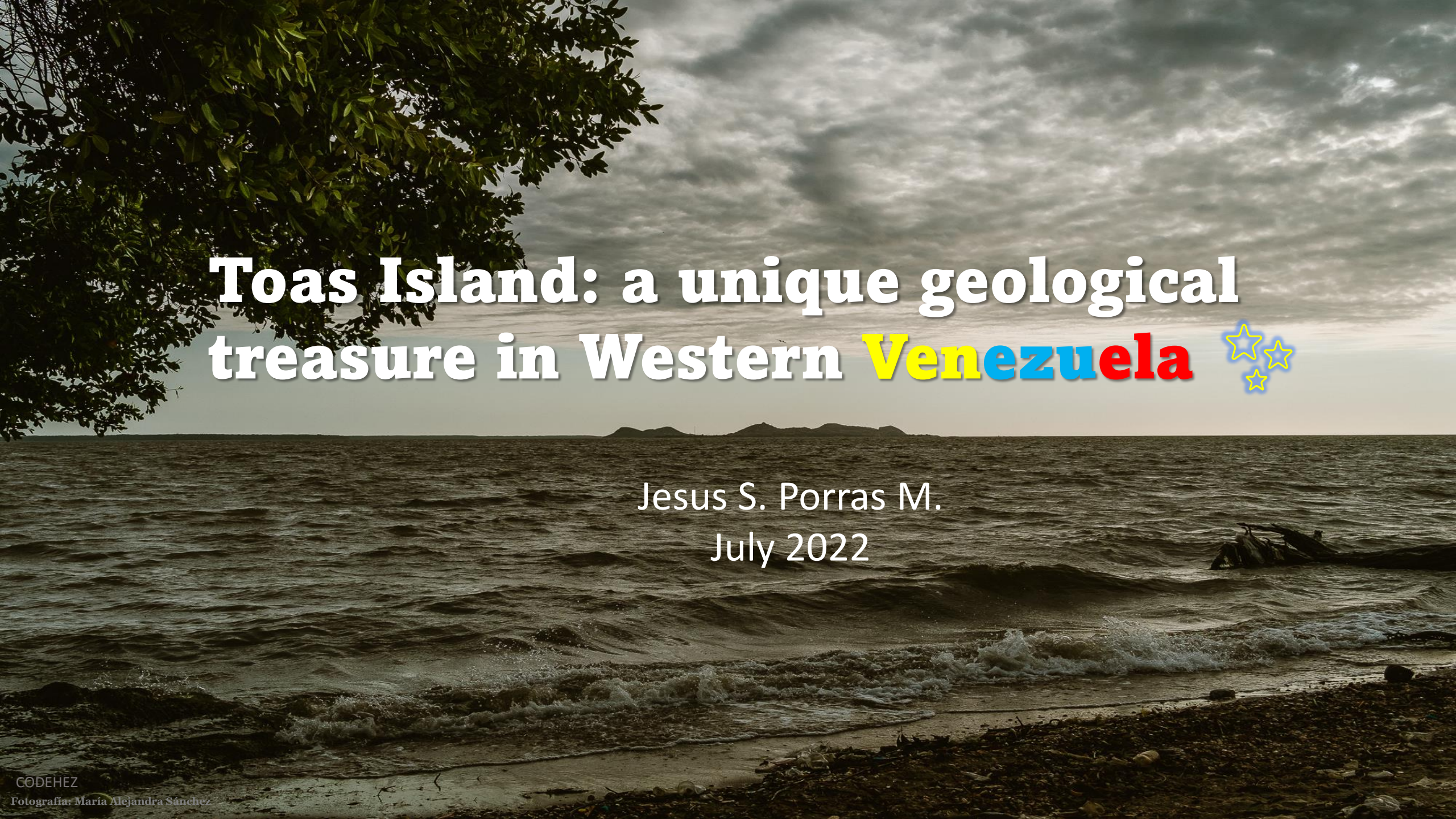
Toas Island: a unique geological treasure in Western Venezuela
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July 2022
CODEHEZ
Fotografía: María Alejandra Sánchez

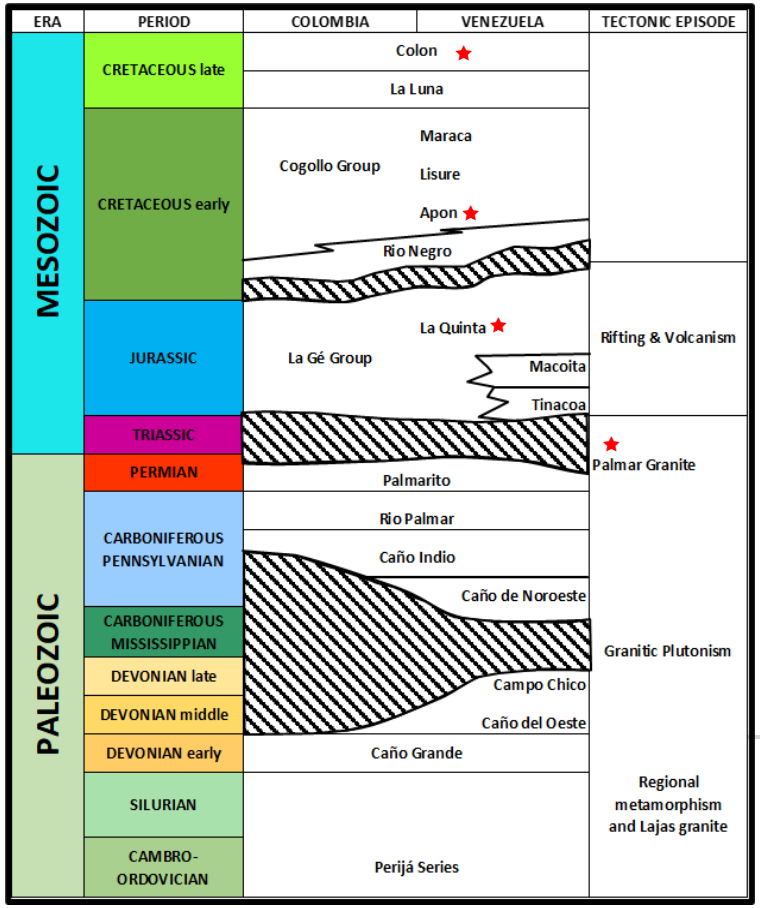
General Facts

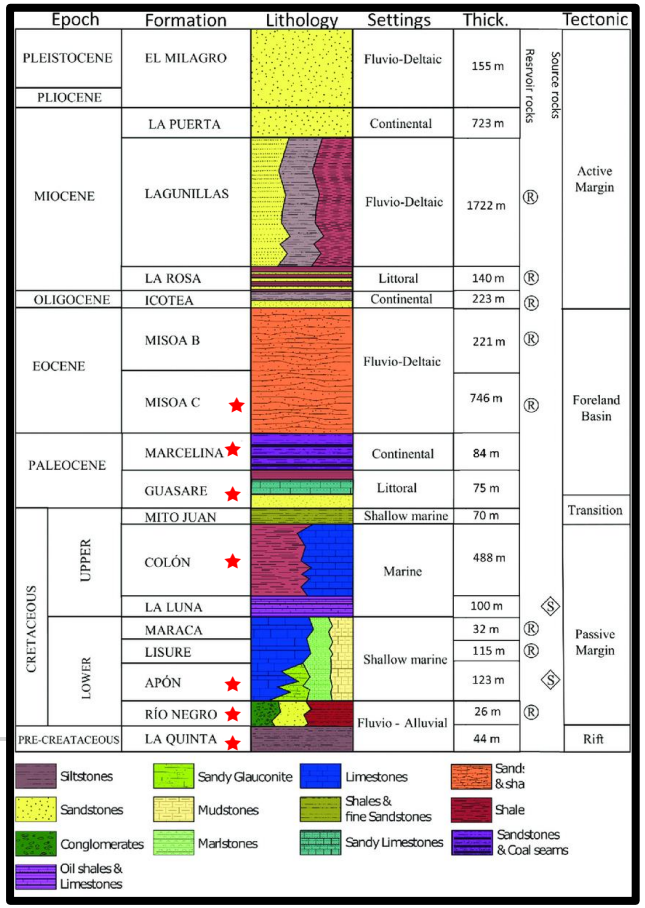
- Complex geology:
  - Tectonic plate boundary and interaction (Caribbean vs. South American Plates)
  - Diverse geotectonic models
    - Granitic intrusion with drag of Tertiary and Mesozoic sequences (Liddle 1946)
    - Uplifted fault block (Bucher, 1952)
    - Rising granite plug (Sutton 1946)
    - Thrusted and overturned anticline flanked by strike-slip faults (Rod 1956, Smith 1931)
    - Flower structure (transpression)/Oblique Shear (Albarracín 1989, Pimentel 1973)
- Encompasses rocks from Paleozoic to Cenozoic ages (the only site of the Maracaibo Basin where this sequence is exposed)
- Zone of highly deformation due to faulting/folding, notable evidences of erosion, weathering and fracturing-jointing, examples of oil stains and sedimentary structures.
- Three tectono-stratigraphic domains or zones
  1. Southern range: limestone mining zone, Paleocene-Eocene Shales, La Quinta formation is missing (Tr-J to T)
  2. Middle valley: eroded and weathered granitic core (Toas granodiorite (Pz), basalt and rhyolite dikes)
  3. Northern range: strongly faulted and deformed, chaotic arrangement of rocks (Marcelina, Guasare, Colón, Río Negro, Apón and La Quinta formations) J to T

Location

- Located on the north shore of Lake Maracaibo Bay
- Approximately 45 km north of Maracaibo
- Area: ~9 km2

Stratigraphy



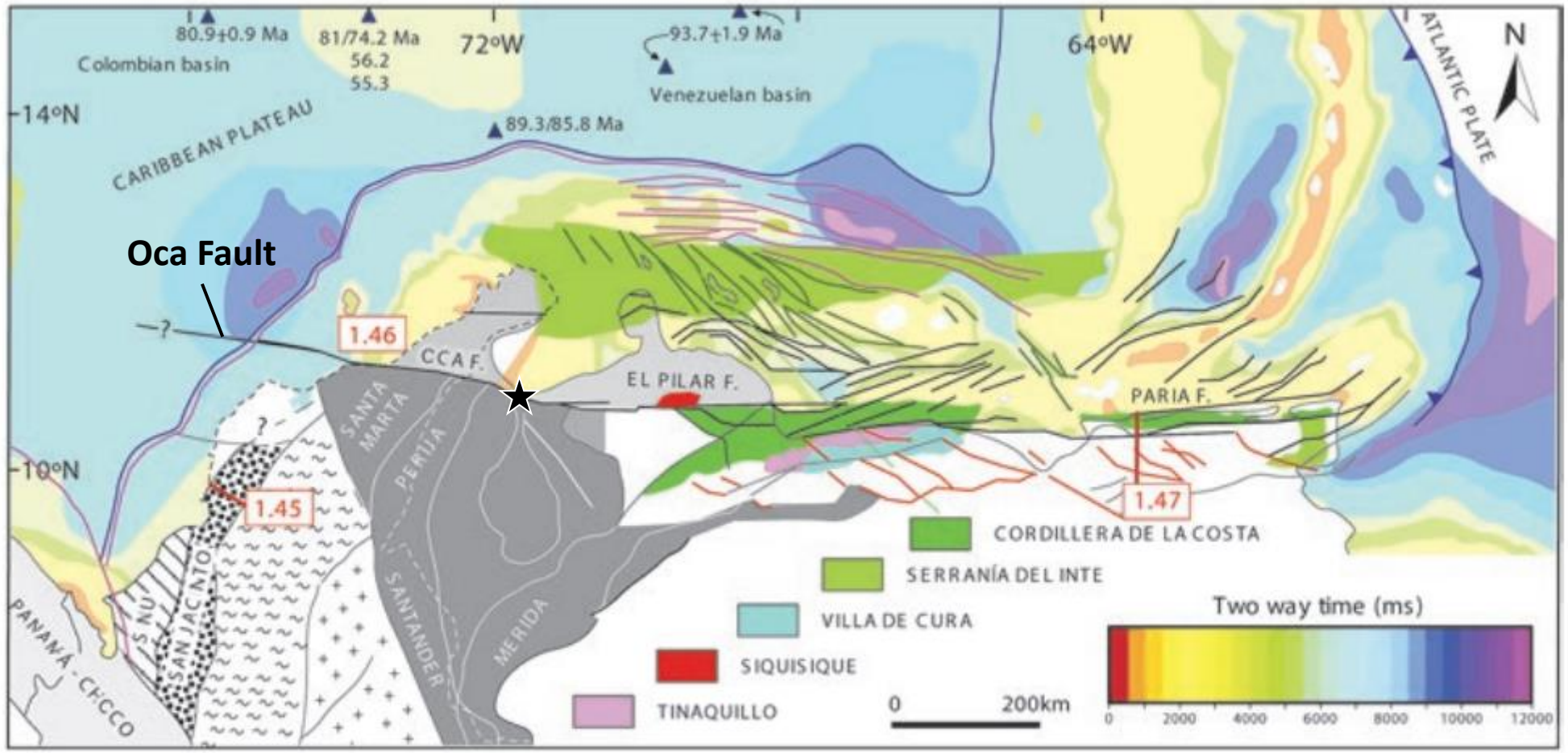


Age	Unit
Eocene	**Misoa fm** interbedded clastics ?
Paleocene	**Marcelina fm** carbonaceous shales **Guasare fm** mixed clastics & carb.
Upper K	**Colon fm** shales
Lower-Middle K	**Cogollo Group** limestones
Lower K	**Rio Negro fm** coarse sands
Triassic-Jurassic	**La Quinta fm** red beds, clastics
Triassic	**El Palmar** eqv. granite-granodiorite

★ outcropping

- Paleozoic to Cenozoic rocks crop out in the island
- Crystalline (granodiorite) and volcanic rocks (rhyolite and basalts), Jurassic red beds of La Quinta, the Cretaceous sequence (Colón and Apón formations), as well as clastic rocks and limestones of the Paleocene, typical of the Maracaibo Basin are exposed.

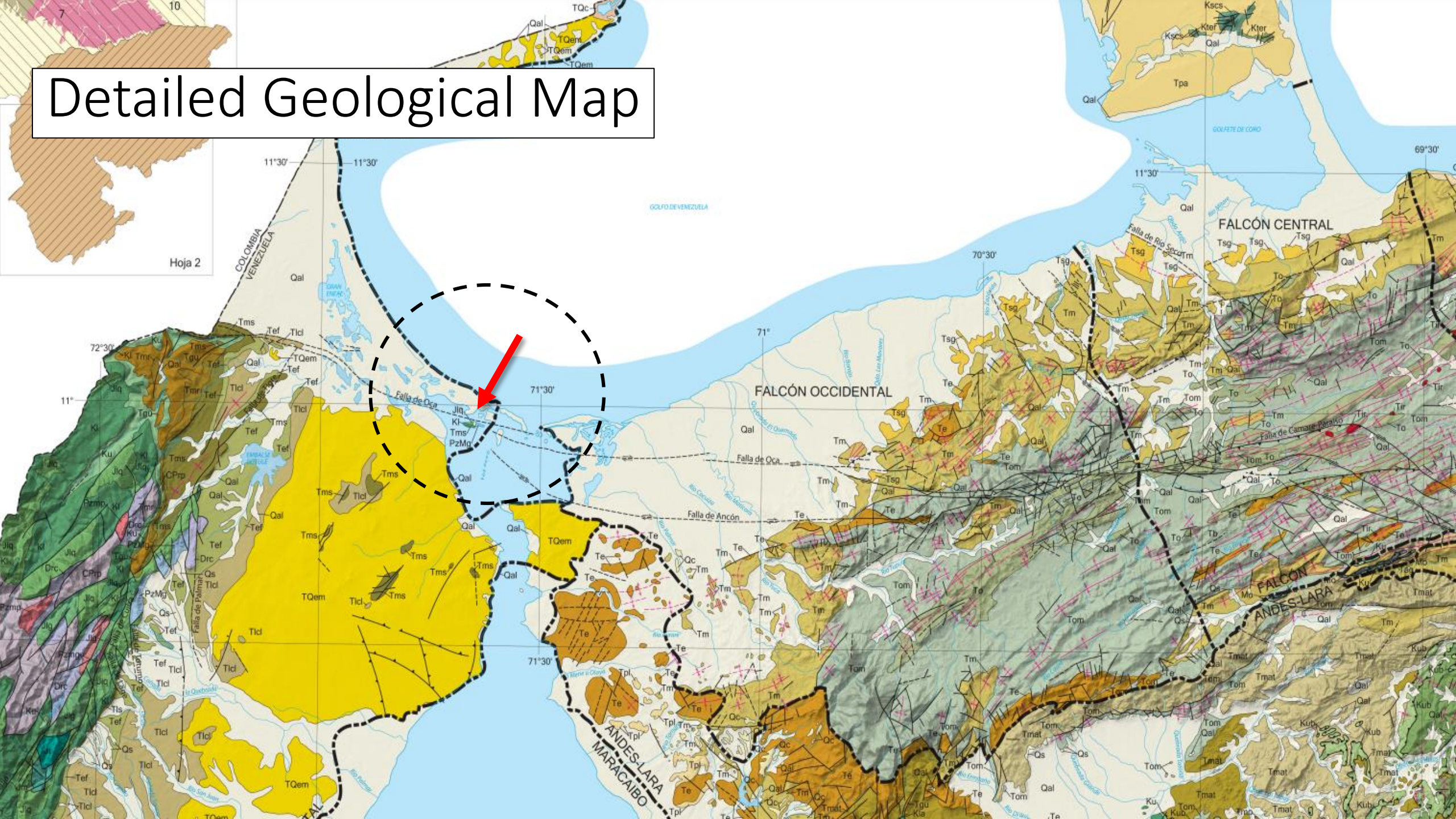
Regional Geology



Cediel, 2019

Fig. 1.44 Diagnostic features of the regional tectonic contact between the southern Caribbean Plate and the SW South American Plate. (Compiled after Escalona and Mann (2011))

Detailed Geological Map



Structural Geology

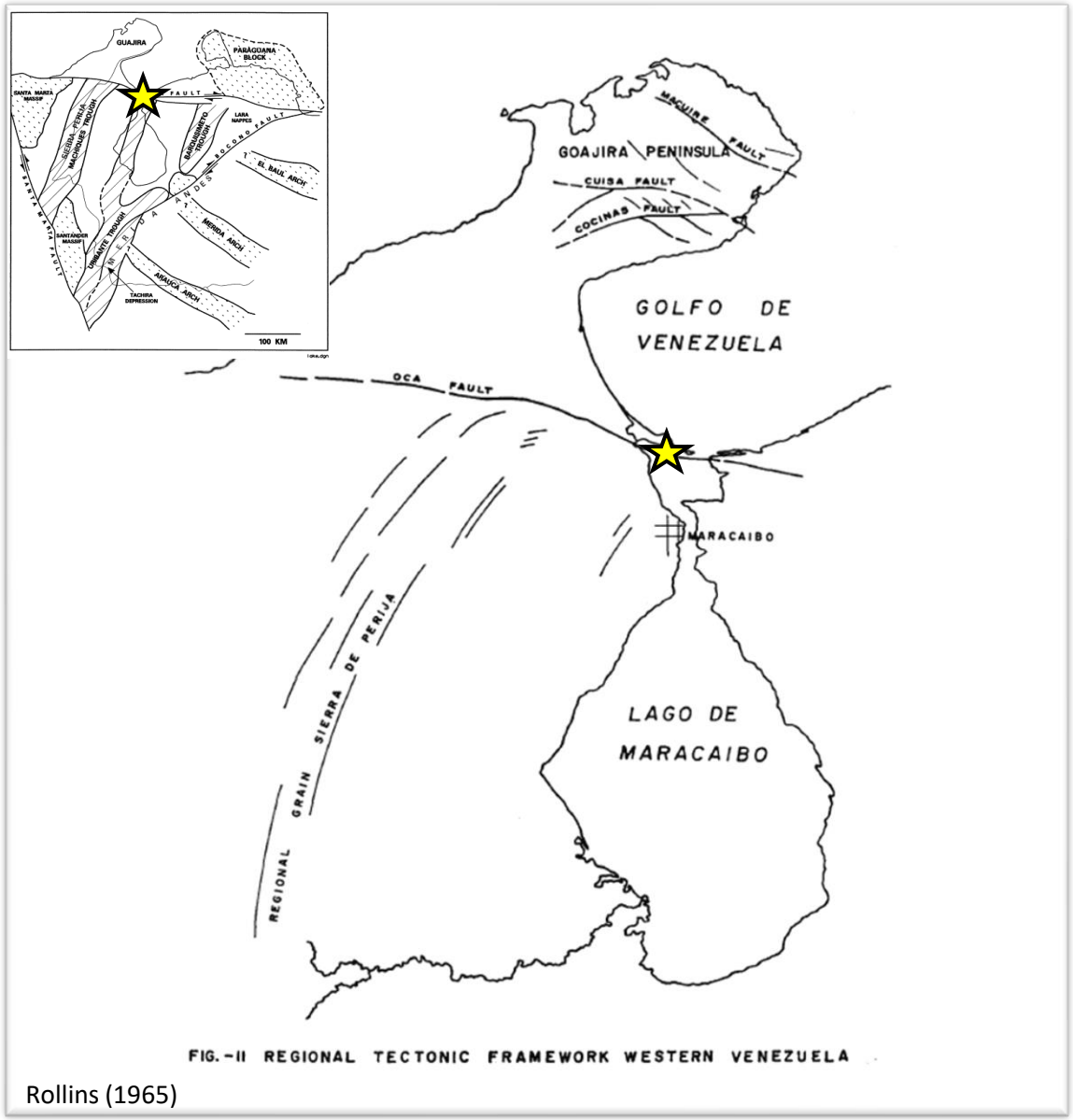


FIG.-II REGIONAL TECTONIC FRAMEWORK WESTERN VENEZUELA

Rollins (1965)

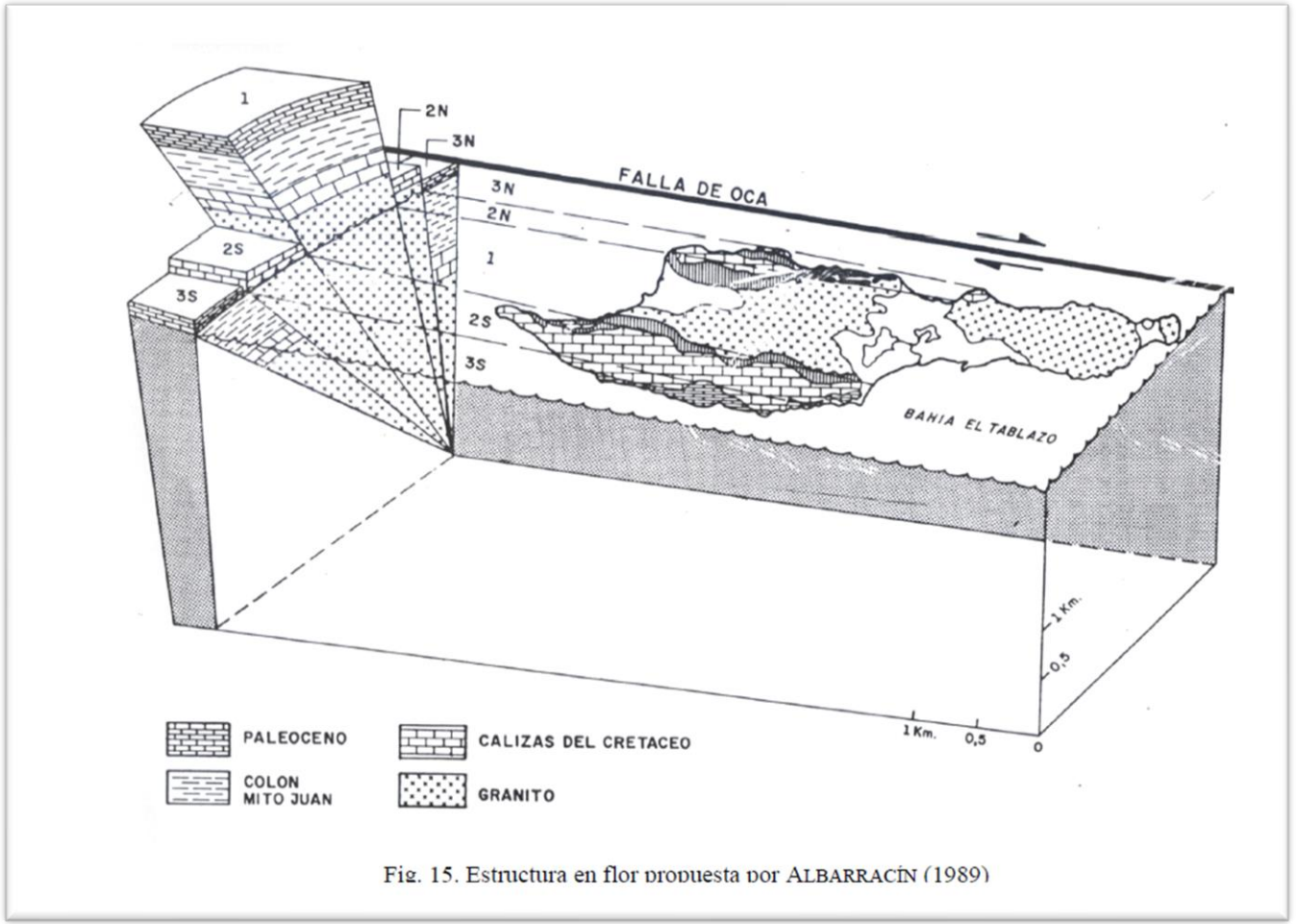
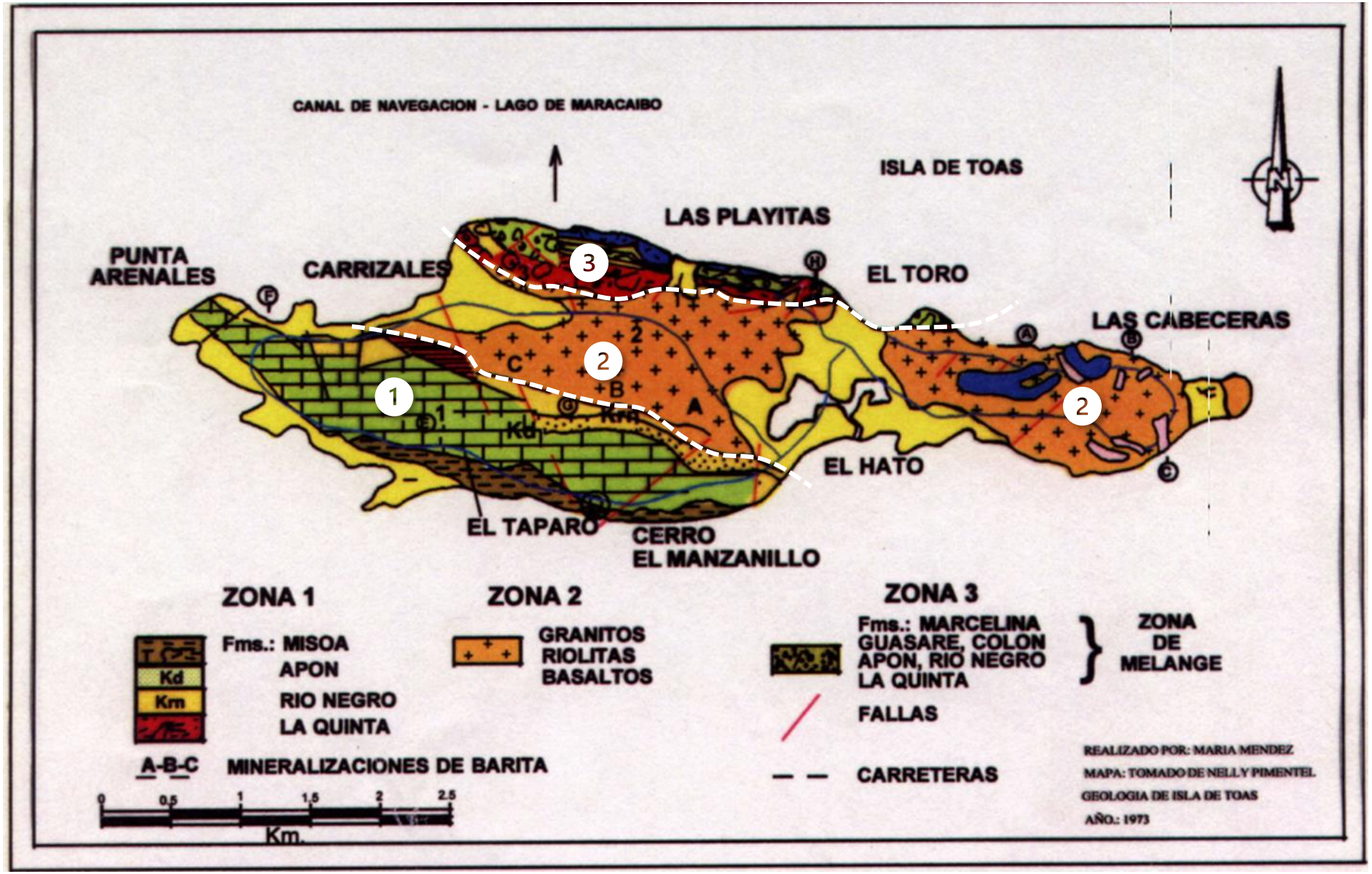


Fig. 15. Estructura en flor propuesta por ALBARRACÍN (1989)

- Positive flower structure
- Interaction of Oca and Ancon faults
- Five (5) structural blocks

Tectono-Stratigraphic Zones



- Three well-defined geological zones
- West-East elongated shape
- Rock ages from Late Paleozoic to Cenozoic (Eocene)

(Pimentel, 1973)

Tectono-Stratigraphic Zones

01

- Limestone quarries area
- Overturned & Faulted fold (Apón fm, K)
- Tilted & Laminations Marcelina fm
- Fractured limestones (Apon fm)
- Liesegang banding (T undf.)
- Gypsum-filled joints
- Karst features & caves (Lourdes V. grotto)

02

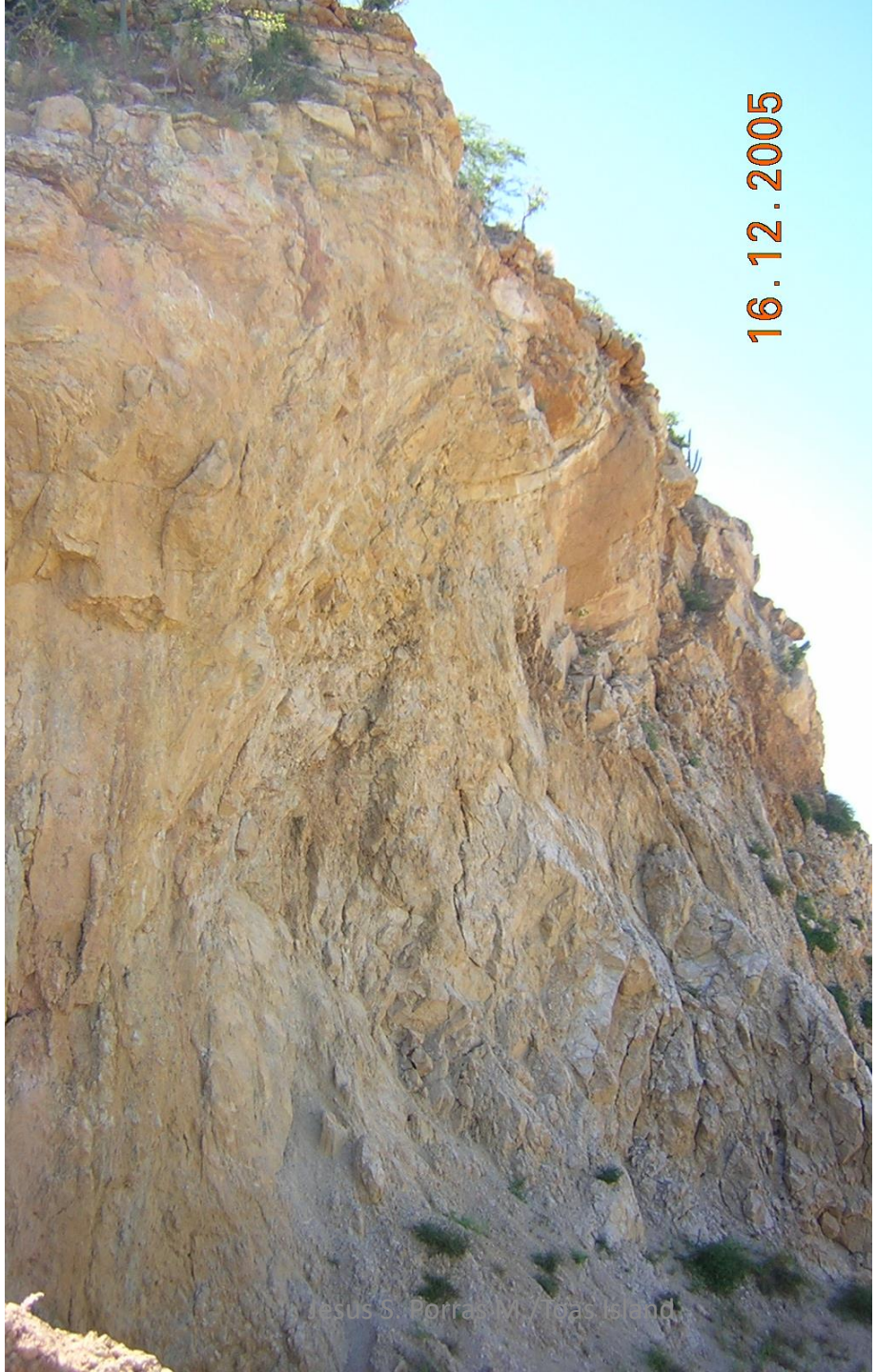
- Contact of La Quinta fm with Toas granodiorite (~ El Palmar granite)
- Highly-fractured and weathered granite
- Andesite, granite and rhyolite contact

03

- Deformation/Melange Zone: includes rocks of the Marcelina & Guasare (P), Apón (K) and La Quinta formations (J-T)
- Apón fm (K): alveolar structures filled w/petroliferous allochthonous limestones
- Apon calcite-filled veins & Marcelina carbonaceous shales
- Guasare fm: cone-in-cone structures.
- Inverted sequence T-J overlying K

Zone 1

- Limestone quarries zone
- Overturned & Faulted fold (Apón fm, K)
- Tilted & Laminations Marcelina fm
- Fractured limestones (Apon fm)
- Liesegang banding (T undf.)
- Gypsum-filled joints
- Karst features & caves (V. Lourdes grotto)



Overturned and faulted fold at Cerro Caribe, W. Toas

Limestones of the southern zone has been mining for years, since the time of Spanish colonization. Are used for cement and construction industries.

- Post-Cretaceous outcrop, probably Paleocene/Eocene in age (Marcelina Fm?)
- Consist of greenish to gray fine-grained rocks, well stratified, that dip steeply to the north
- There are an interesting development of ferruginous concretions (or Liesegang rings?)

Ferruginous concretions (or Liesegang rings ?)

Joints filled with gypsum

Karst features, caverns and natural cavities developed in the Apón limestones (Virgin of Lourdes Grotto)

Zone 2

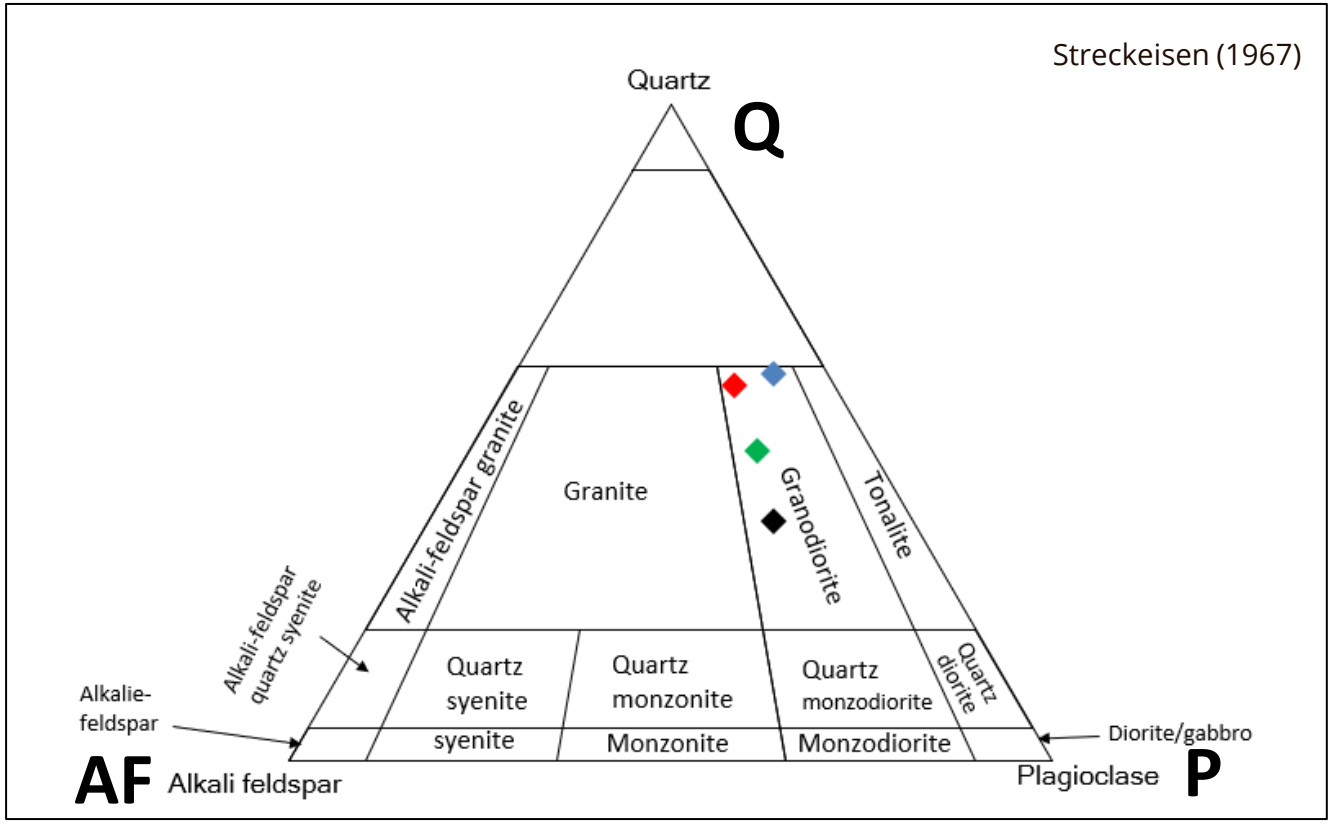
- La Quinta red beds -El Palmar granodiorite contact
- Highly-fractured and weathered granite
- Andesite and rhyolite dikes, intruding the granite

Petrology

Muestras	Composición mineralógica (%) Fenocristales												Matriz no identificable	Texturas	Clasificación según STRECKEISEN (1976)			
															Recálculo			
	Cuarzo	Plagioclasa	Feldespato K	Biotita	Clorita	Calcita	Prehnita	Circón	Apatito	Opacos	Fenocristales	Matriz			A	P	Q	Nombre petrográfico
Rocas plutónicas																		
Zu - 19	35	20	4	7	2	5	0	<1	<1	7	-	-	20	-	7	34	59	Metagranodiorita protocataclástica
Zu - 23	30	30	12	5	10	4	7	<1	<1	2	-	-	0	Sagenítica	15	38	47	Granodiorita Pegmatítica
Zu - 30	20	10	5	3	2	10	0	0	0	1	-	-	49	-	13	30	57	Metagranodiorita cataclástica
Rocas hipoabisales																		
Zu - 22 - A	20	25	10	<1	4	0	1	<1	0	3	60	40	-	Traquítica	18	45	36	Metaporfido de granodiorita protocataclástico

abla 5. Tabla composicional de las muestras analizadas de la Granodiorita de Toas.

Azancot (2008)



https://www.geoplotters.com/find-a-plot

Field Description: weathered, strongly fractured, with barite-filled veins and diaclases

Hand Samples

Texture: coarse grain, cataclastic
Fabric: equigranular to inequigranular
Color: light to dark pink

Outcrop of Toas Granodiorite
(El Palmar Granite equiv.)

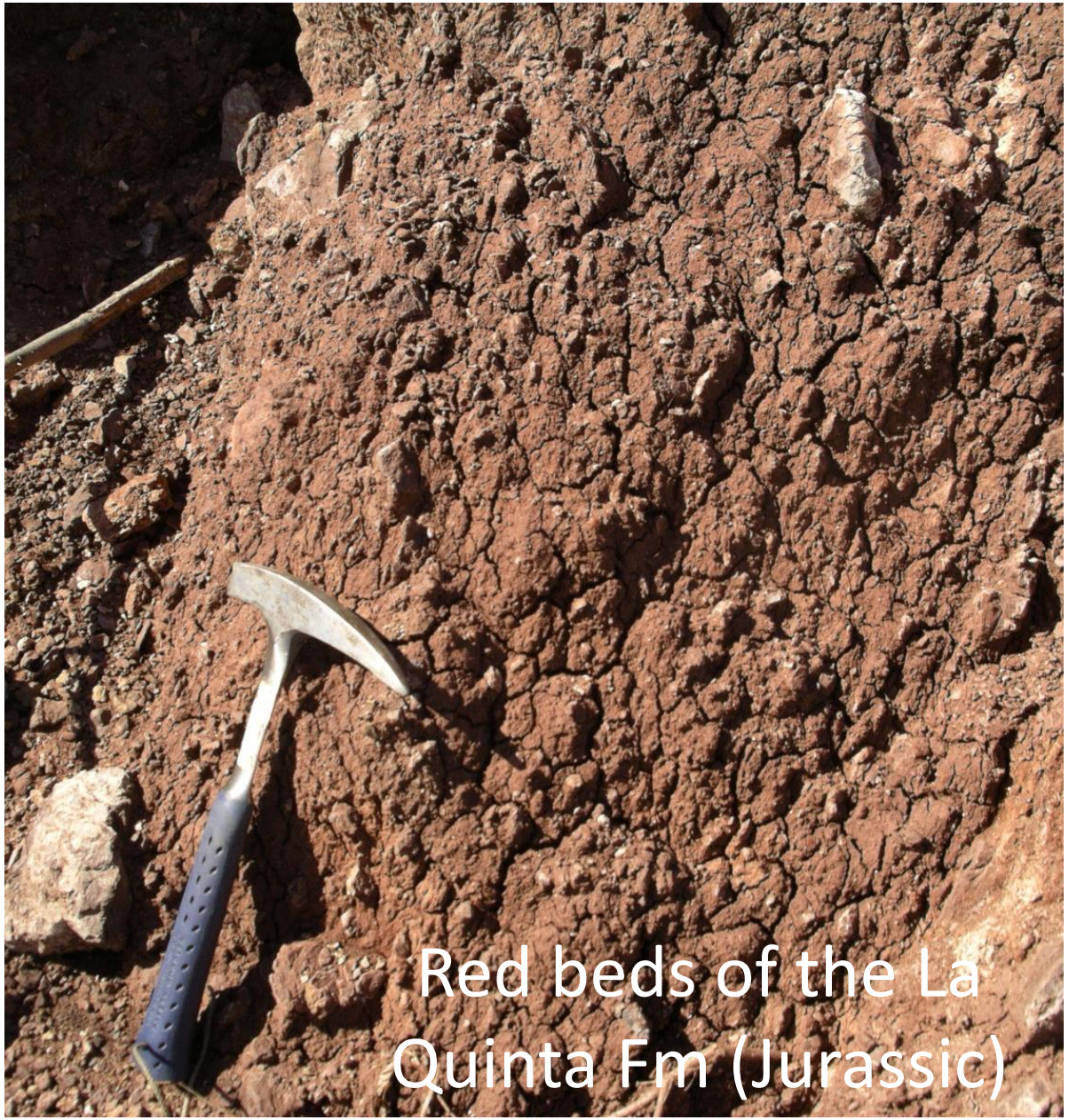
- The Toas granodiorite represents the oldest rocks of the island.
- Is Triassic in age 252±50 m.y. (Dash 1982) and is equivalent to the granites of the Perijá Range

Intense shearing and fracturing of the Toas Granodiorite.

Andesitic basalt and rhyolite dikes intruding the granodiorite near to El Toro town.

Zone 3

- Deformation Zone (Melange Zone): includes rocks of the Marcelina & Guasare (P), Apón (K) and La Quinta formations (J-T)
- Apón fm (K): tafoni-like cavities filled w/petroliferous allochthonous limestones
- Apon calcite-filled veins & Marcelina carbonaceous shales
- Guasare fm: cone-in-cone structures.
- Inverted sequence (J overlying K)

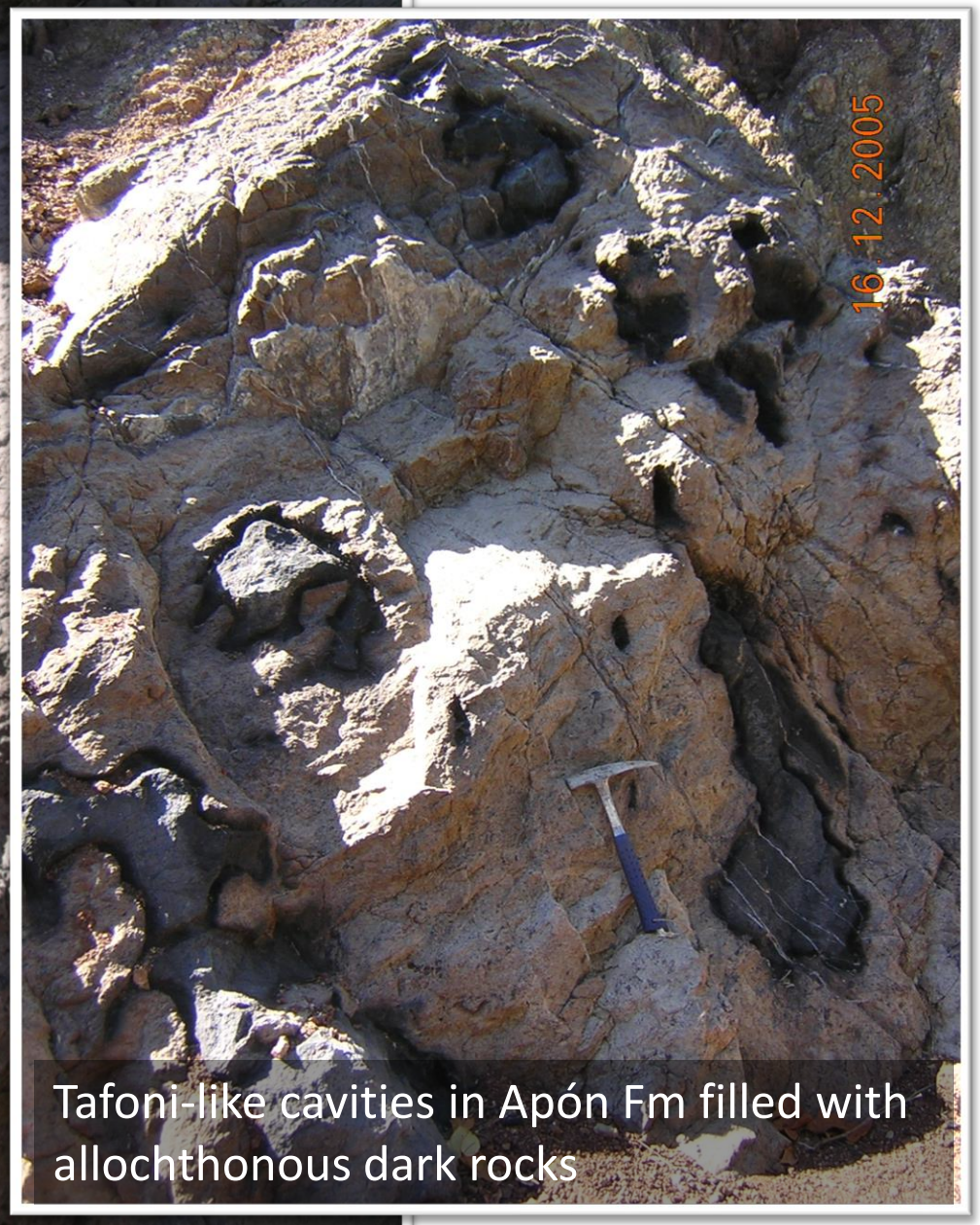


Red beds of the La Quinta Fm (Jurassic)

- Contact between La Quinta Fm (J) and the Apón Fm (K) at Cerro Semeruco, NW Toas
- Apón limestones overlain by La Quinta red beds

La Quinta Fm overlies the Apón limestones probably because structural overturning

- Tafoni-like cavities in the Apon Fm.
- The host rock is the limestone of the Apón Fm (K). The guest rock is a dark petroliferous limestone presumably belonging to La Luna formation (K)

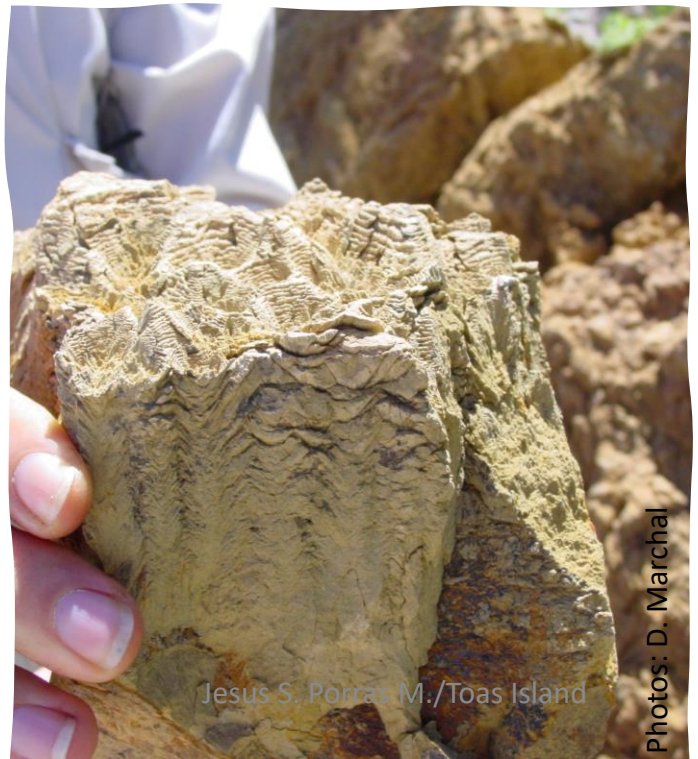


Tafoni-like cavities in Apón Fm filled with allochthonous dark rocks

Strong deformation, dissolution, crumbling and jointing of Apon Fm.

Dry oil stains in Apon limestone

Brecciated (?) and jointed limestone



Cone-in-cone structures in the Guasare formation

Photos: D. Marchal

Coal lens in the Marcelina formation (Paleocene)

Slight folding of the shaly sediments of Marcelina Fm

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