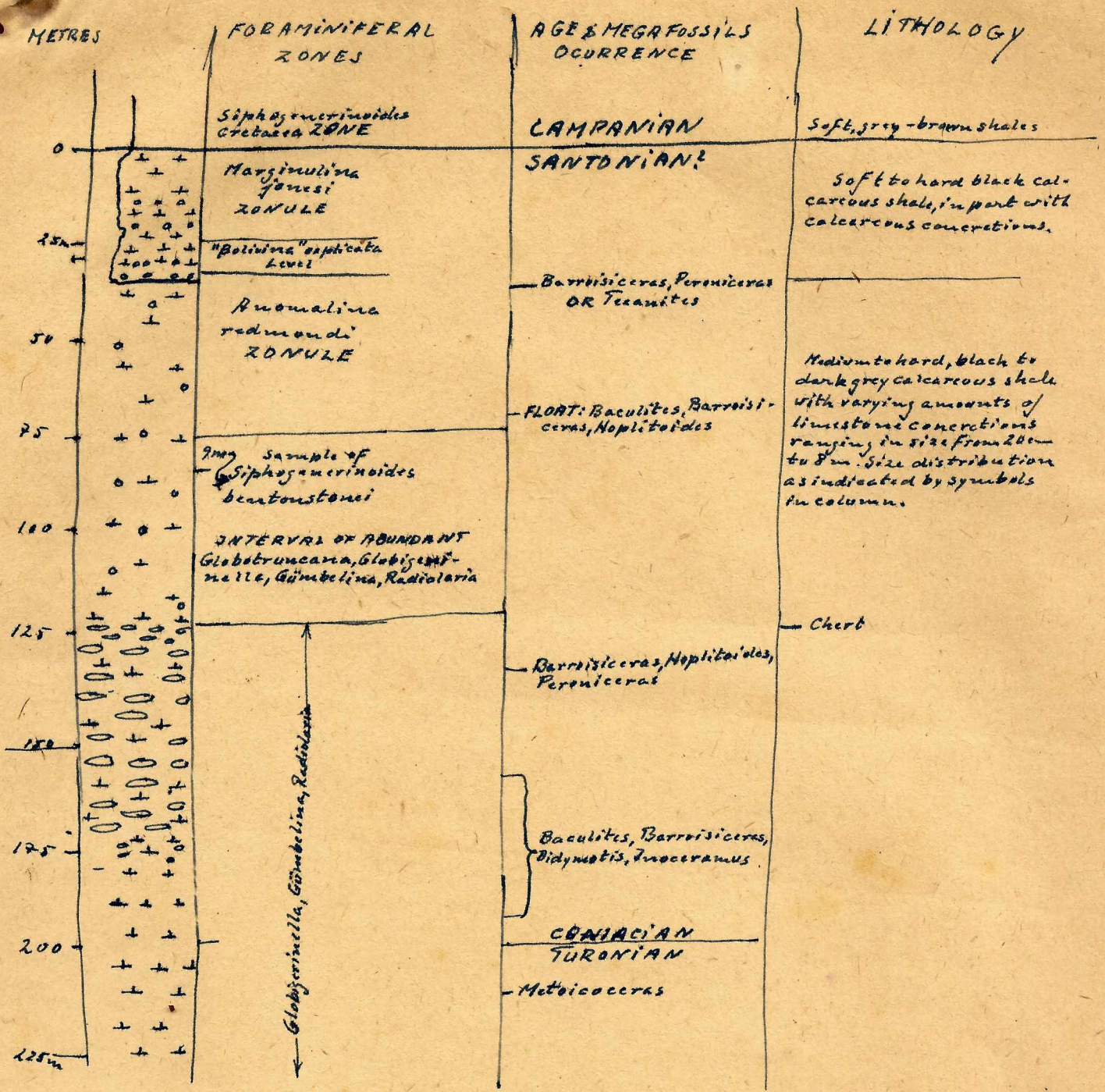
Grundfragen der Allgemeinen Tektonik. W. W. Belousoff, übersetzt von S. v. Bubnoff

Ptol Oszillatorische, plikative u. rupturelle Bewegungen
Primäre tekt. Bewegungen durch Ursachen aus der Tiefe hervorgerufen
u. häufig oszillat. Bewegungen entstanden.
sekund. Bewg. abgeleitet von Spannungen, durch primäre Bewg.
hervorgerufen u. durch versch. Reaktion der Gesteine auf diese
Spannungen; sie sind plikativen u. rupt. Charakters.

Oszillat. Bewg. 2-teilig. 1) allg. Schwing. od. Pulsationen, die
vorwieg. Trans. u. Regr. hervorrufen. 2) wellenförmige
Bewg. bedingen Einmuldung u. Aufwölbung der Erdrinde,
erkennbar an Mächtigk. u. Fazieswechsel
Etagen od. "Zyklen" allgem. Schwing. 150 mill. Jahre; die
allgem. Schwing. in Zusammenhang mit Hebung u. Senkung der
Kontinente.

Wellenförm. o. z. Bewg. auch bei Hebung sammt Magmatismus hervor
u. Einbiegungen barischen.

Ozeane in Paläoz. flachen (Kratonsockel, Geosynkl.). Zunahme der
Wassermenge der Erde im Paläoz. gegen heute.
Ozeane überall mit erlöschenden u. verschwundenen Vulkanen




NOTE: section below "Bolivina" explicata from Quebrada El Salto. Higher part of sections from wells

Afta V. Petters

Composite columnar section showing stratigraphic positions of Siphogenerinoides bentonstonei Redm., n. sp.

A new Siphogenerinoides from the Cretaceous of Colombia. - C.D. Redmond. Micropaleontology, Vol. 1, No. 3, pgs. 248-249, 1955

Siphog. bent. oldest known representative of this genus from q. El Salto, 16km NW of upstream Las Palmas, Tetuan region and crossing of q. Las Robles and the trail connecting Corral de Piedra and Loma Chiquita, approx. 12.5km N of Aguachica on Zamarra-Ocaña aerial cable line.

Types of Tertiary Formations in Northwest Peru
R. H. Stainforth. Bull. Am. Ass. Petrol. Geol. Vol 39, No 11, 1955, pgs 2068-2077.

| New Classification | | Old. Classif. (Olsson, Iddings, Bosworth) | |
|---|---|---|---|
| Heath Sh | U. Olig. | U. Olig. | Heath Sh (of North) |
| Mancora Cgl. | M. Olig. | M. Olig. | Mancora fm. (of North) incl. Punta Brea grits |
| | | U. Olig. (?) | Heath Sh (Cone Hill facies of the South) |
| Cone Hill | | M. Olig. | Mancora fm. (Mirador of south) |
| Mirador Sd. cgl. | | L. Olig. | Chira (Bayovar) Sh. |
| Chira Sh | | | Saman fm. (incl. Verdun grits) |
| Verdun Sd | U. EOCENE | Upper Eo-cene | Pozo Sh. |
| Pozo Sh. | | | Talara Sst |
| Talara Sst | | | ~~Talara Sh (or Saman) cgl~~ |
| Talara Sh | | | Lomitas (or Saman) cgl. |
| Basal Talara Cgl. | M. Eocene | | Restin fm. (part) |
| Cabo Blanco Sh & Sst | L. Eo-cene | Middle Eocene | Cabo Blanco Sd, locally beds of Parinas fm |
| Chacra Sh | | | Restin fm. (part |
| Parinas Sd | | | Parinas sand |
| Pale Grede Sh & Sst | (Midway) | | Pale Grede fm. |
| Salina-Negritos Sh, Sd. & cgl. | Paleocene | | Salina fm. |
| Balcones Sh | (Danian) | Lower Eocene | U. Negritos fm. |
| Mesa Sds | | | Lower Negritos Sh. |
| Petacas Sh, Ancha cgl. | Upper Cret. | | not known |

(X) Miscorrelation of the Mirador and Cone Hill fms of the La Brea - Parinas Estate with the Mancora and Heath of the Lomitas region.

Petacas = Monte Grande fm = Maestricht.: Rugoglobigerina rugosa & Gümbelina globulosa

Ancha Cgl. - Conformable between the Campan. - Maestr. Redondo Sh & the Maestr. Petacas Sh.

Not demonstrably conformable above Petacas; correlative with basal Hat Pass Cgl. 10 km S of Paita, which unconformable on late Maestr. fms; and thus Mesa Cgl. must be determined as basal Tertiary. Passage of both Mesa and Hat Pass into Balcones indicate their lower Paleocene age.

Balcones (S. Frizzell: Bull. Am. Ass Petrol Geol. Vol. 17, pgs 331-53) Marsonella oxycona, Pseudoclavulina (Clavulinoides auct.) clavata, Spiroplectammina grzybowskii, Pelusina scrupora. - B. Stone: Rzehakina epigona vars. - Balcones = Velasco of Mexico (younger than Navarro and older than basal Tertiary Midway of Texas and not represented in the Gulf Coast Sherbino (Frizzell).

The Rzehak. - Spiroplectammina only in lower half of Peruvian Paleocene; U. Paleocene represented by Globorotalia crassata aequa, Bulimina arkadelphiana midwayensis, Siphogenerina elegantula, etc. This subdivision is my equivalent of lower unit stage ("Danian") and an upper one ("Midway"). The "Danian" would represent the Chandiere - Lizard Springs of Trinidad; the "Midway" would be the Soldado fm.

- - - Maestr. Petacas Sh.
- - - - Ancha Petacas cgl.
- . - . - Camp. Maestr. Redondo Sh.

The Soils of Mbozi

Tanganyika Geol. Survey Dept. - Bull N° 24

Govt. Printer, Dar es Salaam, 1955.

by A. H. K. Spurr

Tipos Leyes Disposición Investig. Suelos.

Introd
Trabajos precedentes
Geomorphologie — Parte I
Drenaje.
Geologie
Condiciones climáticas (lluvias, Temperat.)
Hombre de agua, corriente y subterr. Tablas de agua.
Vegetaciones. Tipos, relación con geomorph.

Parte II.

SUELOS. (catenas)

Introd: Grupos de Suelos según su material parental.
Suelos Antiguos.
Suelos Jóvenes

Características generales de los suelos de las zonas antiguas y jóvenes.

Examen petrográfico: grueso, grano, fracciones de mineralos pesados y livianos.

Análisis mecánicos y químicos. Mec: capacidad de conservar agua.
arena y mezcla, limo, silt, greda, humedad.
carbon organico, ratio carbon/nitrogeno.
nitrógeno, calcio intercambiable, potasa,
fosfato disponible

Características morfológicas y composición química.
Espesor, color, estructura, consistencia, textura.

Nutrientes de plantas contenidos en cada tipo de suelos.

Erosion de Suelos.
Mas notable el silt y fertilidad. (arcillas gredosas, de textura gruesa, rojos, pardos y humíferos rosados!)

Productividad y potencial agrícola.
Todos los suelos tropicales pobres en nutrientes de plantas, pero son inicialmente productivos al ser cultivados por primera vez en europeos. El problema es controlar la pérdida rápida de materia orgánica y la preservación de la productividad. Aplicación de fertilizantes artificiales no corrigen necesariamente deficiencias de suelos, p.e. calcio, fosfato y azufre aumentan el rendimiento. Fosfato ruido mezclado en [illegible] y gravel rinde.
Poco se sabe en general sobre reacción de suelos tropicales a toda aplicación de combinaciones de fertilizantes.
Factores climáticos, especialmente distribución de lluvias y la relación lluvia - evaporación tienen gran influencia en la producción de granos del tropico, así como también condiciones físicas del suelo, cambio de agua, reacciones de soluciones del suelo, capacidad de retener la humedad.
Debe observarse sobre todo:
1) Conservar el suelo tope y con su material orgánico.
2) mantener la estructura del suelo tope de manera que el aire y la humedad puedan penetrar libremente
1) con capas superficiales.
3) Conservar el agua del suelo, previniendo evaporación superficial y mitigación de la costra
Abonos reducción de la tasa del Sol.
Abonos verdes. Entrincolar antes de las lluvias. Suelos que se agotan del sol deben arborizarse con arboles leguminosos de raices profundas. Cubrir de pasto, hojas de bananos y otros residuos vegetales evitan también evap. rapida cuando humedecimiento rapido.
Donde hay cultivos mixtos, no hay mejor manera de conservar la fertilidad del suelo, su propiedades naturales que dejarlo bajo pasto y en práctica de cultivos, cotinuar a la rotación de granos.

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Conclusiones: Génesis suelos intimamente relacionada con geomorfología. Los suelos tropicales muy lixiviados y pobres en nutrientes. El clima tuvo mas influencia en la formación de los suelos que la naturaleza de la roca subyacente. La influencia de los condiciones

Submarine Slidings in Western Venezuela (State of Lara)
O. Renz, R. Lakeman & S. van der Heulen.
Bull. Am. Ass. Petrol. Geol. Vol. 39, No 10, 1955, pgs 2053 - 2062.

Stratigraphy.

State of Lara. Regular Section.

900m: Cogollo: On la Quinta, N of Curarigua

L. Cogollo: Basal Cgl of quartz pbls; above cryst. Lst. v. Choff. decipiens, echinoderms & mollusks. bistratal Lst:

M. Cogollo: mainly bistratal Lst w. L, mgr-fgl orthoquartzite. In upper part 10m-10m Orbitolinatexana (Roemer). Rudists.

U. Cogollo: U. Albian; altern. Lst & Sst. Upper mbt part with Venericardia, Paraenganoceras, Hysteroceras & Parvinguieria

270m. La Luna L. Lalima: Lst w. Concretions & Hypoturrilites, Acanthoceras, Mantelliceras = Cenoman.

M. La Luna: Marls & Shales w. fewer Lst pCo, w. ammonites of Lower & U. Turon: Mammites, Hoplitoides, Fagesia, Neoptychites; U. part: Coilopoceras.

U. La Luna: thick-bedded Lst w. stringers of chert p Coniacian a mmon.: Barroisiceras, Paralenticeras, Gauthiericeras.

450m: Colon Thick Shales correl. with Colon of La Paz-Mara. Base: glauconite-phosphat zone, a few metres thick, persists in to Shales w. Siphogenerinoides, Globotruncana & Bolivina a. In middle part conspicuous Sst, above which Baculites sp. of Senon. Overlying Sh w. poor microfauna abund. fr co.

670m. Paleocene. Conform. on Cret. Altern. Lst & Sst w. Sh. layers. Lower part w. Venericardia, prump planicosta. U. part Lithothamnium w. large & common Ranikothalia

220m M. Eocene. Lower Eocene missing; Paleocene unconform. below M. Eoc.
7250m U. Eocene Sh. M. Eoc. Granular oolithic fossiliferous, brick red weathering w. calc. intercal. Faunas, identical w. Caracho Valley (Trujillo)

Bergantin-Imeto trough. - Slab sections

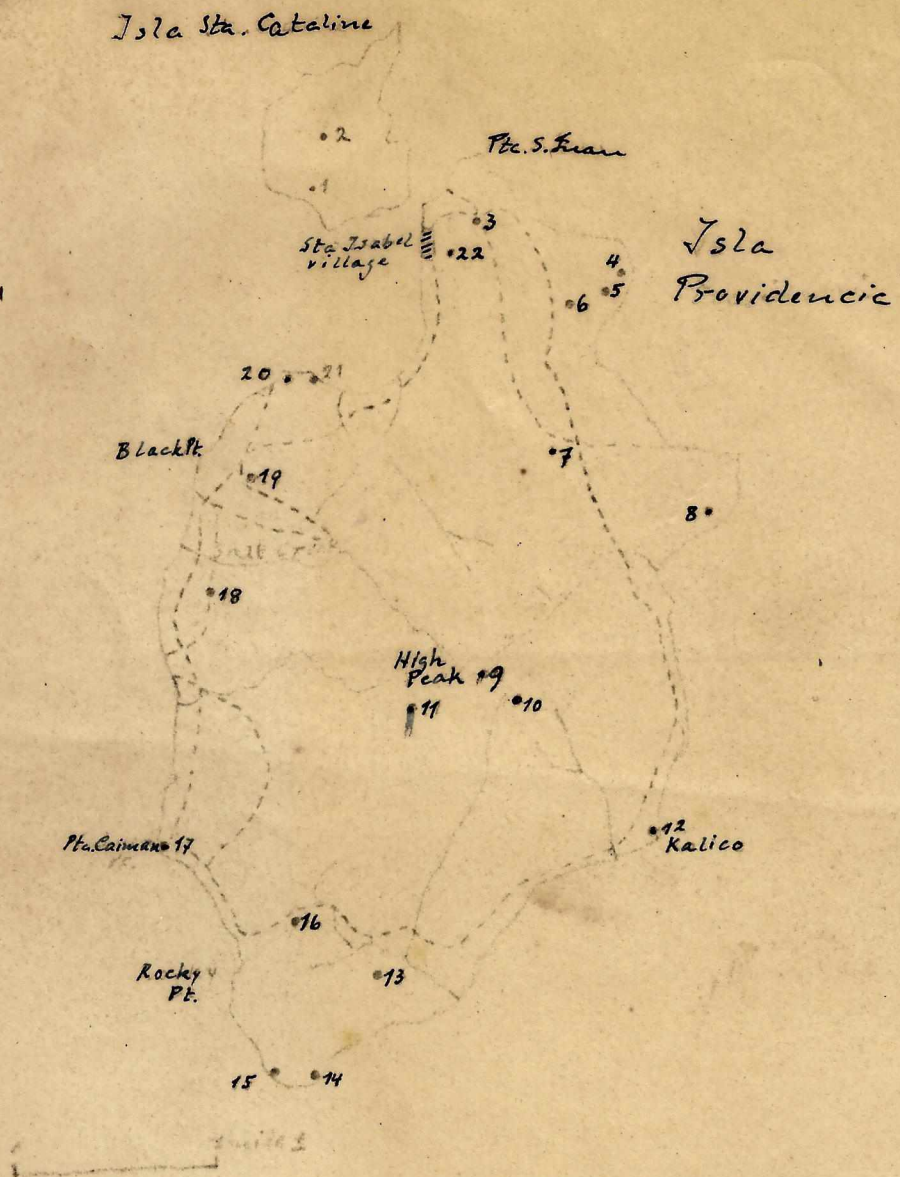
U. Cret. - Mainly cherts, prob. Senon, conformably below 6th Sh w. Colon fauna.

1350m: Paleocene. - Conform. on U. Cret.: monot. seq. of dk gr to blk Sh w. thin fgr, impure Sst & intraformational breccias. L. part boulder bed of Luna & Cogollo Lst. In Sh above La Luna Lithoth. reefs w. Ranikothalia Caudri, Discocyclina (Discocyclina) cf. mestini Vaughan.

1300m L. Eocene. - Conform. on Paleocene: Base: cgl. Sst w. pebbles w. large Paleocene fs; considered to be L. Eoc. Above monoton. blk p d gr. Sh w. bldrs cryst, Cret. & Paleocene rocks. Above Sm lentic. fs stone w. Nautilus. Higher a conspicuous Sst w. pbls of Paleocene, overlain by breccious calc Sst w. large L. eocene fs (Amphistegina aff. cubensis Palmer, Helicostegina sp. Eocenuloides of wellsi Cole & Bermudez, Discocyclina (Discoc.) anconensis Barker U. part: Sh w. L. Eoc. Foram. (Trematostegina schmidli (Cushm.)

7900m M. Eocene: Starts w. Sh. w. Pseudophragmina (Proporocyclina) renzi, de Civrieux. In L. Sh. blk. bed. Above Sh as below. w. 3m Sst bed.

Location of Mitchell's Samples




Sketch of Providencia
(Intendencia San Andrés
y Providencia).

Raoul C. Mitchell

Geologie en Mijnbouw(NW.SEr.).17e Jaargang,Maart 1955

# Geological and Petrographic Notes on the Colombian Islands of La Providencia and San Andrés, West Indies.

-By Raoul Mitchell, (1870 Feb) Consulting geologist and geophysicist, Mamer, Luxembourg.

Extracto petrográfico de Providencia:

LP 1. Augite-andesite. Brown black, oily looking rock, with amigdales of bluish opal. Phenocrysts of andesine and augite, with blende. Groundmass of plagioclase and devitrified glass of very fine grain. Summit of highest hill in Sta. Catalina island.

LP 3. Basalt. Greenish augite phenocrysts and abundant lathes of labradorite. Serpentine(?), developing from decomposed blackish mineral which may be olivine. Crest of road running East from Sta Isabel to east coast.

LP 4. Augite andesite. Similar to LP 1, containing much less opal, which, however, is highly fractured. 150 m from summit of NE Hill, eastern slope.

LP 5. Analcite-andesite. Greenish-brown, deeply weathered rock. Zonal plagioclase, chiefly of albite composition, and purplish pleochroic augite in almost equal proportions. Olivine altered to serpentine. Microlites of augite and very small flakes of biotite. Scattered round grains of analcite ocurring between the plagioclases, and, in some cases, replacing the latter to varying degrees. One or two clusters of calcite. Near base of southern slope of NE Hill.

LP 6. Essexite(?), Greenish-grey rock, of distinct diabasic texture. Andesine the predominant plagioclase, but albite and labradorite recognized. K-orthoclse ocurring as irregular borders around the plagioclases. Purple pleochroic augite. Lathes of strongly pleochroic biotite. Natrolite replacing plagioclse in places. 100 feet below summit of northern side of the gash, Split Hill.

LP 7. Hypersthene-basalt. Greenish-brown rock, fine-grained, with greasy lustre. Several large phenocrysts of hypersthene and clusters of albite in needle-like form. Hypersthene partly altered to poorly pleochrio bluish bastite. Fine, even-grained groundmass of plagioclase, zoisite and augite, lastnamed largely altered to chlorite. Relatively large amount of recrystallized magnetite and thin lathes of apatite. 100 feet below summit of Fair Way Hill, eastern slope.

LP 8. Nepheline-basalt. Brown grey rock. "Hourglass" structure, greenish augite phenocrysts, also euhedral crystals of olivine phenocrysts altering to iron oxydes. Holocrystalline groundmass of augite, nepheline, biotite, analcite and calcite. The nepheline is largely decomposed, showing radiating clusters of acicular crystals. Summit of High Peak.

LP 10 Diabase. Medium-grained, dark grey, deeply weathered rock, with sperioidal structure. Characteristic ophitic texture. Oligoclase and albite prismoidal crystals, with inclusions of apatite. Pale-yellow dipside, highly altered to green chlorite. Cubic crystals of magnetite, altering to limonit. Idiomorphic ilmenite. Partly chloritizized uralie. Fine-grained aggregates of quartz, of secondary origin. Middle of the saddle between High Peak and hill to the SE.

LP 11. Diorite. Coarse grained, greyish rock. Anorthite and bluish augite comprise 90% of the specimen. Minor constituents chiefly hornblende and magnetite. Much of the plagioclase has undergone sericitization, but little chloritzation of the augite is evident. Some quartz shows undulatory extinction. Ilmenite, apatite and magnetite chief accesories. Spanish Saddle, 120 feet below summit, western slope.

LP 12 Quartz-biotite-diorite. Greyish-brown, medium grained rock. Albite, oligoclase, quartz and biotite of hypidiomorph ic ocurrence. The plagioclases are partly sericitized. Quartz has enclosures of apatite as well as gaseous and liquid inclusions. Discloured blackish biotite, altering to chlorite. Brownish-green hornblende, octahedral magnetite, zircon, chlorite and orthoclase also present. Kalico Point.

LP 13 Quartz-biotite-hornblende-diorite. Similar to LP 12, but hornblende, of colourless variety, more prominent. 75 ft. below summit of Murray Hill, eastern slope.

Great and little Corn Islands composed of volcanics, essentially andesitic, unusually fringed by coral reefs.

Westerveld, J; Geol. & Mijnbouw. 17 Jaarg. pg 84-88 1955
The island festoons of Banda sea belong to two drowned fold systems (the Nealmoeat and the Sunda orogen.

LP 14 Quartz-hornblemde diorite. Fine grained, greish-green rock. Partly-twinned albite, showing partial claritization, Hornblende in places corroded and partly decomposed into epidote, Quartz and plagioclase show granophyric integrowths. Prisms of apatite in the plagioclase. Headland at extreme SE corner.

LP 15 Quartz-biotite-diorite. Similar to LP 12, but shows needles of tourmaline ~~Pirginclase~~ and veinlets of epidote. Lighthouse at extreme SW corner.

LP 16 Quartz-biotite-diorite. Similar to LP 15, minus tourmaline. Plagioblase more sericitized and saussuritized. 200 yd on west side of road crossing island at S-end.

LP 17 ~~Hypersthenexandesite~~ Tuffaceous shale. Greenish black, fine-textured, laminated, calcareous shale which could also be considered a atratified ash. Very soft, but less pliable than ordinary shale. Small specks of magnetite and what is considered carbonaceous matter are present. Possible fossil fragments, determination not made, but are foraminifera. Punta Caiman.

LP 18 Hypersthene-andesite. Greyish-brown, finegrained rock. Idiomorphic phenocrysts of bytownite, labradorite and andesine, with complex twinning, & also a few phenocrysts of hypersthene, showing good prismatic cleavage and pleocroism. Scattered, sttongly pleocroic hornblende. Magnetite occurring as a few octahedral crystals. Some microlites of augite. Half-way up w slope of Sugar Loaf.

LP 19 Trachy-andesiye, Grey-black, deeply weathered rock of pronounced porphyritic appearance. The core of the plagioclase phenocrysts consists of bytownite-Labradorite, changing to ~~andesine~~ andesine at the margins. Inlets of sanidine(?). Some plagioclase crystals measure up to 1 cm in length. Also phenocrysts of black augite and corroded, greenish hornblende, Microcrystalline groundmass of blackish hornblende, blue black augite, grey dippside, but chiefly of siliceous material. Few specks of quartz recognized Half-way up westren slope of hill behind Buenavista.

LP 20 Augite-basalt. Greyish-black rock of porphyritic appearance. Large phenocrysts (up to 1,4 cm) of blue augite, shpwing "hour glass" structure, and zoned plagioclase. Magnetite and olivine altering to serpentine, also chlorite prominent. Skeletal grains of ilmenite. In hand specimen, black augite crystals easily detatched from the rock, and show good prism and clinodome facies. 135 ft from summit of Mt. Prosperous, N slope.

LP. 21 Coral Limestone. White, porous rock, partly re-crystallized, consisting chiefly of coral fragments, including Orbicella annularis (Ellis & Solander) Siderastrea siderea (Ellis and Solander) and Solenastrea bournoni Milne-Edwards. Southern headland facing Catalina harbour.

LP 22. Trachyte. Greyish-white, finegrained rock. Irregular shaped crystals of quartz, highly fractured and filled with iro oxydes. Twinned labradorite, of rounded shape. Green augite and blue-purple hypersthene, both of which frequently enclose the labradorite.. Corroded brown hornblende. Ground mass of orthoclase and oligoclase, with some quartz. Half-way up W slope of hill lying 500 yd SE of Sta. Isabel

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The rocks belong ~~essentially~~ to the saturated group of igneous rocks. They stand on submarine ridges less than 500 fthm deep, 10 miles lond and 7 across. Arcuate arrangement of S. Andres-Providencia archipiélago, convex toward W; embryo island arc, comparable to advanced ~~volcanic~~ Lesser Antilles arc, in which Désirade contains a plutonic grano-dioritic basement, similar to diorite of Providencia, the volcanics of which island have a close resemblance to those of Dominica which are somewhat more basic than those of the Leeeward Caribees, and also have some hornblende and augite rather than hypersthene. Olivine less plentyfull in Providencia than in Dominica. - Topogr. & geol. aspects of Providencia similar to Lesser Antilles, as Dominica, Martinique, Sta. Lucia & St. Vincent. - Mitchell erroneous by supposes Lack of tuffs on Providencia and edge Volc. activity: 3/4 mile NW of High Peak said to occur small cauldrons with hot water & steam, & sulphurrous deposits

Split Hill: a large mass, containing rock fragments, fallen into it. The Hill rock is (2) eccinitic, the same composition of much of the Island. Split Hill is the result of a landslip from the South. Shallow crevasses formed by shrinkage of many years ago.

Volcanics of Providencia intruded in many places by dykes, along SE coast, particularly more numerous than 3 feet wide, and length all dykes described by the mapping party. Strike of dykes (SE coast) where measurable, found to vary from N-S to E-W. Weathered surfaces of dykes (SE coast) show many fractures and cracks, in addition to a few large fractures. Further signs of uplift in the massive limestone cliffs and caves at 15 ft above sea level (Informant of Providencia) and Isabel Island.

Handbook of South American Geology
Geol. Soc. of Am. Memoir 65
Ed. W. F. Jenks, Univ. Cincinnati

# Ecuador

## W-Cord.

Between Riobamba & Guaranda W-Cord.:
- S. Juan Form (tuffs, si Sh, Lst) = Macuchi = Yunguilla Formation (NW of Quito) = Guayaquil Form
  - Sh, Lst in volcanics also at Zumbagua, W of Latacunga (Yungs. - S Juan ?)
  - Yunguilla (Los Colorados, W of Quito) becomes red beds w. Cgl ~ Cayo Rumi w. Cgl
- Cayo Rumi cgl.
- Sst

Callo Form. = U. Cenom. - L. Senon. (tuffs, sst, sh & basic erupt.
Pacific Coast & W-Cord.

20 km S. of Riobamba: M. to U. Cret. (sedim. altered sedim. & plutonic Rocks at Punin

L. Cret.
2 Igneous (Acid. Tuffs) of the Cord. acid. ≠ cf. Piñon volcanics of Pacific Coast.
→ Late Jur. - Early Cret. Huluncay - Portovelo - Saigne rocks SE ecuadorian Andes. Zaruma District.
Paleozoic rocks between Sangay & Resumbado (20 km).

## Coast

Coast:
- U & M. Oligo tuffaceous, marine
- L. Oligo: deltaic & freshwater deposits, w thk cgl, silty Sst & colored clay st. (except for N)
- U. Eoc. Sh, locally Sst & red beds
- M. Eocene: Lst, Sh's, Sst's, clay pebl. beds

Tert.
- Paleocene: Estancia Sst, S. Fm' Sst, S. Fm' Sh, Atlanta Formi
  - (thk. seq. of Sst & dgr - Sh = Paleocene
  - Guayaquil Ch
  - thk bigstem platy Sh, pred. volc. = Callo = Latacunga
- Guayaquil chert

Cret.
- Callo Form U. Cret, 50 km S of Manta (Ptr Cayo), Colon Colonche. Cenoman - Senon. -
- Pascuales granodiorite, 23 km N of Guayaquil; pre-Upper Tertiary
- Piñon volcanics: dolerite, diabase, basalt, andesite, dacite, pillow lavas, ± = pyroclast, diorite breccia & cgl + Sh) Sst
  - rio Piñon, Manabi. - Montecristi, Cabo Pascal, Guayaquil, Esmeraldas, Pta Piedras, Masvale

Paleoz.
- Pta Piedras, 27 km S Guayaquil & Cerro Masvale 20 km E of Pta Piedras, phyllite, with Cret. - Jur.
- Schist & slate (Sh & sst) ~ Litol. Amotape

# Llanos Orientales

## Logs. Shell

**Chaffurray N° 1.** — 0 - 66m = (Chaffurray) S. Martin = Cuatern.
66 - 1080' = Serrania + ? Caja
1080 - 1732 = Diablo + ? S. Fern. Limbo ~~+ Cret.~~
1732 - ... = Cuarcita = Vampi's Sst.

" N° 2 0 - 131 = S. Martin
131 - 1236 = Caja
1236 - 2174 = Diablo + ? S. Fern. - Limbo
2174 ... = Cuarcita = Vampi's Sst.

" No 3. 0 - 112 S. Martin
112 - 220 Serrania
220 - 1424 Caja
1424 - 2519 Diablo + ? S. Fern. - Limbo
Basamento (in specific)

" N° 4 0 - 82 Serrania
82 - 1342 Caja
1342 - 2303 Diablo + ? S. Fern. - Limbo.
Monzonita (Basamento Guayanense) ←

" N° 5 ~~0 - 426~~ Serrania
426 - 1422 Caja (facies marina)
1422 - 2148 Diablo + ? S. Fern, Limbo
arenisca cuarcitica = Vampi's Sst

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**Chichimena "E."**
~~San Martin.~~

0 - 660' ± Form. Chaffurray { Arc. 7 cuarc. 15m / Sh & Sst 40m / Sh 150 / Sh & Sst. 751m
660 - 830 Transicion { Lutita, arc. arcn. / Lt beds lignito
830 - 2120 Caja Superior Sst, Sh, lut., Grava en todo el tercio superior, Delgado Sst & Sh. - Color verdoso, tipi
2120 - 2510 Caja Medio Sst, Sh Lamin.
2510 - 2672... Caja Inf. (base perfor) Arcilla roja, carnelitas, amarilla, gri

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**San Martin N° 1** 0 - 15 - 110m Cuatern. Fluvial
15 - 760 - Caja - Mio - Plioc. u. part: rosa Sh, bl. Sh, fm cers Sst / L. part: Sh Sh Sst. } Se ve que no se puede diferenciar formaciones
760 - 950 s. Sh, Sh & - Sst = Diablo - Olig.

680 - 510m = M - U. Olig.
1240 - 1060m = " part. L. Olig.
1610 ~~Eoc.~~ U. Eoc.
1750 ? Paleo. - L. Eoc. ?
2030 = Maestr. Sup.

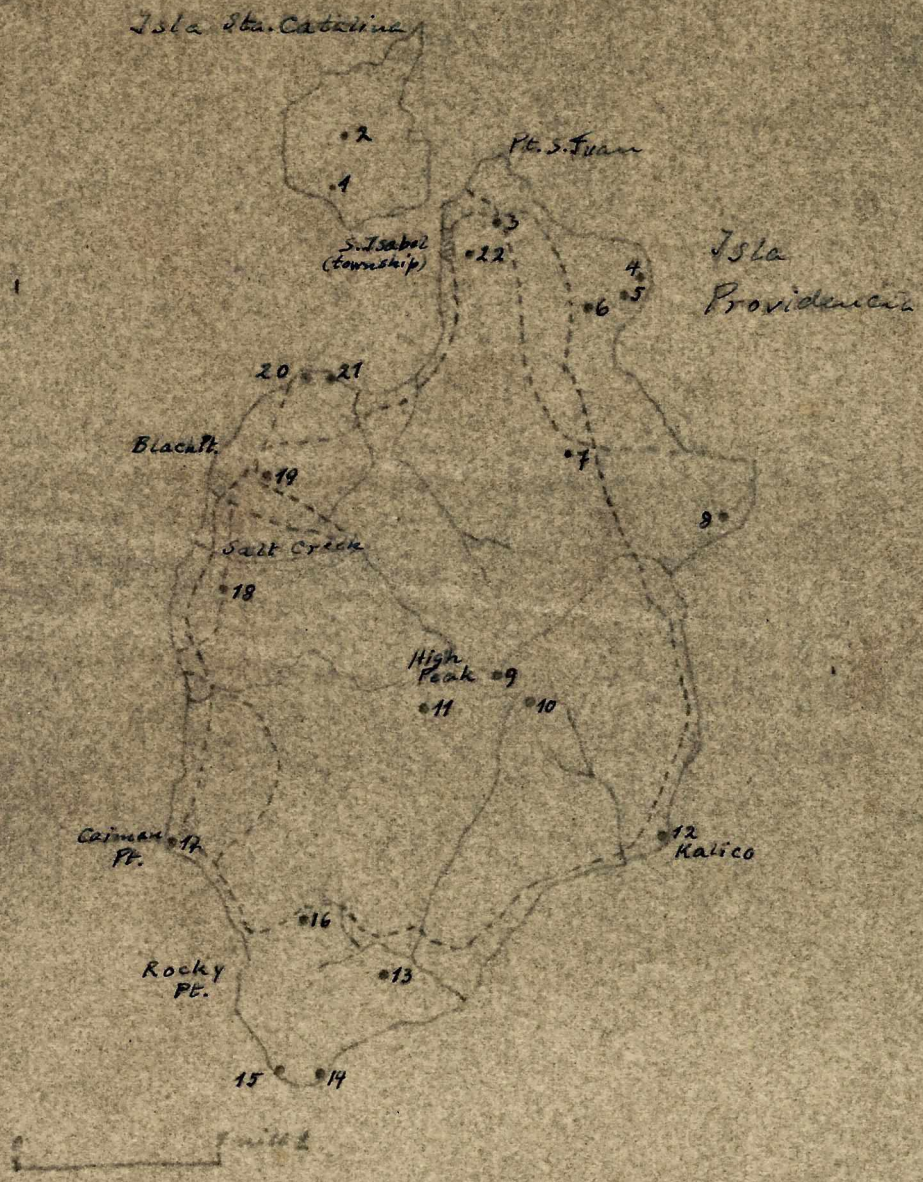
" N° 2. 0 - 25m Cuatern. Grava
25 - 195m S. Martin (? Plioc. Sup.) Sh & Sst, crs at base
195 - 930m Caja: thk Sst upper part m. s. Sh; L. part: Sh & s Sh, little Sst. - Misc. M - Su
930 - 1610 ± 1730 Diablo (Mioc. Inf.). Thin m - crs Sst., gr. & viol. Sh, c - Sh
1610 - 1930 - 2100m S. Fernando (Olig. Sup.) d. Sh, middle part: fg Sst & Sh, at base eg. l. Sst v. ? chert above + Limbo (Eoc.)
? Cret. Sup. U. part (90') Sh & s. Sh; below 40' Sh & Ch; below 70' fm Sst, - Sh

Magdalena
Richmond

Taracué V-2 0-780 m Esmeraldas Richm. (Olig - Eoc) Sh, sh Sst
780-1200 Lisama Richm. Sst, v. mtl. Cl
Siron ign. or clast. volcanics, very hard.

* V3 0-740 Esmeraldas Sst. s. Sh. La Par Sst in low. part
740-1200 Lisama (L-Eoc) Cl.
Siron: h. si. ign. or volanics.

Location of Mite hills, samples




Sketch of Providencia
(Santa Catalina, San Andres
y Providencia)
Robert Mitchell