THE FIVE GIGANUCLEAR GEOLOGICAL AND TECTONIC FORCES THAT GAVE RISE TO THE GULF OF MEXICO. TOLD BY EDINSON ALVAREZ.

IMPORTANT CONTRIBUTIONS IN GEOSCIENCES PROMISE TO REVOLUTIONIZE O&G&M EXPLORATION. No. 6/12.

EDINSON D. ALVAREZ S. 1,2
1 Exploration Geologist, O&G&M Specialist,
Researcher of tectonic and structurally complex areas.
2 Expert in geoscientific solutions through integrated O&G&M studies.
with strong positive economic implications.

Complex Source Theory (Edinson Alvarez 2025): A mechanism used by interdisciplinary groups of specialists in any field of science, where new concepts, new methodologies, new technology, and new knowledge are employed, obtaining new results, in order to resolve complex issues.. (Image Courtesy of Pixabay).

EAST-P Method-Tool (Processing and Seismic Treatment Edinson Alvarez 2025): It requires specialized personnel, computer equipment and advanced software.

Edinson Geochemical Hydrocarbon Family Classification Maps -Tool (Edinson Alvarez 2025): New classification of hydrocarbon families based on geochemical-isotopic-molecular signatures, migration pattern from source rock, their close relationship with geology, geochemical modeling of generation, expulsion, and hydrocarbon migration routes in a regional context.

Integrated O&G&M studies - Onshore-Offshore-Tool: It involves the participation of more than 20 geoscience disciplines, in order to find answers to complex industry problems, with strong positive economic implications.

Citation: Alvarez Serrato Edinson Dario, 2026 The Five Giganuclear Geological and Tectonic Forces that Gave Rise to the Gulf of Mexico, Told By Edinson Alvarez. Important Contributions In Geosciences Promise To Revolutionize O&G&M Exploration. No 6/12.Revista Maya January 2026. 42 p.
Citation Articles 1,2,3,4,5, at the end.

INTRODUCTION

This work aims to contribute to the geoscientific knowledge of an area of importance to the global oil, gas, and mining (O&G&M) industry: the Jurassic evolution of the Gulf of America, Gulf of Mexico, and the Colombian and Venezuelan territories (Northwestern Corner of South America-Gondwana). **This study seeks to demonstrate, with technical and scientific evidence, the relationship between plate tectonics, magmatic arcs, volcanic arcs, and the development of rift zones and subduction zones, combined to understand the origin, growth, and development of sedimentary basins of interest to the global mining and energy industry.**

In this first phase, the central theme is resolving the uncertainties or specific unanswered questions posed by the contemporary geoscientists and researchers worldwide over more than 100 years of the history and development of the petroleum industry in the Gulf of Mexico region. we will examine the implications of this issue for petroleum systems in a broad sense..

On the Colombian side, we would like to highlight the various companies, institutions, entities, and individuals that have contributed to the development of knowledge in these areas, such as the Colombian Geological Service **(SGC)**, the Colombian Petroleum Company **Ecopetrol**, the Institute of Petroleum and Transition Energy Research **(ICPET**), the National Hydrocarbons Agency **(ANH),** and state and private universities such as the University of Caldas, its Institute of Stratigraphic Research **(IIES**), the National University of Colombia **(UNAL**), the Industrial University of Santander **(UIS),** the Pedagogical and Technological University of Colombia **(UPTC)**, **EAFIT** University, the University of Pamplona, and the University of the Andes, among others… For this chapter in particular, the contribution of important researchers and Geoscientists from the Mining and Energy Industry of Mexico and the United States of America, including the **National Autonomous University of Mexico (UNAM).**

Highlighting the tireless and important work carried out by the renowned and honorable Doctors**: James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020, A revised synthesis of the rift and drift history of the Gulf of Mexico and surrounding regions in the light of improved age dating of the Middle Jurassic salt. 49 p.** https://doi.org/10.1144/SP504-2020-43, Free to the public through their YouTube conference. **Cátedra Selecta. James Pindell-2021.**

El Dr. James Pindell has dedicated his entire life to the study, understanding and geological evolution of the Gulf of Mexico with his Master's thesis **Permo-Triassic reconstruction of Western Pangea and the evolution. 1981 And Doctoral Thesis: Plate-tectonic evolution of the Gulf of Mexico and Caribbean region1985.** And significant and sufficient related work up to the date of 2026.

Highlighting the work of the doctors **Restrepo, J.J. & Toussaint, J.F. 2020. Tectonostratigraphic terranes in Colombia: An update. First part: Continental terranes. In: Gómez, J. & Mateus–Zabala, D. (editors), The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, p. 37–63. Bogotá. https://doi.org/10.32685/pub.esp.35.2019.03 ,** who have dedicated their entire lives to the study of Colombian Geology, and their work on tectonostratigraphic terrains, in different and renewed versions of 1973, 1988, 1993, 1998, 2020, among others.

This work incorporates new information of strategic relevance, which will allow for the delimitation, refinement, calibration, and/or strengthening of the geological and tectonic evolution model for the Gulf of Mexico-America during the Upper Triassic-Jurassic period, presented in **Article No. 5 of this series**. This will enable us to understand the succession of geological and/or tectonic events that triggered the origin, growth, and evolution of the Gulf of Mexico. **This question, with nearly 100 years of history, has not yet received a satisfactory answer and is resolved in this chapter.**

We would like to clarify that the narrative style used by the author is solely intended to generate new readers, audience, and interest in scientific research related to Geosciences – Earth sciences. This is to avoid any misinterpretation of arrogance, as the narrative style is simply a strategy for attracting an audience. We have the utmost respect and admiration for those who have made valuable contributions to Geosciences. **All glory and praise belong to God.**

The narrative form is a tribute to one of the greatest figures in world literature, Miguel de Cervantes Saavedra (1547-1616), with his masterful work, Don Quixote of La Mancha (1605). **In this case, we will refer to "Giants" as concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unresolved questions, etc**. We invite you to see the positive side of history, which is the contributions to geosciences for our country, Colombia, and in this case, the impressive and spectacular Gulf of Mexico.

We will take a spectacular, fascinating, wonderful and cinematic geological journey through the Colombian-Mexican-American Jurassic world.

We also draw a parallel with sports, regarding the giants we are going to demolish in this edition. Records are meant to be broken or demolishing; similarly, if our proposal has weaknesses or flaws, it will most likely be surpassed or toppled by a new and/or better proposal in the future.

METODOLOGY

In order to overcome the structural, stratigraphic, sedimentological, volcanological, geological, geophysical, geochronological, geochemical, and seismological obstacles and difficulties posed by the tectonic-structural complexity of the area, the following activities are carried out:

- Compilation of information from petroleum exploration, geochemical, geophysical, geological, stratigraphic, tectonic-structural, petroleum systems, volcanological, geochronological, and other studies of the area of interest.

- As part of the Author's independent professional activity, several integrated studies have been carried out to address the issue of the structural tectonic complexity of the study area, and its implications for oil and gas exploration and production activity in Colombia and the Gulf of Mexico. **This case relates to tectonostratigraphic evolution, primarily during the Jurassic geological period (145 to 201.3 million years ago), also including the Upper Triassic (201.3 to 237 million years ago) (201.3-210 million years ago).**

RESULTS

1. **General Tectonic Framework and Terminology.**

To understand the development of this chapter, we will refer to the following terms, updated from Article 5, some based on the incorporation of new data into the model **(Figures 1, 2):**

Triassic-Jurassic Gulf of Edinson Alvarez: A large body of marine water surrounded by the following geographical features, giving it its gulf-like configuration: the Aoxaca and Chortis terranes to the west-northwest, continental Mexico to the north and east, and continental Colombia to the east-southeast. (Upper Triassic-Lower Jurassic) **(Figures 1, 3)**

Jurassic Bay of Edinson Alvarez: A narrow body of marine water surrounded by the following geographical features, giving it its bay configuration: the Aoxaca and Chortis terranes to the west-northwest, continental Mexico to the north and east, and continental Colombia to the east-southeast. (Lower Jurassic) **(Figures 4, 5)**

Edinson's Jurassic Strait: Opening Zone, fracture-rupture zone, entry of the Pacific Ocean into the Gulf of Mexico and Paleobasin of the Eastern Cordillera of Colombia. (Lower-Middle Jurassic). **(Figures 2,6,7, 8, Art 5-Figures 9,10,14)**

The Edinson's Jurassic Strait, It had several openings or narrow passages named below:

Edinson's Jurassic Strait (North); Main rupture or strait created in the Jurassic 170-169 ma. Between the Mexican Chiapas Massif and the Colombian Upper Guajira (Serrania de Macuira-Cosinas).

JhonEdi's Jurassic Strait (Middle): Break or Strait Created between the Upper Guajira of Colombia (Serrania de Cosinas-Macuira) and the Sierra Nevada de Santa Marta.(Honor Jhon Edinson AlvarezM. Son)

Floris's Jurassic Strait (South): Break or Strait Created between Western Side of the Sierra Nevada de Santa Marta and Serranía de San Lucas, controlled by the Bucaramanga Fault. **(Fig6,Fig14-Art5)** (Honor Florinda Serrato-Mother)

Independent Milenar's Jurassic Strait: Break or Strait Created to the southwest of the Cundinamarca Basin (Southwestern part of the paleobasin of the Eastern Cordillera) controlled by the Ibagué Fault. **(Fig6,Fig14-Art5).** (Honor Ana Milena Alvarez Serrato-Sister).

Triassic -Jurassic Mountain Range Gran Estelar: The Gran Estelar Triassic-Jurassic proto-Cordillera, formed by the union of the west side of the Paleo Sierra Madre Oriental of Mexico, extending throughout Mexico southward and continuing into the Paleo-Central Cordillera of Colombia. Is composed of Precambrian-Paleozoic metamorphic crystalline basement, granitoid intrusions, and fluvial and volcanosedimentary, marine deposits, as well as volcanic arc sedimentary complexes. Paleogeographically, it functions as back retaining wall of the continental slope escarpment of the Gulf of Mexico, relative to the waters of the Pacific Ocean.(Honor beloved wife Estela Moreno Z.)**(Fig.1,3,4,5).**

Large Fault System, Rift, Rudabet Lineament (Honor Ruben Dario Alvarez Betancourt-Father, Figures 1, 3); Composed of the Great System of faults, rift and lineament of the Guaicáramo- foothills Faults (Colombia), Boconó- foothills Faults(Venezuela), NE Yucatán lineament (México), Georgia Rift and Appalachian foothills Lineament (USA).

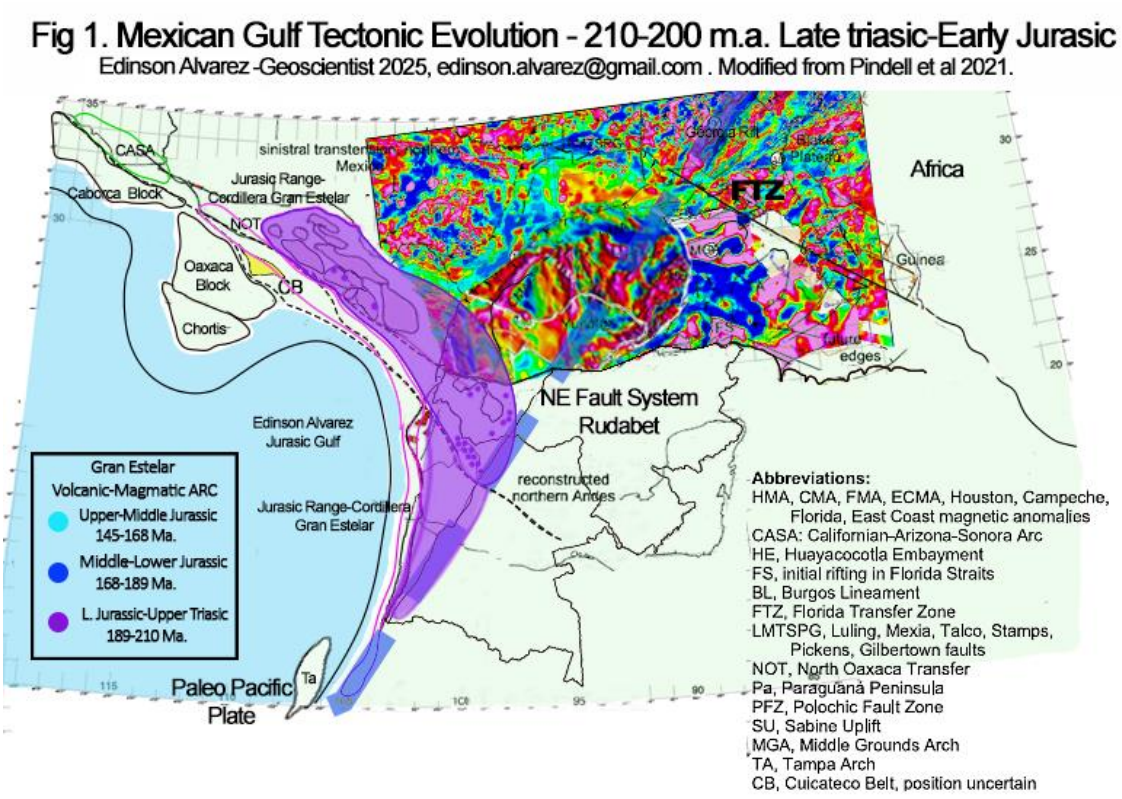


Figure 1. Main Geological, Morphological and Tectonic-Structural Features for Laurentia-Gondwana during the Late Triassic-Early Jurassic Period. 200-210 Ma. Close to 10 Structural Lineaments Control Yucatan's Position.

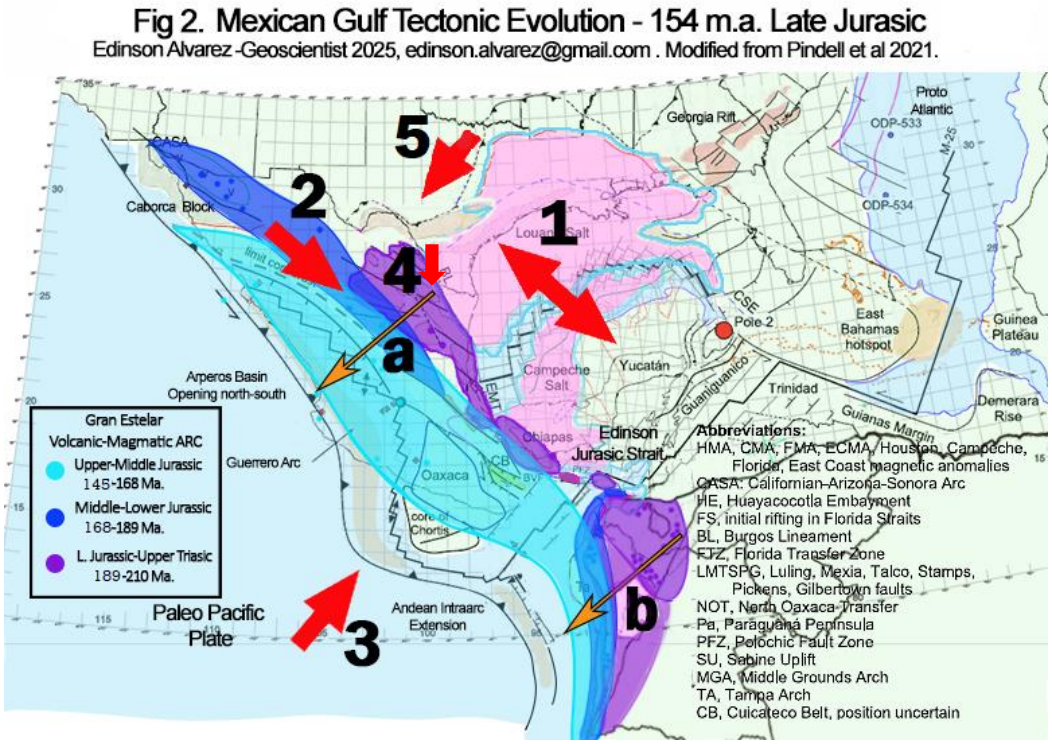


Figure 2. Distribution and Location of the East-Central-West Gran Estelar Magmatic-Volcanic Arcs, **a.b**. E-W Roll Back Direction Paleo Pacific Plate-FarallonesPlate, Laurentia-Godwana. **1, 2,3,4,5** Giganucleares Forces that Gave Origin to the Gulf of Mexico. Described in Item 4-5 of this study.

Eastern Gran Estelar Volcanic-Magmatic Arc (Upper Triassic-Lower Jurassic): Composed of the extension of the Mexican Paleo Sierra Madre Oriental, Perijá, Paleo Mérida, and the Colombian Paleo Cordillera Oriental. (Honor beloved wife, Estela Moreno Z.) **(Figures 1, 2, 3, 4, and 5).**

Central-Middle Gran Estelar Volcanic-Magmatic Arc (Lower Jurassic-Middle Jurassic): Composed of the extension of the Mexican Paleo Sierra Madre Oriental, Paleo Mesa Central, Sierra Nevada de Santa Marta, Serranía de San Lucas, and the Colombian Paleo Cordillera Central. (Honor beloved wife, Estela Moreno Z.) **(Figures 1, 2, 3, 4, 5, and 6).**

Western Gran Estelar Volcanic-Magmatic Arc (Middle-Upper Jurassic): Formed by the extension of the Mexican Paleo Sierra Madre Oriental-Occidental, Paleo Mesa Central, Sierra Nevada de Santa Marta, Serranía de San Lucas and the Paleo Cordillera Central of Colombia. (Honor beloved wife Estela Moreno Z.) **(Figures 1, 2, 3, 4, 5, 6, 7, 8).**

2. Analysis

Using the advanced tools of Complex Source Theory (CST), it became very easy to find an answer to the question posed by the renowned geoscientists honored in this article, and which for decades has kept the community of geologists, stratigraphers, volcanologists, seismologists, geophysicists, geoscientists, and the global mining and energy sector in general up at night.

All the answers come from the paleogeographic reconstruction of the Gulf of Mexico based on the work of renowned geoscientists: **James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020, A revised synthesis of the rift and drift history of the Gulf of Mexico and surrounding regions in the light of improved age dating of the Middle Jurassic salt. 49 p.** https://doi.org/10.1144/SP504-2020-43, Free to the public through their YouTube conference **Cátedra Selecta.- James Pindell-2021.**

From the work of the **Doctors Restrepo, J.J. & Toussaint, J.F. 2020. Tectonostratigraphic terranes in Colombia: An update. First part: Continental terranes. In: Gómez, J. & Mateus–Zabala, D. (editors), The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, p. 37–63. Bogotá.** https://doi.org/10.32685/pub.esp.35.2019.03.

For this chapter, valuable geochronological, geochemical, stratigraphic, sedimentological, and structural data related to volcanic and magmatic arcs for the Triassic-Jurassic period are incorporated to model, from both Mexico-USA (Laurentia) and Colombia-Venezuela (Gondwana); from the renowned Doctors: **Claudio Bartolini 2003, Joshua H. Rosenfeld. 2002, Elena Centeno García 2018-23, Elisa Fitz Díaz.2018-2020, Parolari M, Martini M, Gómez-Tuena A, Ortega-Gutiérrez F, Errázuriz-Henao C, and Cavazos-Tovar JG (2022), Hildebrando Leal-Mejía, Robert P. Shaw, and Joan Carles Melgarejo i Draper 2019, Carlos A. Zuluaga and Julián A. López 2019, BAQUERO Marvin , VISCARRET Patxo , VALENCIA Víctor; TAZZO-RANGEL María Daniela; ANDARA José , URBANI Franco , SIFONTES Ramón , CENTENO José . 2015. Sonia Güiza González, Geoquímica Sénior. 2020-21, López–Isaza,**

J.A. & Zuluaga, C.A. 2020, Spikings, R. & Paul, A. 2019, Rodríguez–García, G., Correa–Martínez, A.M., Zapata–García, G., Arango–Mejía, M.I., Obando–Erazo, G., Zapata–Villada, J.P. & Bermúdez, J.G. 2020. Rodríguez García, G., Correa Martínez, A. M., Zapata, J. P., Ramírez, D. A., & Sabrica, C. A. (2022), Camilo Londoño Bustamante 2020 . (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit), entre otros.

Complementing the above with information from studies conducted by important and recognized geoscientists described in the Bibliography, all integrated with the advanced tools of the **SCT Complex Source Theory (Edinson Alvarez 2025).** Results of the tectonic evolution of the Gulf of Mexico, which can be observed in **Figures 3,4,5,6,7,8** for the Upper Triassic period (201.3 to 210 million years ago) – Jurassic. 145 to 201.3 million years ago.

In the following tectonic-paleogeographic reconstruction, Colombia's Tertiary deformation is restored **(Similar a Pindell 1985, V. Ramos 2021, Edinson Alvarez 2025).** And the stretching of the Eastern Cordillera is consistent with the location of the western margin of proto Cordillera Gran Estelar and later Gran Estelar Middle and West Magmatic Arc. The configuration of the Chibcha Block of **Restrepo, J.J. & Toussaint, J.F. 2020.** Was used**.** All other parameters of the paleogeographic reconstruction were maintained, **Pindell et al 2020-2021.** The Upper Triassic period was regenerated and/or configured based on **Pindell 1985-1992-1994-Pindell et al 2020-2021, Edinson Alvarez 2025).**

The Salt Polygon for Colombia was developed based on the work of **Ingeominas 1970-1985, Dr. Oswaldo Ordoñez C. 2020. And Sonia Güiza González, 2020-21.** Applying an equivalent stretch towards the middle Magdalena Valley (Taking into account the Tertiary deformation of the Eastern Cordillera of Colombia). Presal sediments are not shown in this reconstruction, nor is the Tahami (Ta)-Colombia block discussed (Part of a forthcoming edition).

By incorporating geochronological and other data related to the volcanic-magmatic arcs of the Triassic-Jurassic period of Mexico, Colombia and Venezuela, it was possible to give a better configuration to the location of the Proto Cordillera Gran Estelar, as well as the evolution of the magmatic-volcanic arcs and establish their spatiotemporal correlation of both Laurentia, as well as Gondwana, confirming the solidity of the tectonic evolution model for the Gulf of Mexico-America.

Based on the analysis of the Paleogeographic Reconstruction Tectonic Evolution of the Gulf of Mexico, we begin to answer the different questions raised in the following section of Giants to Be Knocked Down.

Additionally, one of the objectives of this work is to demonstrate the spatio-temporal relationship of the sedimentary deposits of the Jurassic Period of the Gulf of Mexico, with the sedimentary deposits of the same Jurassic period for the Colombian Basins, especially the Jurassic paleobasin of the Eastern Cordillera of Colombia.

Figures 3,4,5,6,7,8, tectonic evolution of the Gulf of Mexico during the Upper Triassic period (201.3 a 210 m.a.) –**Jurássic**. 145 a 201.3 million years ago,

Fig 3. Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurasic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

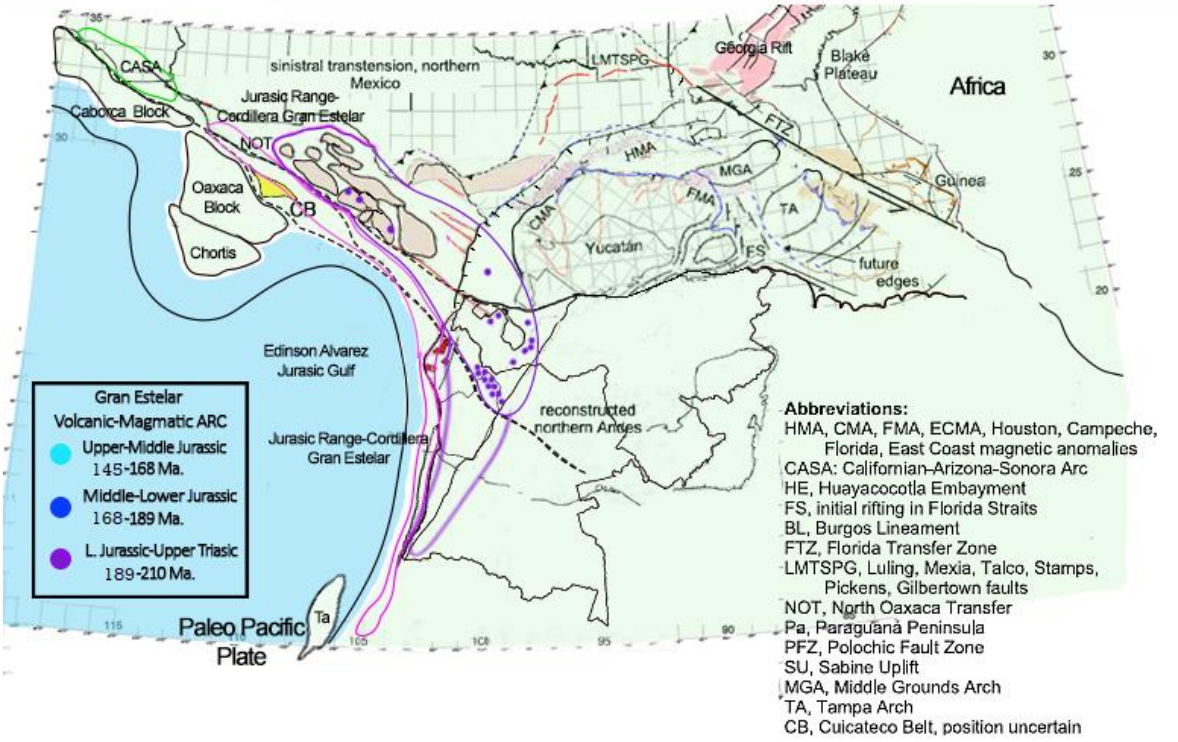


Fig 4. Mexican Gulf Tectonic Evolution - 195 m.a. Early Jurasic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

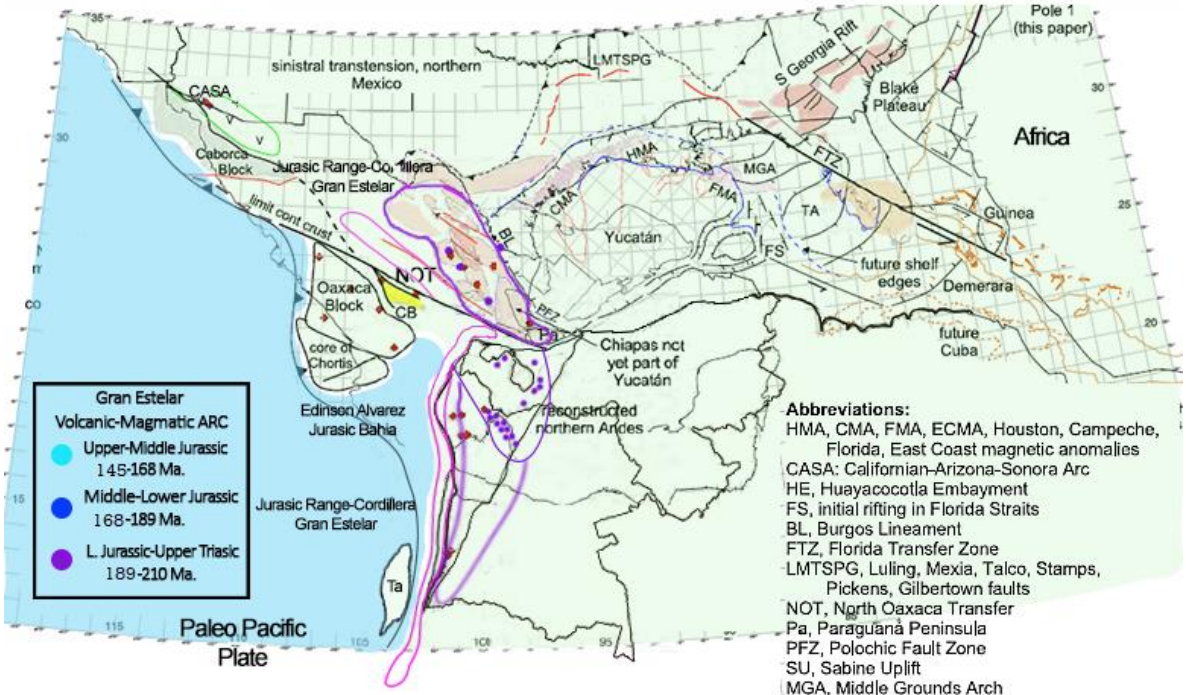


Fig 5. Mexican Gulf Tectonic Evolution - 177 m.a. Early Jurassic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

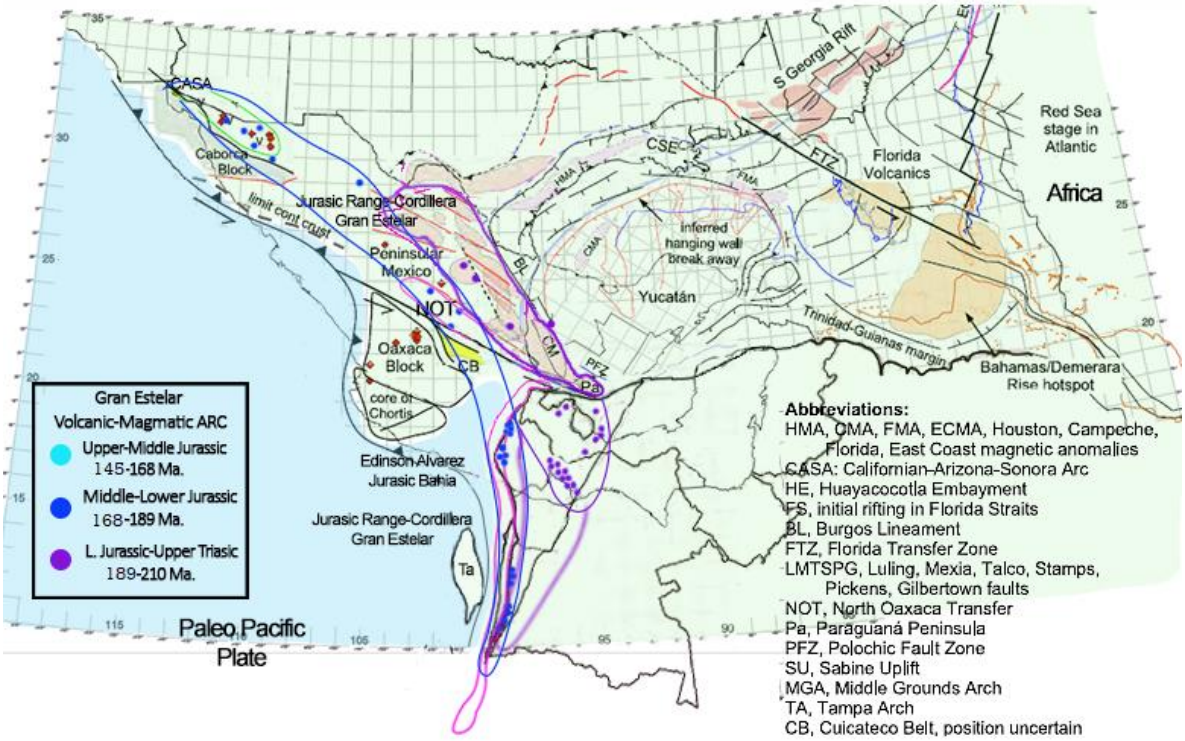


Fig 6. Mexican Gulf Tectonic Evolution - 167 m.a. Middle Jurassic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

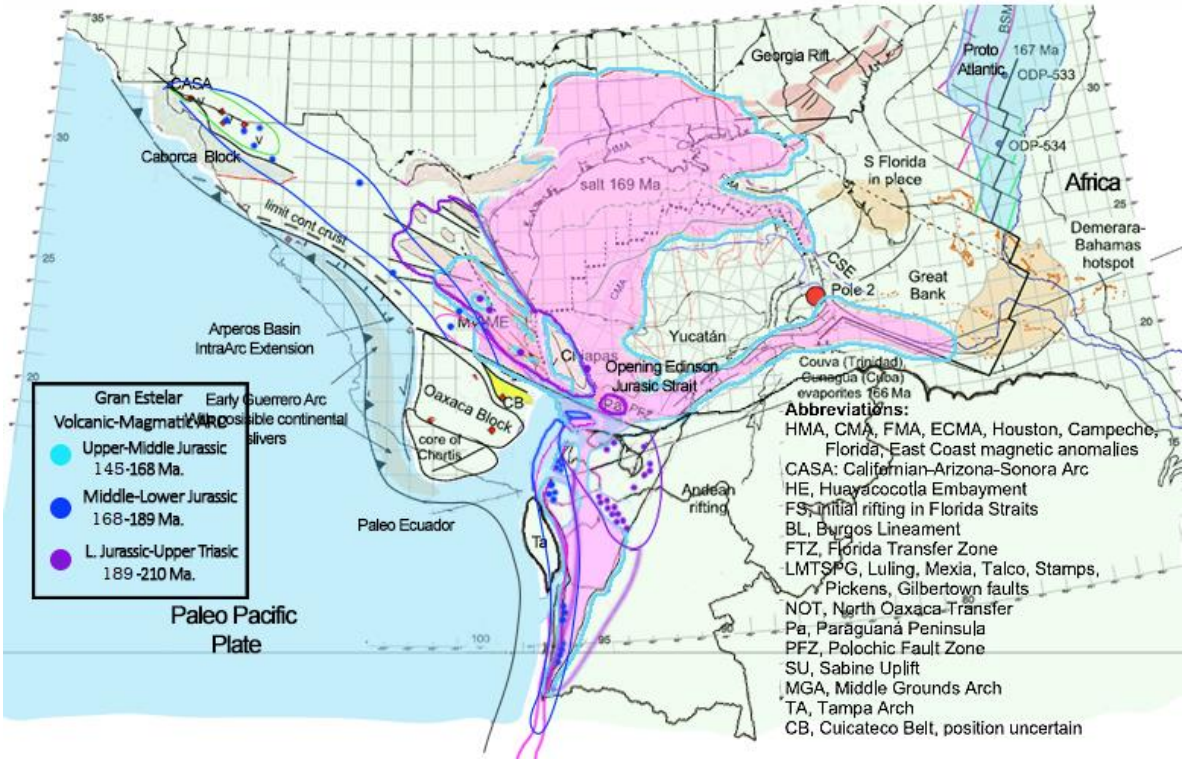


Fig 7. Mexican Gulf Tectonic Evolution - 159 m.a. Late Jurasic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

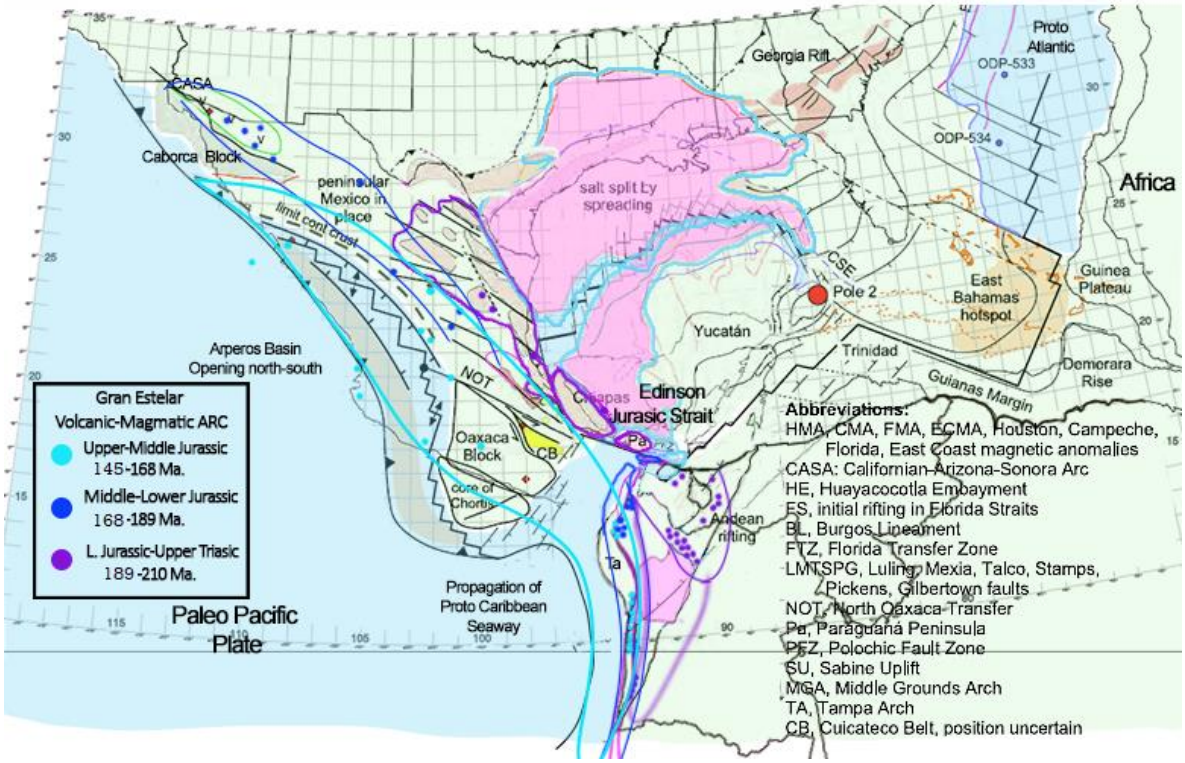
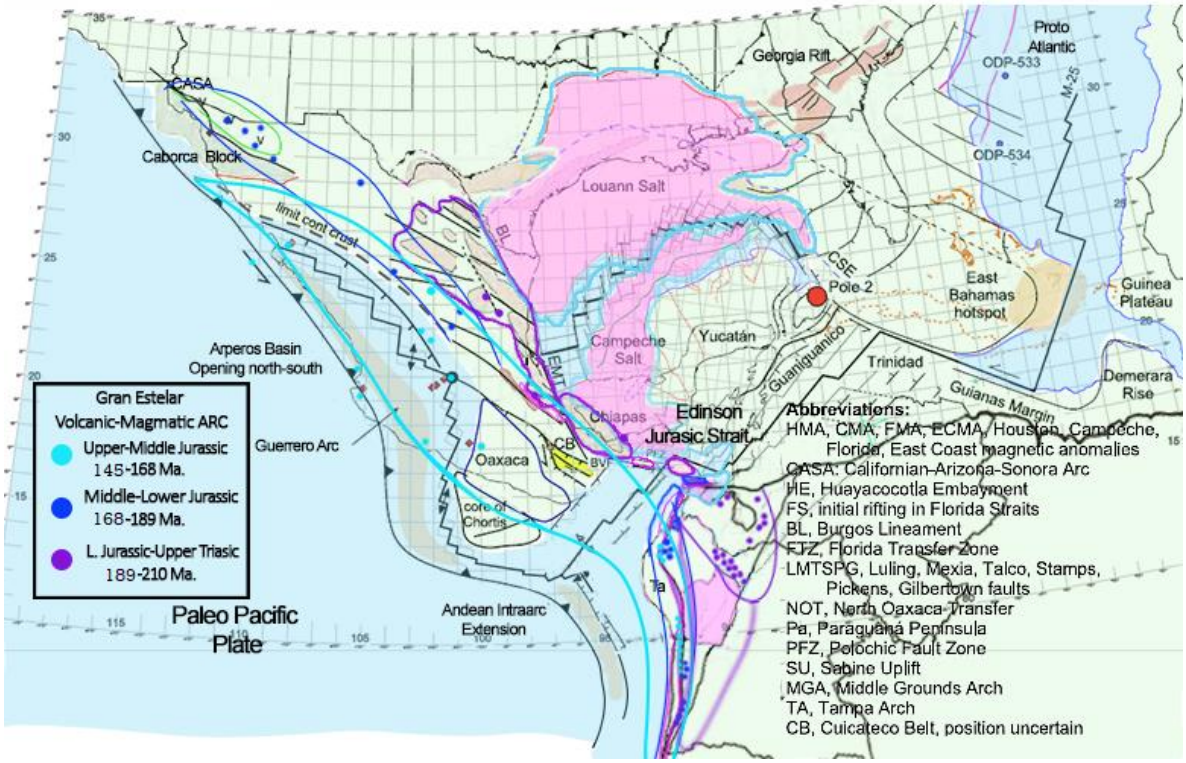


Fig 8. Mexican Gulf Tectonic Evolution - 154 m.a. Late Jurasic

Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.



3. Giants

The following are the Giants that we will demolish in this chapter. **We will refer to Giants as (Concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unresolved questions, etc.).**

3.1 Giant No. 1 (Giant No. 20 Knocked Down this series):

Directly related to the succession of events that generated or gave rise to the structural and sedimentary configuration of the Gulf of Mexico.

Spikings, R. & Paul, A. 2019.

> The relationship between Triassic plate margin extension and the final fragmentation of Pangaea is unclear. Howev-

Filina et al 2022. (Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022.)

> exploration. However, the opening of the basin remains debated for two reasons: 1) the quality of data does not allow for reliable interpretations of crustal features beneath thick and complex overburden, and 2) most industry well and geophysical data are proprietary. The last concerted effort by industry and academia to summarize the

3.2 Giant No.2 (Giant No. 21 Knocked Down this series) :

Alarcón CM et al 2020. (Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020).

> de arcos magmáticos marginales (**Rodríguez, *et al.***, 2018). Uno de los retos actuales es la reconstrucción de la historia geológica del Jurásico en los Andes del norte, no solo desde el punto de vista geoquímico y geocronológico de las rocas plutónicas y volcánicas, sino porque deben entenderse de forma integral las relaciones del magmatismo con la formación de cuencas y la acumulación de sucesiones sedimentarias. Como lo sugieren **Bayona,**

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

> - **Relación entre cuencas sedimentarias, magmatismo y metamorfismo.**

3.3 Giant No.3 (Giant No. 22 Knocked Down this series) :

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- **¿Cómo fueron las variaciones de los espesores corticales durante el Jurásico?**

3.4 Giant No.4 (Giant No. 23 Knocked Down this series) :

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- **¿Cómo se comportó la margen convergente durante el Jurásico?**

3.5 Giant No.5 (Giant No. 24 Knocked Down this series) :

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- Tres modelos de evolución:
  - Slab roll-back
  - Erosión por subducción
  - Convergencia oblicua

3.6 Giant No.6 (Giant No. 25 Knocked Down this series):

Mildred Del Carmen Zepeda Martínez - Tesis Doctoral UNAM. 2021

estas premisas, reconstruir la evolución de las cuencas del Jurásico Inferior–Medio de México no sólo enriquecería el debate sobre la dinámica de un proceso tectónico de escala global como es la fragmentación de un supercontinente, sino que también podría contribuir a la comprensión del origen y distribución de los reservorios de petróleo que existen en el país.

Answers can be found in the Final Conclusions of this study.

4. Spatiotemporal Relationship of Sedimentary Deposits During the Jurassic Period of the Gulf of Mexico with Respect to the Jurassic Sedimentary Deposits of the Colombian Basins.

4.1 Geochronological Correlation of Volcanic and Magmatic Arcs of Laurentia (Mexico-USA)-Gondwana (Colombia-Venezuela):

By incorporating geochronological and other data related to the volcanic-magmatic arcs of the Triassic-Jurassic period of Mexico, Colombia and Venezuela, it was possible to give a better configuration to the location of the Proto Cordillera Gran Estelar, as well as the evolution of the magmatic-volcanic arcs and establish their spatiotemporal correlation of both Laurentia, as well as Gondwana, confirming the solidity of the tectonic evolution model for the Gulf of Mexico-America.

The analysis of radiometric dating of magmatic (igneous-volcanic) rocks was thus carried out for the area of interest, the Laurentian-Gondwanan suture boundary of the Upper Triassic-Jurassic period. Three major groups of isotopic ages were found: U-Pb, K-Ar, and Ar-Ar, obtained from different studies, as follows:

4.1.1 Eastern Gran Estelar Volcanic-Magmatic Arc (Upper Triassic-Lower Jurassic-210-189 Ma):

Venezuela: Ministerio de Minas e Hidrocarburos de Venezuela 1968. **(Figures 2,3,4)**
Sierra Perijá
Granito el palmar K-AR 210.
Granodiorita El Palmar sm 200+-4
Cordillera de los Andes Mérida
Granodiorita Sierra Nevada de Mérida Rb-Sr 200+-2,5
Granito de Tovar Rb-Sr 200+-6
Granito porfídico Valera K-Ar 210+-5
Granito de Piñango K-Ar 195+-5, 200+-10, 196+-10
Granito de Timotes K-Ar 181+-9 (Anómalo)
Baquero Marvin et al 2015. Mérida.
Granodiorita el Carmen 211+- 1 ma. Vande lelij et al 2011.
Granito de La Culata 206,1 (+3,0/-3,8) Ma y 207,3 (+4,0/-3,0) Ma Upper Triassic.

Colombia:
Santander Plutonic group: SantaBárbara - Rionegro –Mogotes Batholiths and The Pescadero, La Corcova and Páramo Rico plutons (U-Pb zircon, Ma) 210–196. **Hildebrando Leal-Mejía et al 2019.**

México:
Valle de Huizachal-Aramberri U-Pb **195**-189
Chiapas U-Pb 191 **Parolari M, Martini M. et al 2022.**
Chiapas 196. **Elena Centeno García 2023.**

Eastern Gran Estelar Volcanic-Magmatic Arc (Upper Triassic-Lower Jurassic): Composed of the extension of the Mexican Paleo Sierra Madre Oriental, Perijá, Paleo Mérida, and the Colombian Paleo Cordillera Oriental. (Honor beloved wife, Estela Moreno Z.) **(Figures 1, 2, 3, 4, and 5).**

4.1.2 Central-Middle Gran Estelar Volcanic-Magmatic Arc (Lower Jurassic-Middle Jurassic-168-189 ma):

Venezuela: Ministerio de Minas e Hidrocarburos de Venezuela 1968. **(Figures 2,5,6)**
Cordillera de los Andes Mérida
Granito El Baño sm 175+-2,5 (Location Anomaly - Refers to a value that is outside the general trend of the Arch, explained as a deviation from the general placement route of the main arch)

Colombia:
Southern Ibagué Batholith, Norosí and San Martín batholiths (U-Pb zircon, Ma) Ca. 189–182
Sierra Nevada de Santa Marta batholiths (pueblo Bello-Patillal and Aracataca-central) Ca. 180
Mocoa-Garzón trend batholiths Ca. 179–173. **Hildebrando Leal-Mejía et al 2019.**

México:
Durango U-Pb 184-168
Sierra de Catorce-Charcas-Zacatecas U-Pb 179-168
Tizapa Mine U-Pb 186
Ayú Complex U-Pb 175-168
Tlaxiaco Basin U-Pb 184-177
Acapaulco U-Pb 179
Islas Marias U-Pb 170
Parolari M, Martini M. et al 2022., Elena Centeno García 2023.

Central-Middle Gran Estelar Volcanic-Magmatic Arc (Lower Jurassic-Middle Jurassic): Composed of the extension of the Mexican Paleo Sierra Madre Oriental, Paleo Mesa Central, Sierra Nevada de Santa Marta, Serranía de San Lucas, and the Colombian Paleo Cordillera Central. (Honor beloved wife, Estela Moreno Z.) **(Figures 1, 2, 3, 4, 5, and 6).**

4.1.3 Western Gran Estelar Volcanic-Magmatic Arc (Middle-Upper Jurassic-145-168 ma):

Colombia:
Northern Ibagué Batholith Ca. 169–152
Segovia Batholith Ca. 167–158. **Hildebrando Leal-Mejía et al 2019.**

México:
Different Magmatic Bodies West of the Arperos Suture, Terreno Guerrero 150-165 **Centeno García 2023.**

Western Gran Estelar Volcanic-Magmatic Arc (Middle-Upper Jurassic): Formed by the extension of the Mexican Paleo Sierra Madre Oriental-Occidental, Paleo Mesa Central, Sierra Nevada de Santa Marta, Serranía de San Lucas and the Paleo Cordillera Central of Colombia. (Honor beloved wife Estela Moreno Z.) **(Figures 1, 2, 3, 4, 5, 6, 7, 8).**

4.2 Geological, geochemical, sedimentological, facial, structural, paleogeographic, paleontological, geochronological correlation, Laurentia (Mexico-USA)-Gondwana (Colombia-Venezuela):

To further consolidate, strengthen and test our model presented to the international geoscientific community in article 5 of this series in December 2025 (https://revistamaya.com/wp-content/uploads/2025/12/Revista-Maya-Geociencias-EDICION-ESPECIALXXVII-2025.pdf), We will proceed to integrate the technical and scientific evidence that allows us to validate the geological and tectonic evolution model proposed in this work for the Gulf of Mexico. **(Figures 9 y 10)**

4.2.1 Roll Back Model of the Farallones Plate (Triassic-Jurassic).

In the important work of **Dra. Danny Yulimar Mejía Vélez 2019 (Master's Thesis Unal-Colombia**), she summarizes:

> Los modelos más aceptados en la actualidad sobre la evolución de la margen noroccidental de Gondwana en el Jurásico defienden la existencia de un arco continuo desde el Jurásico inferior hasta el cretáceo superior construido en una margen sometida a un régimen extensional en una subducción tipo roll-back, esta hipótesis soporta su argumento en la migración del frente magmático desde el oriente sin considerar ningún tipo de influencia de desplazamientos en el rumbo durante la estructuración y evolución del arco (Villagomez et al. 2011; Cochrane et al 2014a, Cochrane et al. 2014b; Spikings et al. 2015, Spikings et al. 2016; Van der Lelij et al. 2016; Zapata et al. 2016; Spikings et al. 2019).

Similarly, **Dr. Elena Centeno García 2023**, Mexican site-UNAM points to the same conclusion for Laurentia. **(Figures 9 y 10)**:

> 1. Magmatismo tiene una tendencia a migrar de E a W entre los 190 y 155 Ma

4.2.2 Roll Back Model of the Farallones Plate (Triassic-Jurassic). Geochronology in Zircons, Laurentia (Mexico-USA)-Gondwana (Colombia-Venezuela):

The Zircon geochronology results have been integrated from the work of Dra. **Elisa Fitz et al 2020 y del Dr, Hildebrando Leal Mejía et al 2019 (Figure 9).**

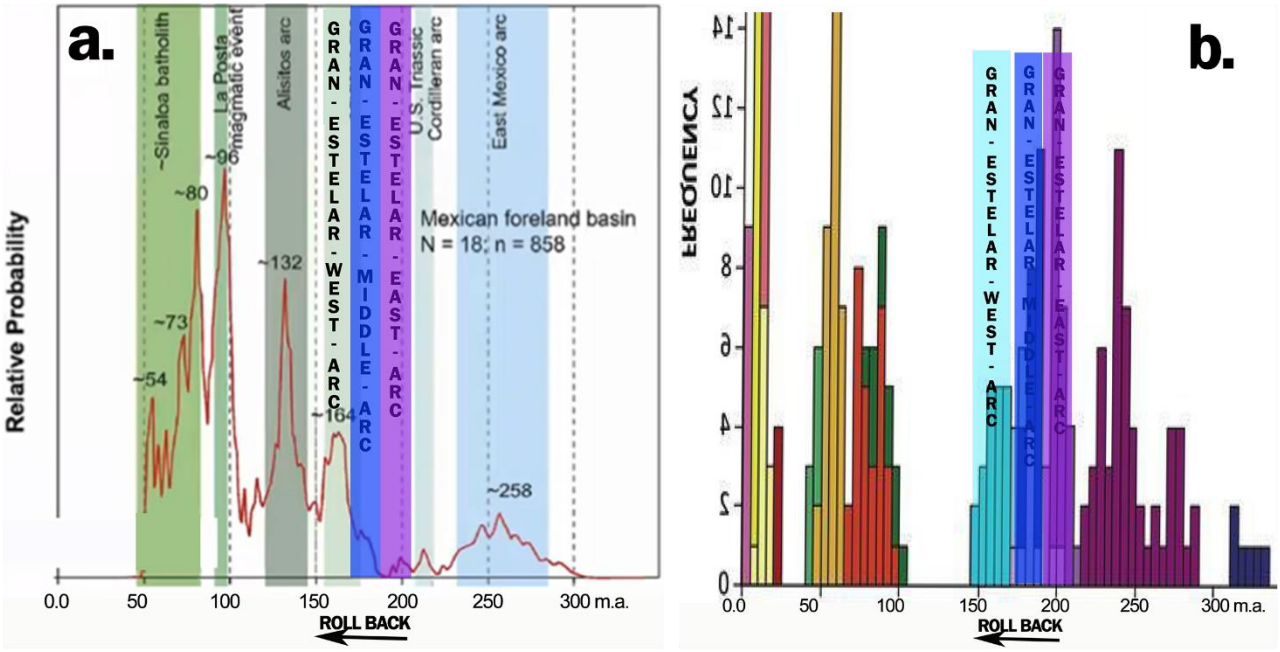


Figure 9. a. Geochronological Analysis of U-Pb in Detrital Zircons in the Mexican Orogen. **b**. Granitoides Colombia. Modified from **Elisa Fitz et al 2020** And **Dr, Hildebrando Leal Mejía et al 2019.** In both cases, the peaks corresponding to the formation dates of **the East-Middle-West Gran Estelar Magmatic-Volcanic Arcs are observed.**

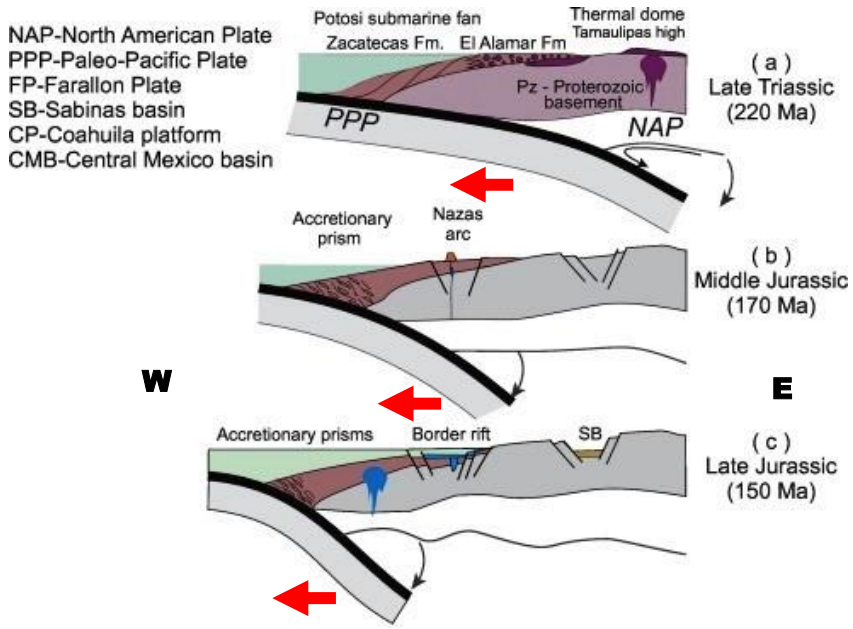
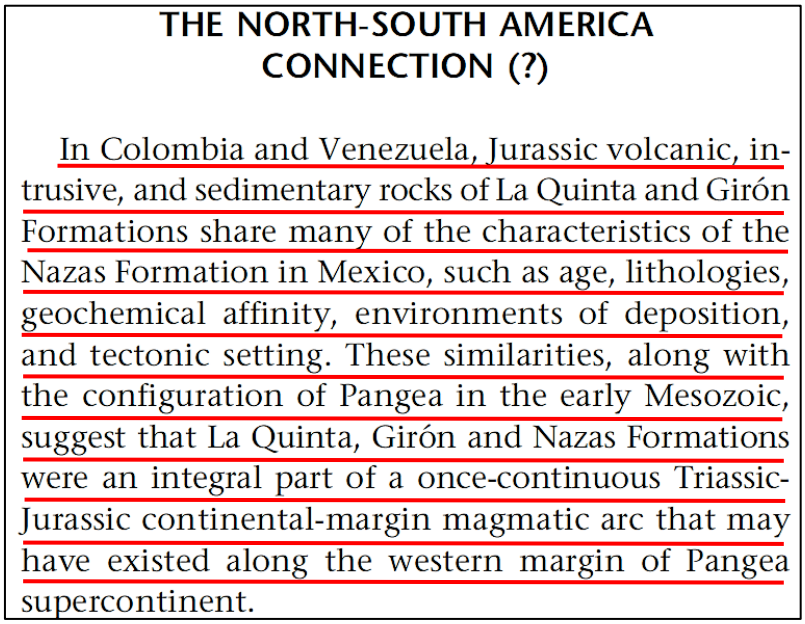


Figure 10. Tectonic evolution of the Mexico Subduction Zone for the Late Triassic-Jurassic. Taken from Elisa Fitz et al 2018, showing the E-W rollback of the Farallones Plate. Images **a.** (to210ma) and **c..:** the Gran Estelar Magmatic Arc are missing.

4.2.3 Geological, geochemical, sedimentological, facial, structural, paleogeographic, paleontological, geochronological correlation, Laurentia (Mexico-USA)-Gondwana (Colombia-Venezuela):

Dr. Claudio Bartolini et al. (2003) made a significant contribution to the geosciences of the Laurentian-Gondwanan Triassic and Jurassic periods with their extensive correlation between the Nazas Formation of Mexico and the Girón and La Quinta Formations in Colombia and Venezuela. This correlation has been extensively studied and proposed by other authors. However, the need to solidify and/or confirm this important analysis and postulate had remained unresolved. We are proud to have verified this 23 years later through the tectonic and geochronological reconstruction presented in this work. **(Fig. 1,3).**

Bartolini, C., H. Lang, and T. Spell, 2003.



THE NORTH-SOUTH AMERICA CONNECTION (?)

In Colombia and Venezuela, Jurassic volcanic, intrusive, and sedimentary rocks of La Quinta and Girón Formations share many of the characteristics of the Nazas Formation in Mexico, such as age, lithologies, geochemical affinity, environments of deposition, and tectonic setting. These similarities, along with the configuration of Pangea in the early Mesozoic, suggest that La Quinta, Girón and Nazas Formations were an integral part of a once-continuous Triassic-Jurassic continental-margin magmatic arc that may have existed along the western margin of Pangea supercontinent.

Figure 3 of this article confirms the important theory postulated by Drs. Bartolini, C., H. Lang, and T. Spell, 2003. Great achievement and success of the present study.

Dr. Edinson Alvarez (Article 5 of this Series, 2025) makes a significant contribution to the geosciences of the Laurentian-Gondwanan Triassic and Jurassic periods with the extensive correlation between the Louant Salt Formation (Gulf of Mexico, America) and the Zipaquirá Salt Formation (Cundinamarca Basin, Colombia, 2025). He projects the existence of the Lower Jurassic Zipa Formation (Edinson Alvarez, 2025), which is correlated with marine formations and facies, such as the nearby Montebel Formation in the Eastern Cordillera of Colombia; the Morrocoyal Formation in the Middle Magdalena Valley and near the western part of the Sierra Nevada de Santa Marta, Colombia; and the Werner Formation in the Gulf of Mexico. (**Figure 11**. Spatiotemporal correlation –tectonic-palogeographic reconstruction–Salt Formation Gulf of Mexico, with the Sal of Colombia, Zipaquirá Formation Edinson Alvarez 2025–Complements to Article 5 of this Series).

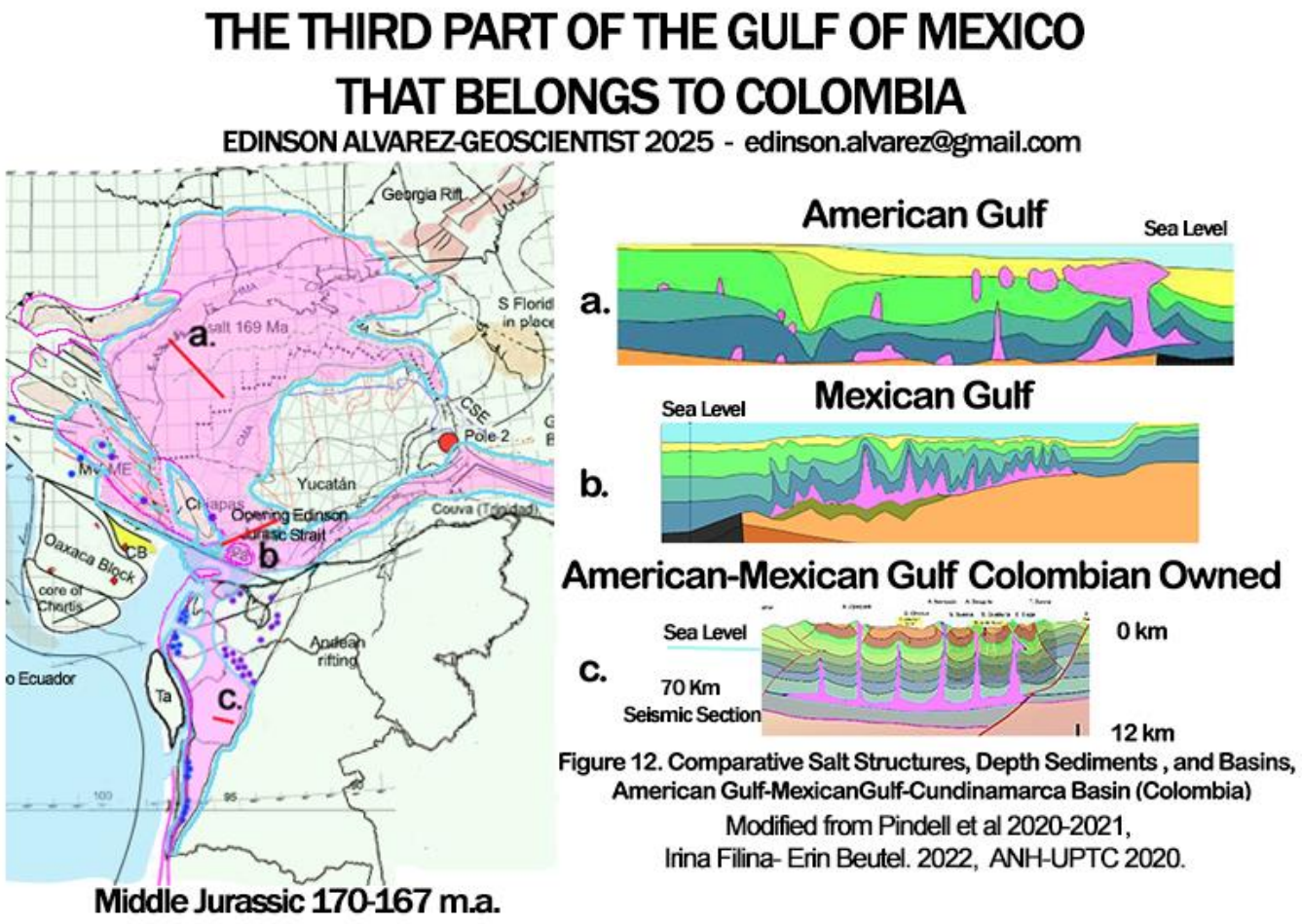


Figure 11. Correlation of Salt Formation in the Gulf of Mexico with the Salt of Colombia, Zipaquirá Salt Formation, Elevated to Formation Rank by Edinson Alvarez 2025.

4.3 The Five Giganuclear Geological and Tectonic Forces that Gave Rise to the Gulf of Mexico.

An Advanced Information Integration was performed, **based on the principles of the SCT Complex Source Theory (Edinson Alvarez 2025).** Step to Determine the Origin and Evolution of the Gulf of Mexico. **Figure 2.**

4.3.1 Mantle Plume

A mantle plume just beneath the Gulf of Mexico caused uplift, extension, and flow of mafic magmas, generating the central Gulf rift at the end of the Middle Jurassic and terminating the magmatic and/or lava flows at the lower Cretaceous. **(Period estimated in Filina and Beutel 2022). (Supercontinent Fragmentation Requirements - Juan Pablo Lovecchio 2020 - Item 4.3.3) (Figure 2 - No. 1)**

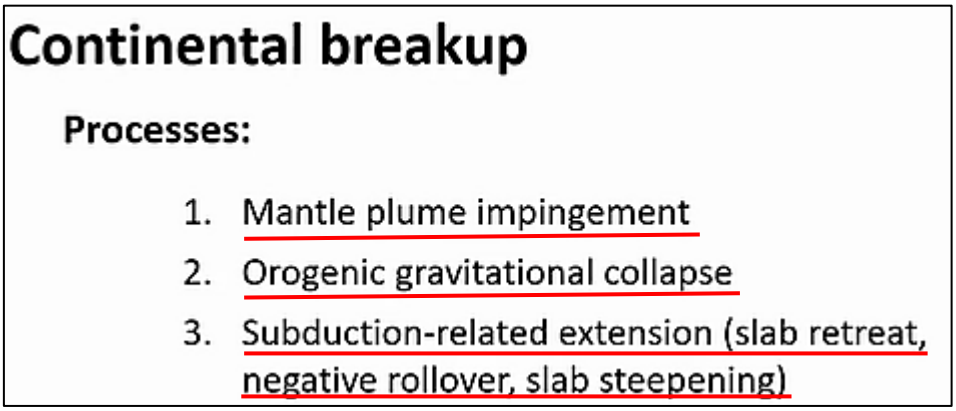
4.3.2 Subduction with Roll Back Extension

The Roll Back in the Subduction of the Farrallones Plate over Mexican-American territory **(Laurentia)** and over Colombian-Venezuelan territory **(Gondwana),** fully studied and verified by the studies cited above. **Dany Yuleimar Mejía Vélez 2019 (Tesis Maestría Unal-Colombia), Elena Centeno García 2023, Elisa Fitz et al 2018, entre otros. (Figura 2-No.3., a y b)**

4.3.3 Gravitational Collapse

The Gravitational Collapse of the volcanoclastic sequence of **the Nazas Formation and overlying units, in the Oxfordian Late Jurassic 157-163 Ma (Bartolini et al 2003), Pindell 2020-2021, among others. (Figure 2-No. 4.)**

The three above are consistent with the list presented by Dr. Juan Pablo Lovecchio in 2020, (Requirements for Supercontinent Fragmentation-)



However, with the **SCT Complex Source Theory (Edinson Alvarez 2025),** two new forces have been added that participated in the origin, creation and evolution of the Gulf of Mexico-America.

4.3.4 Transform Fault Movement Aligned with North Oaxaca Transfer, Mojave-Sonora and Tamaulipas Transfer.

The movement of Transform Faults in the Western Part of Laurentia was vital not only for the transport of Allochthonous Blocks such as Aoxaca and Chortis, etc... but also helped and facilitated the journey, transport and deformation of the Gravitational Collapse of the Nazas Formation, mentioned above. **(Figura 2-No.2.)**

4.3.5 Continental Drift Movement of the North American Plate.

The Continental Drift Movement of the North American Plate, widely studied and also referred to by **Dr. Elisa Fitz in 2020, moved towards the Southwest (SW), also contributing stress and deformation to the complex and varied geological and tectonic environment of the Gulf of Mexico.**

The way in which the events, interaction and analysis of the five geological and tectonic forces mentioned above developed can be observed in the Sequence of Figures 1,2,3,4,5,6,7,8, together with the graphs and stratigraphic columns referred to in Article 5 of this Series.

DISCUSSION

This work unlocks several existing limitations in the geoscientific world related to the tectonic evolution of one of the main oil sources in the world, the Gulf of Mexico (Gulf of America-Gulf of Mexico) and in parallel the Jurassic petroleum system of the Colombian basins.

One of the main geological features is **the discovery of the Rudabet Great Fault System-Lineament (Honor to Ruben Dario Alvarez Betancourt (Father), Figures 1 and 3)**. This system controls the base of the large continental structural scarp of Laurentia **(Figure 3).** This discovery helps resolve several contemporary questions, which are central to this study, and which address uncertainties raised by leading geoscientists worldwide.: **James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020-2021; Mildred Del Carmen Zepeda Martinez - Tesis Doctoral UNAM. 2021; Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020; Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022. And others.** This feature demonstrates that the **Restrepo and Toussaint 2020 Chibcha Terrane constitutes**, according to this study, the westernmost part of the large Laurentian structural escarpment **(Figure 3).** It occupies approximately one-third of the size of the basin that gave rise to the Gulf of Mexico-Gulf of America (including the Paleobasin of the Eastern Cordillera of Colombia) during the Triassic-Jurassic period.

Although improvements, refinements, and modifications can be made to the proposal presented in this study, the fact remains that the perfect tied up obtained through **the Rudabet Fault-Lineament System (Honor Ruben Dario Alvarez Betancourt-Father., Figures 1 and 3)** is and will be the starting point for future reconstructions of tectonic evolution forward or backward from this tie-down point or constraint in geological time. The issue that still warrants review is determining whether this tie-down point corresponds to the 200 Ma age of the Dr. Pindell et al. 2020-2021 model, or to a slightly earlier age between 200 and 210 Ma. This would require considering the travel velocities of the Chortis-Oaxaca blocks and their implications for past reconstructions, a topic beyond the scope of this work.

Supporting the existence of a mountain-volcanic chain from the Upper Triassic to the Middle-Upper Jurassic, extending from Mexico (Laurentia) and Colombia (Gondwana), referred to in this work as the **Triassic-Jurassic Gran Estelar ProtoCordillera**: formed by the high-mountain terrain located adjacent to the west of the Paleo Sierra Madre Oriental of Mexico and the Proto Central Cordillera of Colombia, are the following elements:

1. According to the paleogeographic-tectonic reconstruction carried out in this work, a structural element is required to act as back retaining wall of the continental slope escarpment of the Gulf of Mexico, relative to the waters of the Pacific Ocean.(Honor beloved wife Estela Moreno Z.) **(Figures 1, 2, 3, 4 y 5).**

2. When analyzing the location and evolution during the Upper Triassic-Jurassic period of the Gran Estelar East, Middle and West Volcanic-Magmatic Arcs, it is observed, interpreted and analyzed that the area of intersection, overlap or crossing of these three magmatic arcs is located right in the area where the existence of this volcanic mountain range is projected. **(Figures 1, 2, 3, 4 y 5).**

3. A large part of the Upper Triassic-Upper Jurassic Gran Estelar protomountain underwent gravitational collapse and extension during the Middle-Late Jurassic in Mexico. Also with the separation of Laurentia and Gondwana, eroded, buried, and/or dissolved it across of Mexico, allowing the influx of Jurassic waters through the main opening, the **Edinson Alvarez Strait (Figure 6)** (located between the Chiapas Massif and the Guajira Peninsula (in the Middle Jurassic, the Serranía de Cosinas and Serranía de Macuira)) **(See Article 5 of this series).** Meanwhile, in Colombia, the activity of the Middle and Western Gran Estelar Volcanic-Magmatic Arcs helped shape the Central Cordillera of Colombia.

4. Zircon detritus analyses carried out west of the proto-mountain range of the Upper Triassic-Upper Jurassic Great Stellar, in the Sierra Zacatecas area (Central Zone of Mexico), in the La Pimienta, Las Pilas and La Escondida Formations, reflect the existence of these volcanic units, as contributors of detrital material for the aforementioned formations. **Figure 12. Modified from Berlaine Ortega-Flores 2016.**

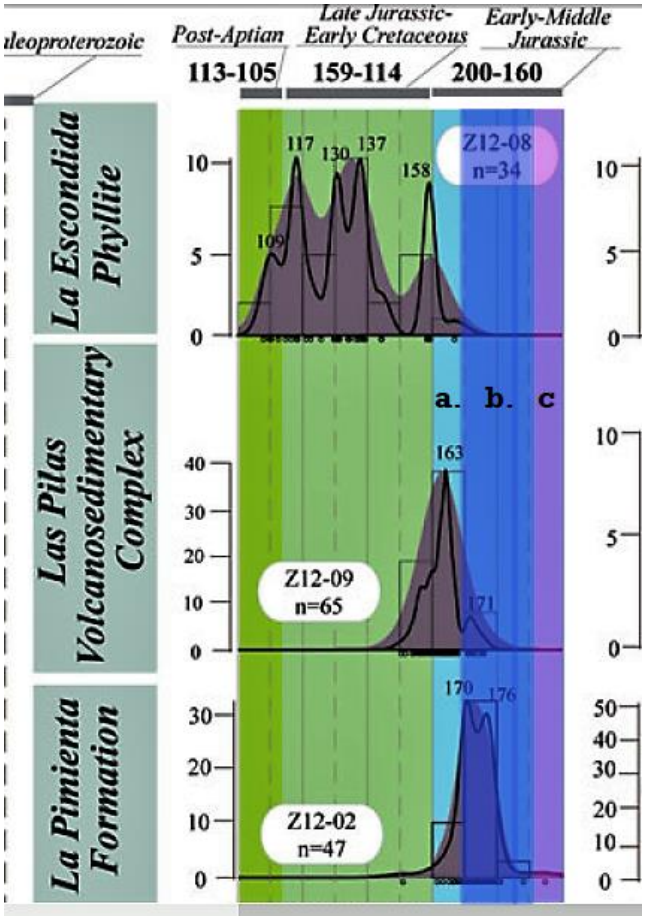


Figure 12. Detrital deposition corresponding to the **Gran Estelar East(c), Middle(b), and West(a) volcanic arcs** in the Sierra Zacatecas area of Mexico. Modified from **Berlaine Ortega-Flores 2016.**

In Colombia, the oil sector and the geoscientific community have traditionally assumed that the salt corresponds to Cretaceous deposition, as shown on all cornostratigraphic maps of the country up to 2025. However, there are several points that do not support this thesis and, on the contrary, contradict this theory, among them are **(See Article 5 of this Series):**

1- Since the Cretaceous play is one of the most studied and drilled in the country due to the interest in its petroleum systems, there is no significant report of salt or saline deformation in the Llanos basin, Catatumbo, upper-middle Magdalena valley, Maracaibo Basin, where Cretaceous deposition was also recorded.

2- The Jurassic paleobasin of the Eastern Cordillera of Colombia has been little studied and almost unexplored, according to **ANH-UPTC 2020.**

3- The few wells drilled in the Eastern Cordillera basin of Colombia mostly only reach the Cretaceous sequence, leaving the Jurassic record unknown. This is especially true in the Cundinamarca basin. **(Figure 14- Artlcle 5, this series).**

4- The analysis of the facts, indications, evidence, and previous records clearly shows us that while the Cretaceous transgression to the South American continent has been widely studied and analyzed, we find that the entry of the sea or flooding into the territory was extensive and massive, that is, there was direct communication with the open sea, therefore there were normal salinity conditions unsuitable for the deposition of salt.. While the analysis of the facts, clues, evidence, and records provided in this work demonstrates that during the Middle Jurassic period **(Bajocian-Bathonian, 166-170 Ma)**, the Naza Arch of Mexico was in collision with the northwestern corner of South America (Gondwana), breaking the Jurassic Gran Estelar Ridge, creating the Edinson Strait (Edinson Strait-Noth, JhonEdi Strait–Center, and Floris Strait-South) entering the Pacific Ocean to flood the Gulf of Mexico (Gulf of America and Gulf of Mexico), also flooding the paleobasin of the Eastern Cordillera of Colombia, **Demonstrated by the marine corridors of the lower and middle Jurassic, defined from the stratigraphic columns 1,2,3,3a,3b,3d and 3d; 4, 4a, 3c, (later eroded), Figures 6,9,10,11,12,13,14,15,16.** This generated a restricted flow of seawater, causing low circulation and therefore hypersalinity, which, combined with the large extent of the Basin and the high atmospheric conditions of high temperatures, favored the rapid deposition of salt. **(Filina et al 2022),** which reached a thickness of 3 to 4 km. **We can clearly conclude that the salt from the Eastern Cordillera of Colombia is part of the same environment, time and conditions as those that formed in the Gulf of Mexico during the Middle Jurassic. (See Article 5 of this Series).**

Implications in Colombian Petroleum Systems.

We can conclude from the corresponding analysis of the items in section 4.0 of Article 5 of this Series, that we have identified two new unexplored plays and/or Hypothetical petroleum systems in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Cordillera of Colombia.

1. **Jurassic Play**: Formed by the deposition of organic shales from the Lower Jurassic - Hypothetical **Zipa Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Morrocoyal and Montebel formations (Marine and Marines Facies). Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and a 3 to 4 km seal of salt deposited during the Middle Jurassic.

2. **Cretaceous play associated with salt seal:** Source Rock: Fómeque Formation, Reservoir Rock: Une Formation, Seal Rock: Migrated Salt. The same applies to upper sequences.

The Regional Stratigraphic and Structural Analysis indicates that there is a possibility that, beneath the Jurassic Play described above, lies the Triassic sequence made up of the units and/or their equivalents **(Figure 9,14- chapter 5 of this series, station 11):**

On the east side, the Ibagué batholith intrudes another series of sedimentary and volcanic rocks of pre-Cretaceous age, formerly known as the **Payandé Group**, which consists of three clearly distinguishable units, chronostratigraphically ordered from youngest to oldest as follows **(Alberto Nuñez 1986):**

- **Saldaña Formation:** This is the uppermost unit; it is divided into two members, a lower, predominantly volcanic one, informally called the Volcanic Unit by Jimeno and Guevara (1976:19), and an upper, sedimentary one that lies unconformably on top of the former, called the Arkosic Unit by the same authors. Upper Triassic-Lower Jurassic age. (Bayona et al 2020).

- **Payandé Formation:** composed of two members, one calcareous and the other clastic; fossiliferous levels reported in this unit have confirmed a Late Triassic age (Karnian-Norian). (Bayona et al 2020).

- **Luisa Formation:** It consists of thick beds of sedimentary breccias and arkosic conglomerates, evidence of intense erosion. Because it is overlain by the fossiliferous Payandé Formation, it is assigned a Permian age. (Bayona et al 2020).

The integration of knowledge developed through the Complex Source Theory (CST) and its various advanced tools allows us to shed light on and answer all the questions that, for more than one hundred years (the contemporary era), have troubled geoscientists and petroleum explorers regarding the tectonic, sedimentary, stratigraphic, and structural evolution of the Gulf of Mexico (Gulf of America-Gulf of Mexico and the paleo-Eastern Cordillera of Colombia). **Figures 1 to 8. (The same treatment has been applied to all other oil and mining basins in Colombia.)**

The answers become logical, simple, and gain value in light of Complex Source Theory (CST) and its tools, as you will see in the concluding part of this study.

If your company faces a highly complex geoscientific problem with significant economic implications, Complex Source Theory (CST) and its tools are here to solve it. For a more detailed analysis and solution to complex tectonic, structural, and stratigraphic problems, please consult with the author of this article.

CONCLUSION

The SCT Complex Source Theory and its advanced tools demonstrate their value in this report, contributing to the knowledge and understanding of the tectonic evolution of the Gulf of Mexico (Gulf of America-Gulf of Mexico and the Paleobasin of the Eastern Cordillera of Colombia) during the Upper Triassic-Jurassic Period. This contributes to geoscientific knowledge and development, which will help guarantee the country's energy, economic, and social sustainability.

Through this analysis, we have demonstrated how the SCT's postulates have been corroborated and proven over time, revealing their predictive power. And in this article, dedicated to Miguel de Cervantes Saavedra and his work, **we verify the demolition of Six (6) giants in the field (we will refer to giants as: concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unanswered questions, etc.). Counting a total of 25 giants taken down in these 6 published articles.**

5.1 Giant No. 1 (Giant No. 20 Knocked Down this series):

Directly related to the succession of events that generated or gave rise to the structural and sedimentary configuration of the Gulf of Mexico.

Spikings, R. & Paul, A. 2019.

> The relationship between Triassic plate margin extension and the final fragmentation of Pangaea is unclear. Howev-

Filina et al 2022. (Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022.)

> exploration. However, the opening of the basin remains debated for two reasons: 1) the quality of data does not allow for reliable interpretations of crustal features beneath thick and complex overburden, and 2) most industry well and geophysical data are proprietary. The last concerted effort by industry and academia to summarize the

Answer: This study largely clarifies the spatio-temporal relationship of subduction processes, the generation of volcanic-plutonic arcs, rifting, and basin filling and deposition, providing the general framework for subsequent and prior processes in the tectono-stratigraphic formation and evolution of Mexican, American, and Colombian basins during the Jurassic Period and part of the Upper Triassic. **It also point out the processes that led to the extension and fragmentation of Pangaea, specifically. (Figures 2, 3, 4, 5, 6, 7, 8)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.2 Giant No. 2 (Giant No. 21 Knocked Down this series):

Alarcón CM et al 2020. (Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020).

> de arcos magmáticos marginales (**Rodríguez, *et al.*,** 2018). Uno de los retos actuales es la reconstrucción de la historia geológica del Jurásico en los Andes del norte, no solo desde el punto de vista geoquímico y geocronológico de las rocas plutónicas y volcánicas, sino porque deben entenderse de forma integral las relaciones del magmatismo con la formación de cuencas y la acumulación de sucesiones sedimentarias. Como lo sugieren **Bayona,**

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- **Relación entre cuencas sedimentarias, magmatismo y metamorfismo.**

Answer: The spatiotemporal relationship of subduction processes, the generation of volcanic-plutonic arcs, rifting, basin filling and deposition is largely clarified, providing the general framework for subsequent and prior processes in the tectono-stratigraphic formation and evolution of Mexican, American, and Colombian basins during the Jurassic Period and the Upper Triassic. The tectonic-structural-sedimentary spatiotemporal framework is determined in order to establish the relationships between sedimentary basins, magmatism, and metamorphism. **(Figures 3, 4, 5, 6, 7, 8)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.3 Giant No. 3 (Giant No. 22 Knocked Down this series):

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- **¿Cómo fueron las variaciones de los espesores corticales durante el Jurásico?**

Answer: The integration and interpretation of volcanic, magmatic, tectonic-structural events, sedimentation, paleogeographic and geochronological relationships, among others, allow us to infer, estimate, and establish the relationship of crustal thicknesses during the Upper Triassic-Jurassic period. **(Figures 3,4,5,6,7,8)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.4 Giant No. 4 (Giant No. 23 Knocked Down this series):

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- **¿Cómo se comportó la margen convergente durante el Jurásico?**

Answer: The integration and interpretation of volcanic, magmatic, tectonic-structural events, sedimentation, paleogeographic and geochronological relationships, among others, allow us to determine how the Convergent Margin behaved during the Upper Triassic-Jurassic period. **(Figures 3,4,5,6,7,8)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.5 Giant No. 5 (Giant No. 24 Knocked Down this series):

Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Unal, Grupo Tectónica-Eafit)

- Tres modelos de evolución:
  - Slab roll-back
  - Erosión por subducción
  - Convergencia oblicua

Answer: It is clear that geoscientific researchers from both the North (Mexico-USA) and the South (Colombia-Venezuela), and the rest of the world, along with the results of this study (Edinson Alvarez 2025-26), confirm the Slab Roll Back model as one of the main triggers for the opening and evolution of the Gulf of Mexico-America-fragmentation of Pangaea. The other events are complementary and may or may not be due to particular local or regional situations within the evolutionary process. **(Figures 2, 3,4,5,6,7,8,10)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.6 Giant No. 6 (Giant No. 25 Knocked Down this series):

Mildred Del Carmen Zepeda Martínez - Tesis Doctoral UNAM. 2021

> estas premisas, reconstruir la evolución de las cuencas del Jurásico Inferior–Medio de México no sólo enriquecería el debate sobre la dinámica de un proceso tectónico de escala global como es la fragmentación de un supercontinente, sino que también podría contribuir a la comprensión del origen y distribución de los reservorios de petróleo que existen en el país.

Answer: The contributions and geoscientific knowledge of this study **clearly impact the processes of formation, generation and evolution of petroleum and mining systems, both in the Gulf of Mexico-America, the Eastern Cordillera of Colombia and the basins of Venezuela, as well as the mineral resources of the continental part of the aforementioned countries. (Figures 1,2,3,4,5,6,7,8)** (For further details regarding the events and implications in the oil, gas, and mineral exploration cycle, please consult the author of this article).

5.7 Implications in Colombian Petroleum Systems.

We can conclude from the corresponding analysis of the items in section 4.0 of Article 5 of this Series, that we have identified two new unexplored plays and/or Hypothetical petroleum systems in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Cordillera of Colombia.

1. **Jurassic Play**: Formed by the deposition of organic shales from the Lower Jurassic - Hypothetical **Zipa Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Morrocoyal and Montebel formations (Marine and Marines Facies). Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and a 3 to 4 km seal of salt deposited during the Middle Jurassic.
2. **Cretaceous play associated with salt seal:** Source Rock: Fómeque Formation, Reservoir Rock: Une Formation, Seal Rock: Migrated Salt. The same applies to upper sequences.

The Regional Stratigraphic and Structural Analysis indicates the possibility that, beneath the Jurassic Play described above, the Triassic sequence comprised of the **Saldaña, Payandé, and Luisa Formations and/or their equivalents may lie in the Cundinamarca Basin, Colombia.** This possibility must be confirmed or refuted through 2D-3D seismic analysis and interpretation, and deep drilling in the basin. (**Work for the ANH, Colombian Geological Survey, Ecopetrol, and/or Foreign Companies) (Figure 9,14, Article 5 of this series, station 11).**

5.8 Through the interpretation of the intersection of the East-Middle and West Gran Estelar Magmatic-Volcanic Arcs, as well as the existence of detrital deposition of Upper Triassic-Jurassic zircons in sequences later than the western Sierra Zacatecas (Central Zone of Mexico), among others, they help to demonstrate the existence of the Proto Gran Estelar Cordillera of the Upper Triassic-Jurassic, of continental extent, encompassing from north-central Mexico to southern Colombia. **Figures 1,2,3,4,5,6,7,8,9,12.**

5.9 The Five Giganuclear Geological and Tectonic Forces that Gave Rise to the Gulf of Mexico-América.

This study identified the different events that gave rise to the Gulf of Mexico-America. Five major forces participated in its origin, creation, evolution, and development **(Figure 2.):**

5.9.1 Mantle Plume

A mantle plume just beneath the Gulf of Mexico caused uplift, extension, and flow of mafic magmas, generating the central Gulf rift at the end of the Middle Jurassic and terminating the magmatic and/or lava flows at the lower Cretaceous. **(Period estimated in Filina and Beutel 2022). (Supercontinent Fragmentation Requirements - Juan Pablo Lovecchio 2020 - Item 4.3.3) (Figure 2 - No. 1)**

5.9.2 Subduction with Roll Back Extension

The Roll Back in the Subduction of the Farrallones Plate over Mexican-American territory **(Laurentia)** and over Colombian-Venezuelan territory **(Gondwana),** fully studied and verified by the studies cited above. **Dany Yuleimar Mejía Vélez 2019 (Tesis Maestría Unal-Colombia), Elena Centeno García 2023, Elisa Fitz et al 2018, entre otros. (Figura 2-a,b, 2-No3).**

5.9.3 Gravitational Collapse

The Gravitational Collapse of the volcanosedimentary sequence of **the Nazas Formation and overlying units, in the Oxfordian Late Jurassic 157-163 Ma (Bartolini et al 2003), Pindell 2020-2021, among others. (Figure 2-No. 4.)**

The three above are consistent with the list presented by Dr. Juan Pablo Lovecchio in 2020, (Requirements for Supercontinent Fragmentation-Item 4.3.3)

However, with the **SCT Complex Source Theory (Edinson Alvarez 2025),** two new forces have been added that participated in the origin, creation and evolution of the Gulf of Mexico-America.

5.9.4 Transform Fault Movement Aligned with North Oaxaca Transfer, Mojave-Sonora and Tamaulipas Transfer.

The movement of Transform Faults in the Western Part of Laurentia was vital not only for the transport of Allochthonous Blocks such as Aoxaca and Chortis, etc... but also helped and facilitated the journey, transport and deformation of the Gravitational Collapse of the Nazas Formation, mentioned above. **(Figure 2-No.2.)**

5.9.5 Continental Drift Movement of the North American Plate.

The Continental Drift Movement of the North American Plate, widely studied and also referred to by **Dr. Elisa Fitz in 2020, moved towards the Southwest (SW), also contributing stress and deformation to the complex and varied geological and tectonic environment of the Gulf of Mexico. (Figure 2-No5)**

The way in which the events, interaction and analysis of the five geological and tectonic forces mentioned above developed can be observed in the Sequence of Figures 1,2,3,4,5,6,7,8, together with the graphs and stratigraphic columns referred to in Article 5 of this Series.

5.10 Considerations for the Nobel Prize in Science-Geosciences

According to the report **HISTORY OF OIL EXPLORATION IN MEXICO**, https://www.facebook.com/groups/tampicoantiguo/posts/2373490346009997/ : The beginning of the global oil industry took place with the success of the Drake well, in Oil Creek, Pennsylvania, in the year 1859. (approximately 170 years ago).

And according to Google.com, the first mobile offshore drilling rig (MODU) to drill in the Gulf of Mexico was the Mr. Charlie in 1954, near Louisiana, USA, a global pioneer of offshore drilling. (Approximately 70 years ago).

In the important contributions of Dr. Josh Rosenfeld. 2002. He states:

> Muchos geocientíficos y empresas han gastado energía y recursos para proveer los datos e interpretaciones que apoyan el entendimiento actual del Bloque de Yucatán.

The above indicates that despite having made important contributions to the knowledge of the Basin, **by more than Ten Thousand (10.000) Geoscientists from around the world, in more than 100 years of History (Public-Private-Independent-Academic)**; uncertainties still persist about the Origin and Tectonostratigraphic Evolution of the Gulf of Mexico (Related as Giants in Articles 5 and 6 of this Series):

This is a topic that we have happily resolved through the Advanced Tools of Complex Source Theory (SCT- Edinson Alvarez 2025), with important implications for the global oil, gas and mining production exploration cycle. (Figures 1,2,3,4,5,6,7,8,13,14,15).

A question with nearly 500 years of history has been successfully answered, along with 24 other questions, most of them over 100 years old, through a series of articles 1 through 6. These articles respond to questions posed by the world's leading contemporary geoscientists. This valuable and important work, a significant contribution to the global geosciences, allows us to humbly put forward for consideration the nomination and awarding of the Nobel Prize in Science, Based on the discoveries made in this study...

a

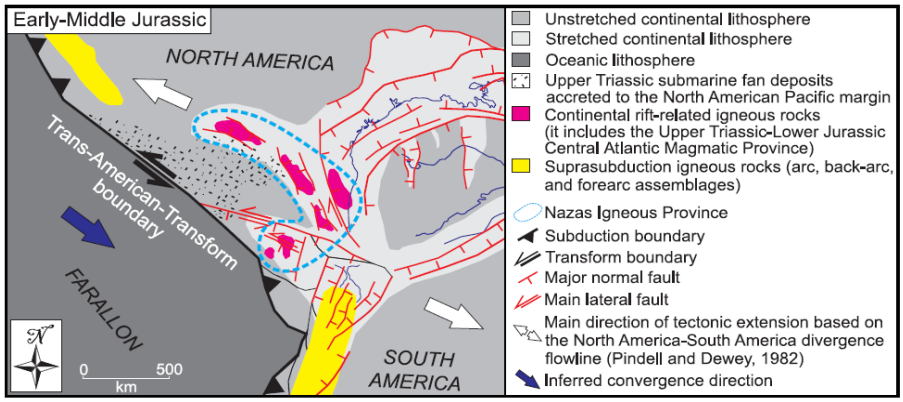


Fig. 13. (Colour online) Geotectonic reconstruction of the North America – South America divergent boundary during Early–Middle Jurassic time (~190–170 Ma; after Boschma *et al.* 2014; Bayona *et al.* 2020; Erlich & Pindell, 2021 and Pindell *et al.* 2021). The reconstruction shows the novel interpretation of the Nazas province as a magmatic provinc related to the continental rift between North and South America. In this new scenario, we propose that the Mexican segment of the North American margin was a transfori boundary.

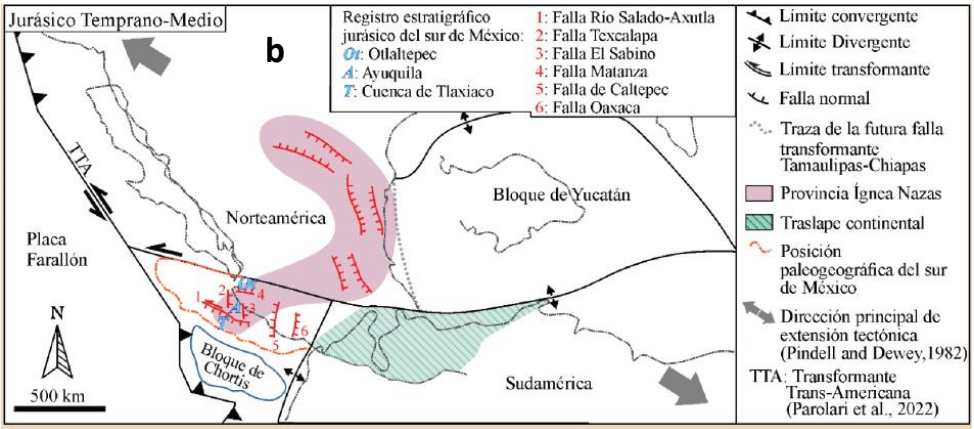


Figura 2. Reconstrucción paleogeográfica del margen oeste ecuatorial de Pangea durante el Jurásico Temprano–Medio, mostrando la posición paleogeográfica del sur de México en una posición más noroccidental y la localización de las fallas mayores que delimitaron las cuencas desarrolladas durante el desarrollo del rift de Pangea. Adaptado de Parolari et al. (2022) y Zepeda-Martínez et al. (2021).

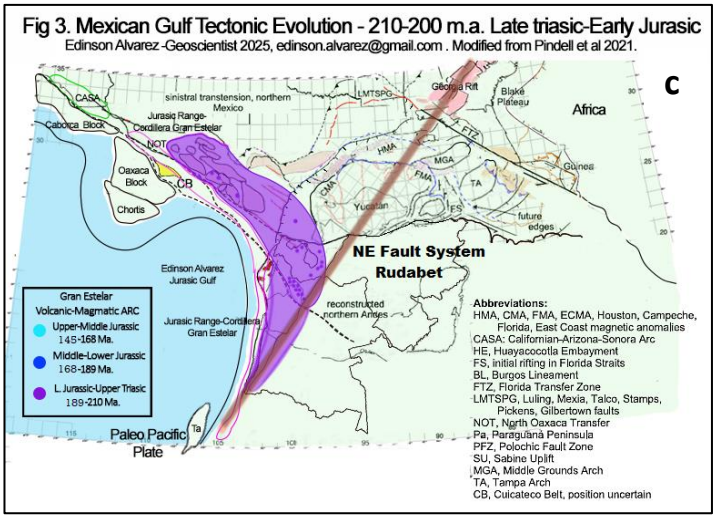


Figure 13. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Parolari M, Martini M. et al 2022. b. María Patricia Velasco de León 2024. c. Edinson Alvarez 2025-2026.**

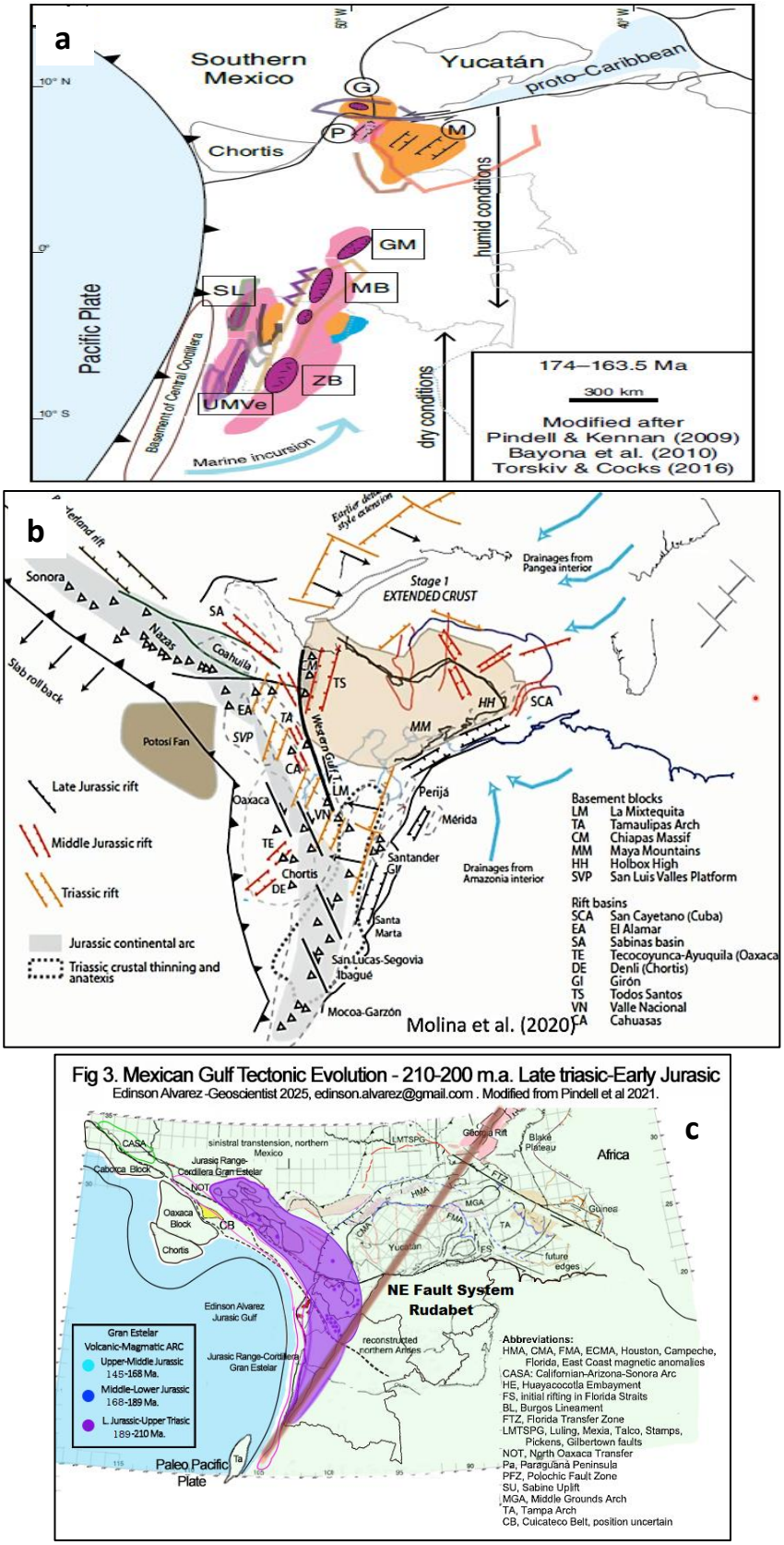


Figure 14. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a.** Modified from **Bayona et al 2019-20. b. Molina et al 2020, taken from Bayona 2021. c. Edinson Alvarez 2025-2026.**

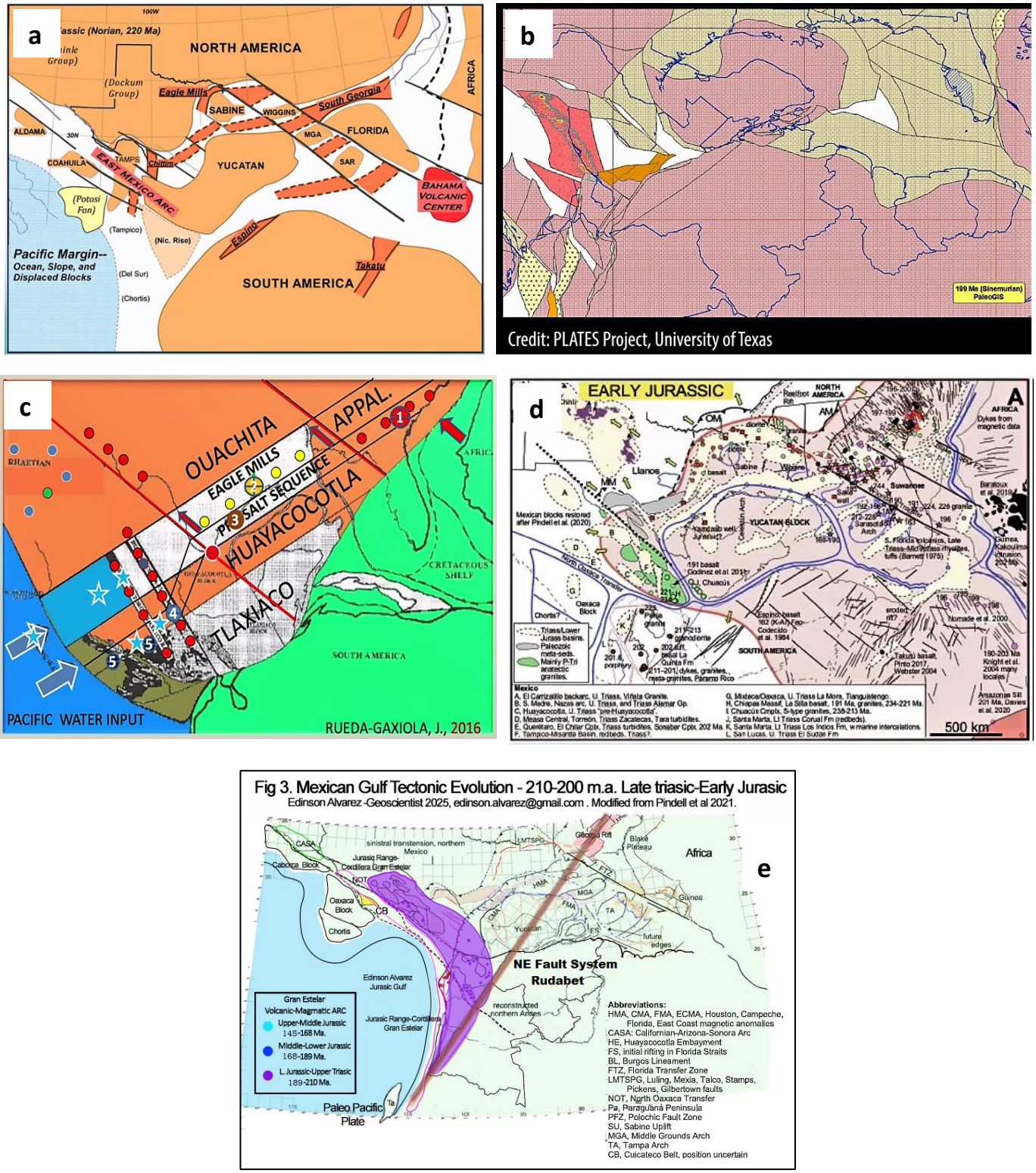


Figure 15. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Tom Ewing- 2016. b. Plates Project Texas University, taken from** Robert J. Stern and Randy Keller **2018. c. Rueda-Gaxiola J. 2016-2019 d. Pindell and Heyn 2022 e. Edinson Alvarez 2025-2026, Upper Triassic-Lower Jurassic.**

This methodology is also applicable to complex areas such as pre-salt belts, the Gulf of Mexico, Gulf of America, Brazilian coast, African coast, Mediterranean, the coasts of Alaska and Canada, the mountain ranges and foothills of the Rocky Mountains, Andes, Atlas Mountains, Himalayas, and the Arabian Peninsula, among others, as well as areas of low or minimal tectonic structural complexity. **It also helps increase production in complex reservoirs by confirming and refining the geological and geomechanical models of reservoirs that present this problem of double or even triple interpretations and models**.

Some of the tools of the SCT Complex Source Theory, such as the SCT EAST-P method, were proposed to Ecopetrol in April 2024, for a value comparable to the transactions of large technology companies. This value logically exceeded the company's economic and financial capacity; **therefore, we invite to @Pötus, Forbes List and giant Companies to participate in this development.**

If your company faces a highly complex geoscientific problem with significant economic implications, Complex Source Theory (CST) and its tools are here to solve it. For a more detailed analysis and solution to complex tectonic, structural, and stratigraphic problems, please consult with the author of this article.

Analysis of the technical support has deserved him recognition for his contributions to geoscientific knowledge of Colombia by important personalities and entities.. (Maya journal of geosciences September edition 2025, pag. 154, Art-1/10), https://revistamaya.com/wp-content/uploads/2025/08/Revista-Maya-Geociencias-Septiembre-2025.pdf,

Article-1(Páginas-150-154): Alvarez Serrato Edinson Dario, 2025. Predictive Corridor Model O&G prospects, Lower Magdalena Valley and SSJ 2025. P 150-154. https://revistamaya.com/wp-content/uploads/2025/08/Revista-Maya-Geociencias-Septiembre-2025.pdf

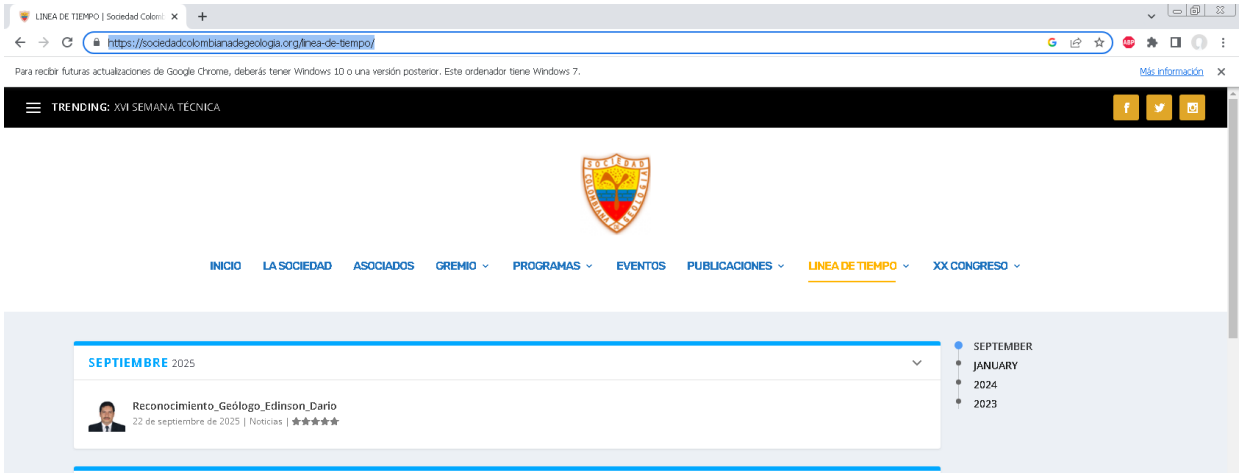
Article -2(Páginas-37-47): Alvarez Serrato Edinson Dario, 2025. Structural Seismic Interpretation of SSJ (2003-2025) Vs East-P Method Solution by Edinson Alvarez-2025. P-37-47. https://revistamaya.com/wp-content/uploads/2025/09/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXV-2025.pdf https://revistamaya.com/wp-content/uploads/2025/09/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXV-2025.pdf.

Article -3(páginas-76-98): Alvarez Serrato Edinson Dario, 2025. Regional Integration, complex seismic interpretation and Petroleum systems. of VIM- SSJ - SinuOFF, Guajira OFF. And Urabá.2025. P 79-98. : https://revistamaya.com/wpcontent/uploads/2025/10/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXVI-2025.pdf https://revistamaya.com/wp-content/uploads/2025/10/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXVI-2025.pdf

Article -4(páginas-169-180): Alvarez Serrato Edinson Dario, 2025. Solution to Uncertainty Volcanic Arc Of The Subduction Zone, Over The Central Cordillera, Colombian Andes. 2025. P 169-180. https://revistamaya.com/wp-content/uploads/2025/11/Revista-Maya-Geociencias-Diciembre-2025.pdf https://revistamaya.com/wp-content/uploads/2025/11/Revista-Maya-Geociencias-Diciembre-2025.pdf

Article -5(páginas-169-180): Alvarez Serrato Edinson Dario, 2025. The third part of the Gulf of Mexico that belongs to Colombia. A Marvelous, Magical, And Cinematic Journey Through The Jurassic Period, Told By Edinson Alvarez.2025. Cordillera Oriental de Colombia. Importantes Contribuciones En Geociencias Prometen Revolucionar La Exploración O&G&M. No 5/10.Revista Maya Diciembre 2025. 39 p. https://revistamaya.com/wp-content/uploads/2025/12/Revista-Maya-Geociencias-EDICION-ESPECIALXXVII-2025.pdf

The prestigious **Colombian Geological Society (SCG)** has joined in disseminating the recognition and results of the research work through publication on its website. https://sociedadcolombianadegeologia.org/reconocimiento_edinson_dario/



Note1: The Colombian Geological Society (SCG) and **the Colombian Association of Petroleum Geologists and Geophysicists (ACGGP)** are private organizations that fulfill a similar social function - public functions: To disseminate, publicize, and support everything related to knowledge of Geosciences and Earth Sciences.

We reject the institutional blockade and censorship applied to this research work by **Jaime Gonzalo Checa Jimenez, President of ACGGP, and Flover Rodriguez Portillo, Executive Director**, who have on three occasions denied the publication of both the recognition granted by prestigious entities for the research work in geosciences and the informative articles presenting the results of the work classified as being of national interest. **In addition to denying the recognition granted for contributions to the country's geosciences, they are arbitrarily attempting to impose a prior review of the informative articles, which is prohibited by law and international agreements and treaties, violating freedom of expression and freedom of information, fundamental and supreme values in a democracy. (Art 20** Constitución Nacional Colombia**, Art 13 CADH- Convención Americana Derechos Humanos)**

"Censorship is inherently discriminatory (...)" (Judgment T 539 of 1994). Based on the premise, the application of censorship discriminates against the affected person, by the same way Furthermore, through their actions, **Mr. Jaime Gonzalo Checa Jimenez, President of the ACGGP, and Mr. Flover Rodriguez Portillo, Executive Director**, would be discriminating against the President of the United States of America, who is one of the many individuals and audience members to whom this informational message is directed. In addition, they are concealing information of national interest from the Colombian people by obstructing the free flow of information and public debate regarding the results of this geoscience research. **(Art 20** Constitución Nacional Colombia **, Art 13 Convención Americana Derechos Humanos).**

ACKNOWLEDGMENTS:

Sincere thanks to **Drs. Claudio Bartolini, Josh Rosenfeld, and the entire team of editors, assistants, and members of the Maya Journal of Geosciences** for their support in publishing and disseminating the results of this research. And to all those who contributed to its development.

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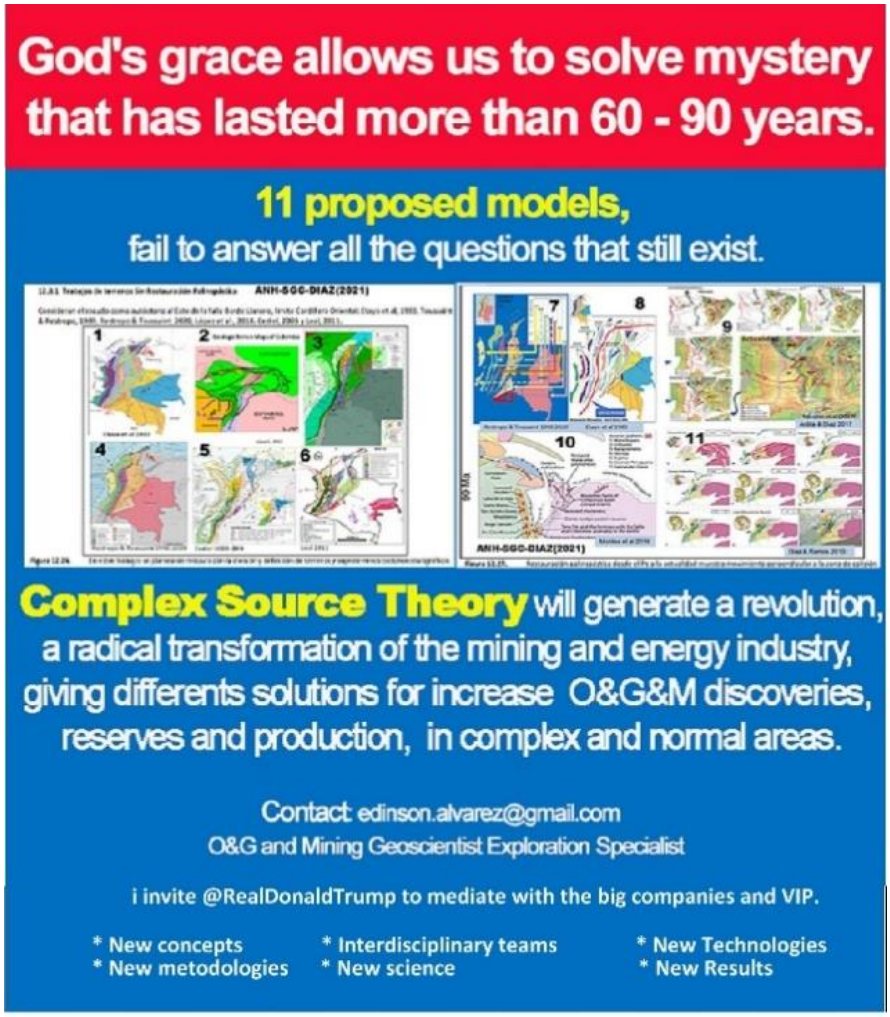

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The God´s grace guide us to develop the ¨Complex Source Theory¨, a new mechanism that allow us increasing traditional O&G&M discoveries, production, reserves, as new energies and CCUS.

Geological mapping, surveys design, acquisition, processor PSTM (Conv-3C-4C-TZ-OBC), geomodeller, seismic interpreter and reservoir characterization (Conventional-and-Unconventional Reservoirs). Stratigraphic sequence, seismic attributes, AVO analysis, fluids substitution, seismic inversion, risk and uncertainty, leads and prospects, reserves.

Discovery of New prospective corridors and O&G prospects, in Foothills, Llanos, Putumayo, VIM, VMM, VSM, COR, CR, CAT, GuajiraOff-Guajira, SSJFB, Sinú-Sinu Off, Cayos basin, Colombia basin.

IMPORTANT CONTRIBUTIONS IN GEOSCIENCES
PROMISE TO REVOLUTIONIZE O&G&M EXPLORATION. No 5/10.

THE THIRD PART OF THE GULF OF MEXICO THAT BELONGS TO COLOMBIA. A MARVELOUS, MAGICAL, AND CINEMATIC JOURNEY THROUGH THE JURASSIC PERIOD, TOLD BY EDINSON ALVAREZ.

EDINSON D. ALVAREZ S. 1,2
1 Exploration Geologist, O&G&M Specialist,
Researcher of tectonic and structurally complex areas.
2 Expert in geoscientific solutions through integrated O&G&M studies.
with strong positive economic implications.

Complex Source Theory (Edinson Alvarez 2025): A mechanism used by interdisciplinary groups of specialists in any field of science, where new concepts, new methodologies, new technology, and new knowledge are employed, obtaining new results, in order to resolve complex issues.. (Image Courtesy of Pixabay).

EAST-P Method-Tool (Processing and Seismic Treatment Edinson Alvarez 2025): It requires specialized personnel, computer equipment and advanced software.

Edinson Geochemical Hydrocarbon Family Classification Maps -Tool (Edinson Alvarez 2025): New classification of hydrocarbon families based on geochemical-isotopic-molecular signatures, migration pa□ern from source rock, their close relationship with geology, geochemical modeling of generation, expulsion, and hydrocarbon migration routes in a regional context.

Integrated O&G&M studies - Onshore-Offshore-Tool: It involves the participation of more than 20 geoscience disciplines, in order to find answers to complex industry problems, with strong positive economic implications.

Citation: Alvarez Serrato Edinson Dario, 2025 The Third Part Of The Gulf Of Mexico That Belongs To Colombia. A Marvelous, Magical, And Cinematic Journey Through The Jurassic Period, Told By Edinson Alvarez. Important Contributions In Geosciences Promise To Revolutionize O&G&M Exploration. No 5/10.Revista Maya December 2025. 39 p.
Citation Articles 1,2,3, at the end.

INTRODUCTION

This work aims to contribute to the geoscientific knowledge of an area of importance to the global oil, gas, and mining (O&G&M) industry: the Jurassic evolution of the Gulf of America, Gulf of Mexico, and the Colombian and Venezuelan territories (Northwestern Corner of South America-Gondwana). **This study seeks to demonstrate, with technical and scientific evidence, the relationship between plate tectonics, magmatic arcs, volcanic arcs, and the development of rift zones and subduction zones, combined to understand the origin, growth, and development of sedimentary basins of interest to the global mining and energy industry.**

In this first phase, the central theme is resolving the uncertainties or specific unanswered questions posed by the first Spanish explorers in 1525 when they founded the city of Santa Marta and in 1538 when they founded the city of Bogotá, Colombia, approximately 500 years ago. We will also address the questions posed by contemporary geoscientists and researchers worldwide over more than 100 years of the history and development of the petroleum industry in the Gulf of Mexico region. we will examine the implications of this issue for petroleum, mining, and social systems in a broad sense..

On the Colombian side, we would like to highlight the various companies, institutions, entities, and individuals that have contributed to the development of knowledge in these areas, such as the Colombian Geological Service **(SGC)**, the Colombian Petroleum Company **Ecopetrol**, the Institute of Petroleum and Transition Energy Research **(ICPET**), the National Hydrocarbons Agency **(ANH),** and state and private universities such as the University of Caldas, its Institute of Stratigraphic Research **(IIES**), the National University of Colombia **(UNAL**), the Industrial University of Santander **(UIS),** the Pedagogical and Technological University of Colombia **(UPTC)**, **EAFIT** University, the University of Pamplona, and the University of the Andes, among others…

Highlighting the tireless and important work carried out by the renowned and honorable Doctors**: James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020, A revised synthesis of the rift and drift history of the Gulf of Mexico and surrounding regions in the light of improved age dating of the Middle Jurassic salt. 49 p.** https://doi.org/10.1144/SP504-2020-43, Free to the public through their YouTube conference. **Cátedra Selecta.- James Pindell-2021.**

El Dr. James Pindell has dedicated his entire life to the study, understanding and geological evolution of the Gulf of Mexico with his Master's thesis **Permo-Triassic reconstruction of Western Pangea and the evolution. 1981 And Doctoral Thesis: Plate-tectonic evolution of the Gulf of Mexico and Caribbean region1985.** And significant and sufficient related work up to the date of 2025.

Highlighting the work of the doctors **Restrepo, J.J. & Toussaint, J.F. 2020. Tectonostratigraphic terranes in Colombia: An update. First part: Continental terranes. In: Gómez, J. & Mateus–Zabala, D. (editors), The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, p. 37–63. Bogotá. https://doi.org/10.32685/pub.esp.35.2019.03 ,** who have dedicated their entire lives to the study of Colombian Geology, and their work on tectonostratigraphic terrains, in different and renewed versions of 1973, 1988, 1993, 1998, 2020, among others.

We would like to clarify that the narrative style used by the author is solely intended to generate new readers, audience, and interest in scientific research related to Geosciences – Earth sciences. This is to avoid any misinterpretation of arrogance, as the narrative style is simply a strategy for attracting an audience. We have the utmost respect and admiration for those who have made valuable contributions to Geosciences. All glory and praise belong to God.

The narrative form is a tribute to one of the greatest figures in world literature, Miguel de Cervantes Saavedra (1547-1616), with his masterful work, Don Quixote of La Mancha (1605). **In this case, we will refer to "Giants" as concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unresolved questions, etc**. We invite you to see the positive side of history, which is the contributions to geosciences for our country, Colombia, and in this case, the impressive and spectacular Gulf of Mexico.

We will take a spectacular, fascinating, wonderful and cinematic geological journey through the Colombian-Mexican-American Jurassic world.

We also draw a parallel with sports, regarding the giants we are going to demolish in this edition. Records are meant to be broken or demolishing; similarly, if our proposal has weaknesses or flaws, it will most likely be surpassed or toppled by a new and/or better proposal in the future.

METODOLOGY

In order to overcome the structural, stratigraphic, sedimentological, volcanological, geological, geophysical, geochronological, geochemical, and seismological obstacles and difficulties posed by the tectonic-structural complexity of the area, the following activities are carried out:

- Compilation of information from petroleum exploration, geochemical, geophysical, geological, stratigraphic, tectonic-structural, petroleum systems, volcanological, geochronological, and other studies of the area of interest.

- As part of the Author's independent professional activity, several integrated studies have been carried out to address the issue of the structural tectonic complexity of the study area, and its implications for oil and gas exploration and production activity in Colombia and the Gulf of Mexico. **This case relates to tectonostratigraphic evolution, primarily during the Jurassic geological period (145 to 201.3 million years ago), also including the Late Triassic (201.3 to 237 million years ago) (201.3-210 million years ago).**

RESULTS

1. General Tectonic Framework and Terminology.

To understand the development of this chapter, we will refer to the following terms **(Figures 1 and 2):**

Triassic-Jurassic Gulf of Edinson Alvarez: A large body of marine water surrounded by the following geographical features, giving it its gulf-like configuration: the Aoxaca and Chortis terranes to the west-northwest, continental Mexico to the north and east, and continental Colombia to the east-southeast. (Upper Triassic-Lower Jurassic) **(Figures 1 y 3)**

Jurassic Bay of Edinson Alvarez: A narrow body of marine water surrounded by the following geographical features, giving it its bay configuration: the Aoxaca and Chortis terranes to the west-northwest, continental Mexico to the north and east, and continental Colombia to the east-southeast. (Lower Jurassic) **(Figures 4 y 5)**

Edinson's Jurassic Strait: Opening Zone, fracture-rupture zone, entry of the Pacific Ocean into the Gulf of Mexico and Paleobasin of the Eastern Cordillera of Colombia. (Lower-Middle Jurassic). **(Figures 2,6,7, 9,10 y 14)**

The Edinson's Jurassic Strait, It had several openings or narrow passages named below:

Edinson's Jurassic Strait (North); Main rupture or strait created in the Jurassic 170-169 ma. Between the Mexican Chiapas Massif and the Colombian Upper Guajira (Serrania de Macuira-Cosinas).

JhonEdi's Jurassic Strait (Middle): Break or Strait Created between the Upper Guajira of Colombia (Serrania de Cosinas-Macuira) and the Sierra Nevada de Santa Marta.(Honor Jhon Edinson Alvarez M.–Son)

Floris's Jurassic Strait (South): Break or Strait Created on the Western Side of the Sierra Nevada de Santa Marta, controlled by the Bucaramanga Fault. **(Figure 14)** (Honor Florinda Serrato-Mother)

Independent Milenar's Jurassic Strait: Break or Strait Created to the southwest of the Cundinamarca Basin (Southwestern part of the paleobasin of the Eastern Cordillera) controlled by the Ibagué Fault. **(Figure 14).** (Honor Ana Milena Alvarez Serrato-Sister).

Jurassic Mountain Range Gran Estelar: The Great Triassic-Jurassic Cordillera, formed by the union of the Paleo Sierra Madre Oriental of Mexico and the Paleo Cordillera Central of Colombia, is composed of Precambrian-Paleozoic metamorphic crystalline basement, granitoid intrusions, and fluvial and volcanosedimentary deposits, as well as volcanic arc sedimentary complexes. Paleogeographically, it functions as back retaining wall of the slope escarpment of the Gulf of Mexico, relative to the waters of the Pacific Ocean. (Honor beloved wife Estela Moreno Z.) **(Figures 1, 3, 4 y 5).**

Large Fault System, Rift, Rudabet Lineament (Honor Ruben Dario Alvarez Betancourt-Father, Figures 1 y 3); Composed of the Great System of faults, rift and lineament of the Guaicáramo- foothills Faults (Colombia), Boconó- foothills Faults(Venezuela), NE Yucatán lineament, Georgia Rift and Appalachian foothills Lineament.

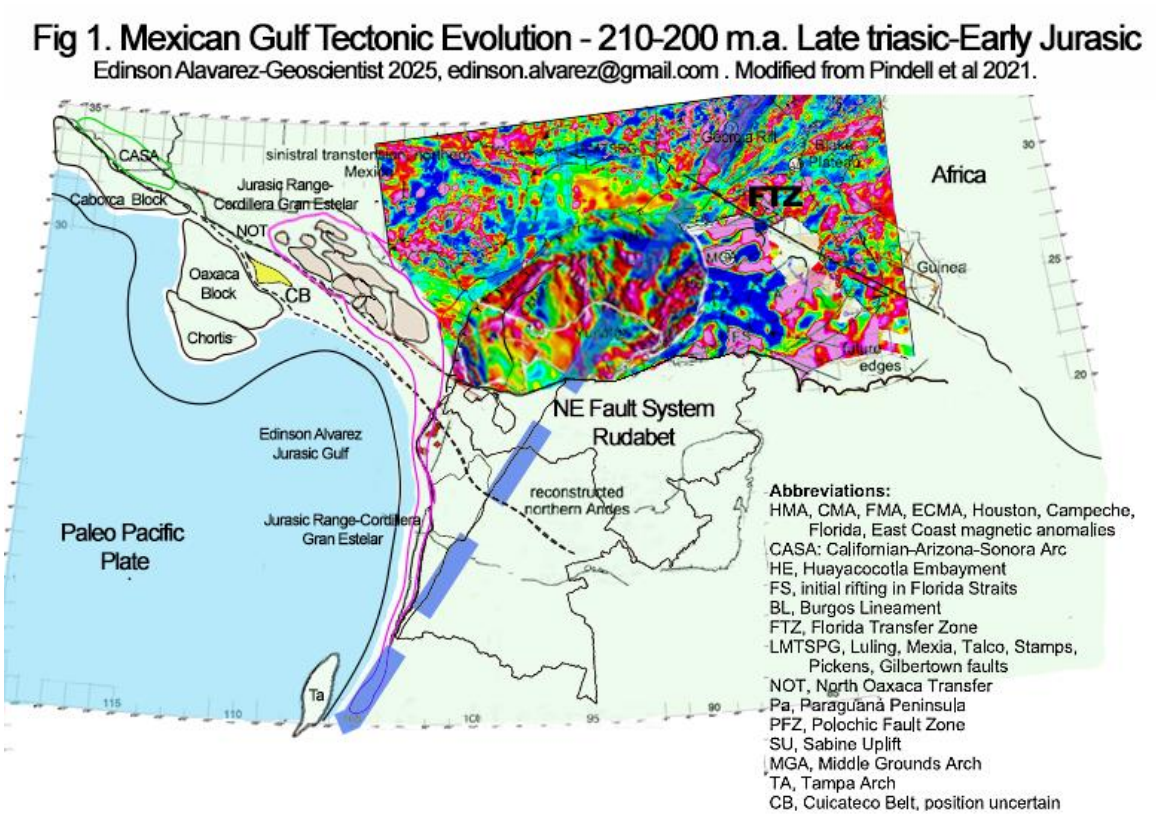


Figure 1. Main Geological, Morphological and Tectonic-Structural Features for Laurentia-Gondwana during the Late Triassic-Early Jurassic Period. 200-210 Ma.

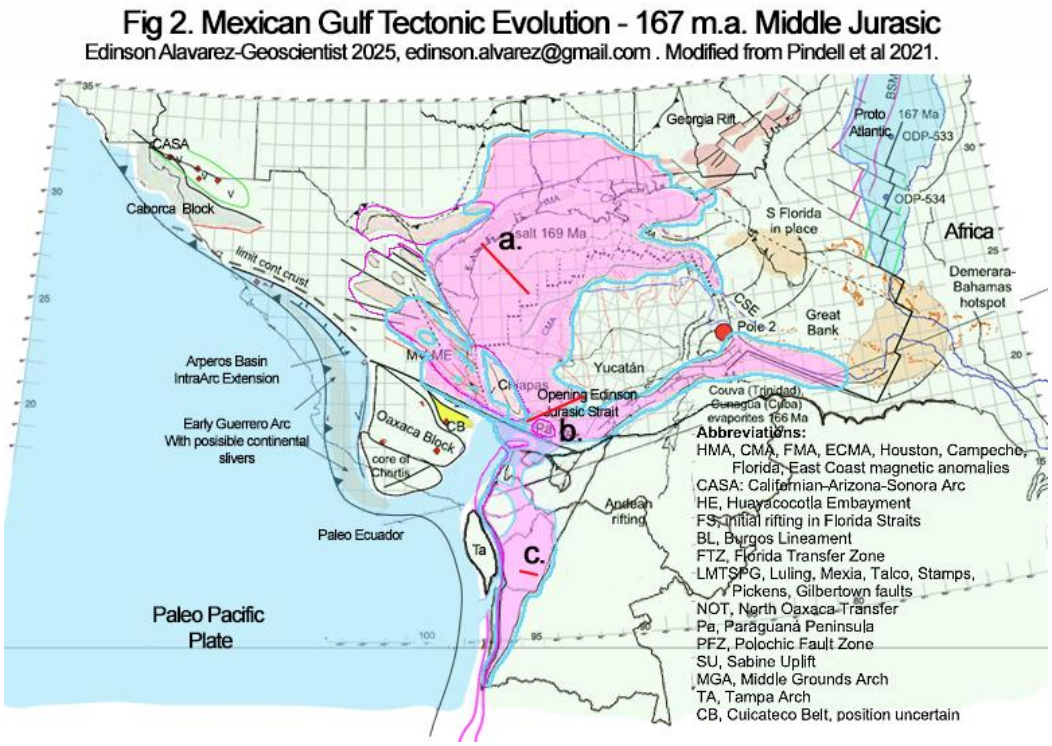


Figura 2. Location of the Seismic-Stratigraphic profiles in **a.** Gulf of America, **b**. Gulf of Mexico, **c.** Cundinamarca Basin-Colombia, Pink color corresponds to Salt Deposits for the period 170 to 166 m.a. approximately, (**Figure 16**)

2. Analysis

Using the advanced tools of Complex Source Theory (CST), it became very easy to find an answer to the question posed by the renowned geoscientists honored in this article, and which for decades has kept the community of geologists, stratigraphers, volcanologists, seismologists, geophysicists, geoscientists, and the global mining and energy sector in general up at night.

All the answers come from the paleogeographic reconstruction of the Gulf of Mexico based on the work of renowned geoscientists: **James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020, A revised synthesis of the rift and drift history of the Gulf of Mexico and surrounding regions in the light of improved age dating of the Middle Jurassic salt. 49 p.** https://doi.org/10.1144/SP504-2020-43, Free to the public through their YouTube conference **Cátedra Selecta.- James Pindell-2021.**

and from the work of the **Doctors Restrepo, J.J. & Toussaint, J.F. 2020. Tectonostratigraphic terranes in Colombia: An update. First part: Continental terranes. In: Gómez, J. & Mateus–Zabala, D. (editors), The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, p. 37–63. Bogotá.** **https://doi.org/10.32685/pub.esp.35.2019.03.**

Logically complemented by information from studies conducted by important and recognized geoscientists described in the Bibliography, all integrated with the advanced tools of the **SCT Complex Source Theory (Edinson Alvarez 2025).** Results of the tectonic evolution of the Gulf of Mexico, which can be observed in **Figures 3,4,5,6,7,8** for the Late Triassic period (201.3 to 210 million years ago) – Jurassic. 145 to 201.3 million years ago.

In the following tectonic-paleogeographic reconstruction, Colombia's Tertiary deformation is restored **(Similar a Pindell 1985, V. Ramos 2021).** And the stretching of the Eastern Cordillera is consistent with the location of the western margin of the superimposed volcanic arc. The configuration of the Chibcha Block of **Restrepo, J.J. & Toussaint, J.F. 2020.** Was used**.** All other parameters of the paleogeographic reconstruction were maintained, **Pindell et al 2020-2021.** The Late Triassic period was regenerated and/or configured based on **Pindell 1985-1992-1994-Pindell et al 2020-2021.**

The Salt Polygon for Colombia was developed based on the work of **Ingeominas 1970-1985 y el Dr. Oswaldo Ordoñez C. 2020.** Applying an equivalent stretch towards the middle Magdalena Valley. Presal sediments are not shown in this reconstruction, nor is the Tahami (Ta)-Colombia block discussed (Part of a forthcoming edition).

Based on the analysis of the Paleogeographic Reconstruction Tectonic Evolution of the Gulf of Mexico, we begin to answer the different questions raised in the following section of Giants to Be Knocked Down.

Additionally, one of the objectives of this work is to demonstrate the spatio-temporal relationship of the sedimentary deposits of the Jurassic Period of the Gulf of Mexico, with the sedimentary deposits of the same Jurassic period for the Colombian Basins, especially the Jurassic paleobasin of the Eastern Cordillera of Colombia.

Figures 3,4,5,6,7,8, tectonic evolution of the Gulf of Mexico during the Late Triassic period (201.3 a 210 m.a.) –**Jurássic**. 145 a 201.3 million years ago,

Fig 3. Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

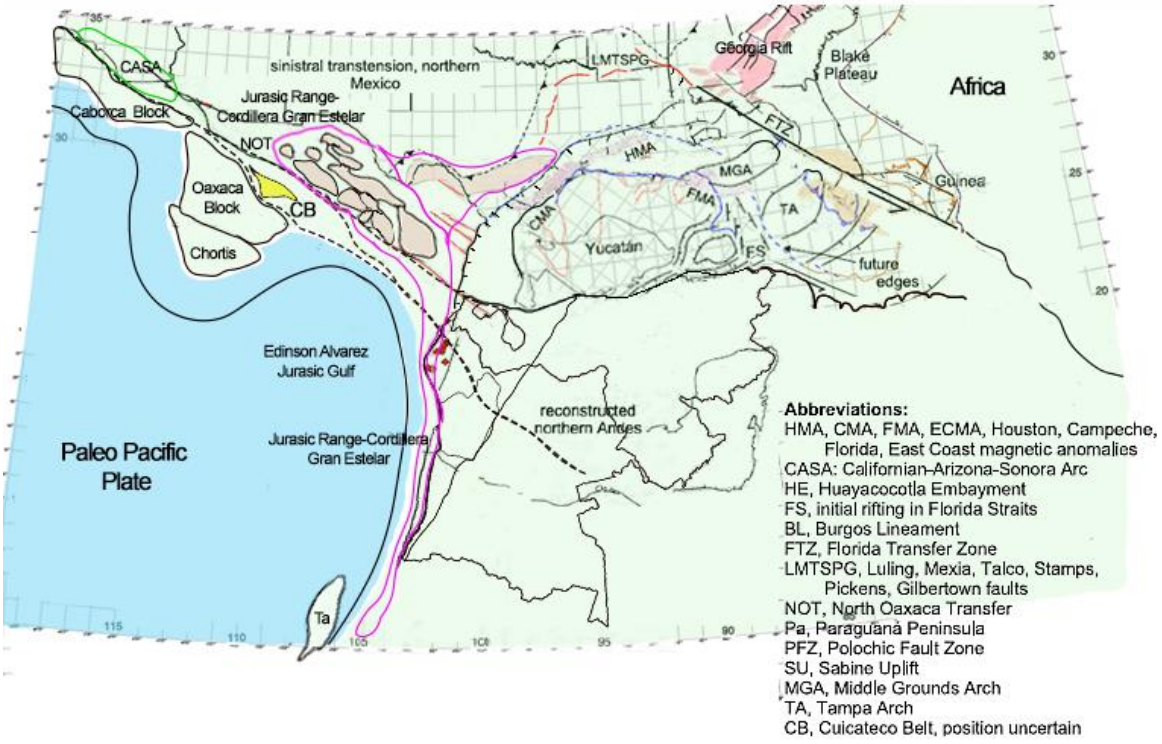


Fig 4. Mexican Gulf Tectonic Evolution - 195 m.a. Early Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

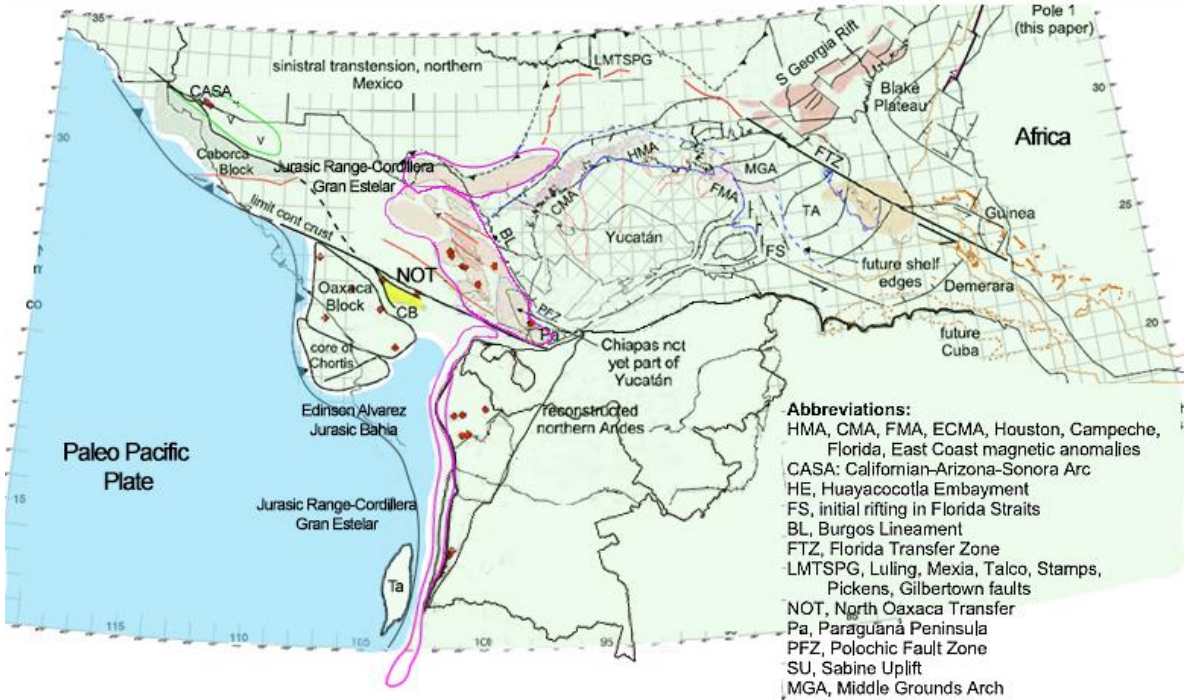


Fig 5. Mexican Gulf Tectonic Evolution - 177 m.a. Early Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

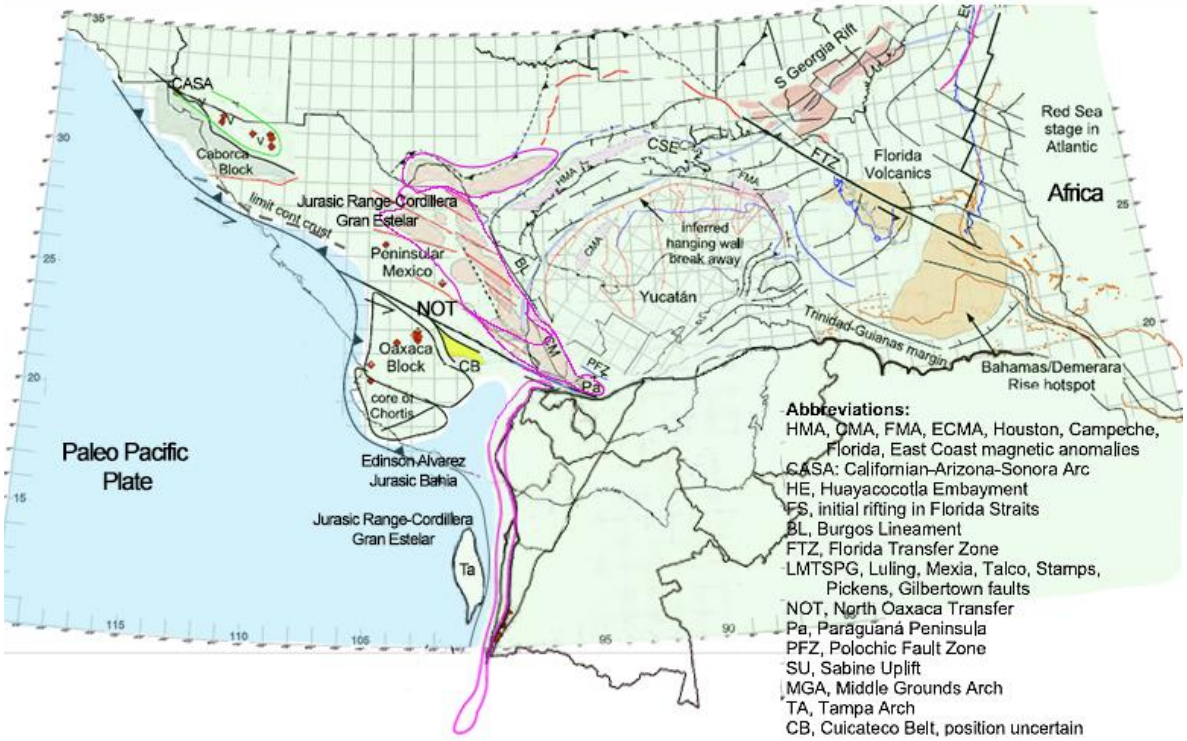


Fig 6. Mexican Gulf Tectonic Evolution - 167 m.a. Middle Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

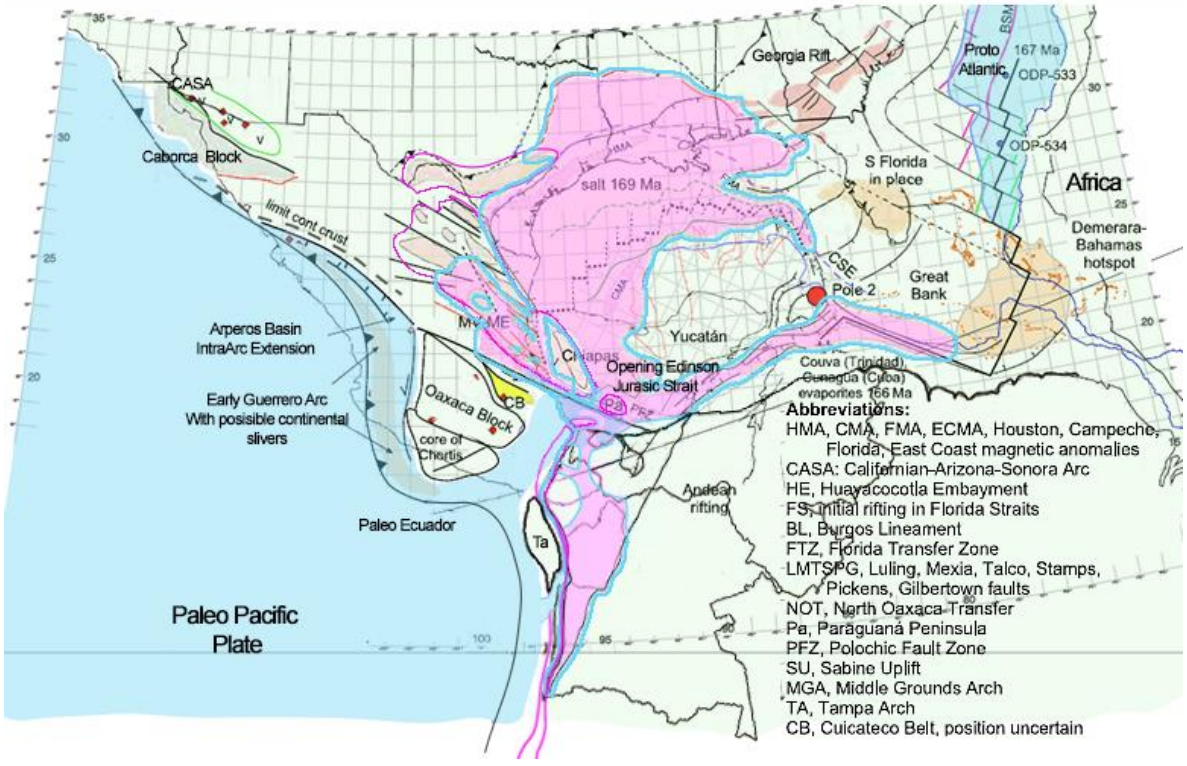
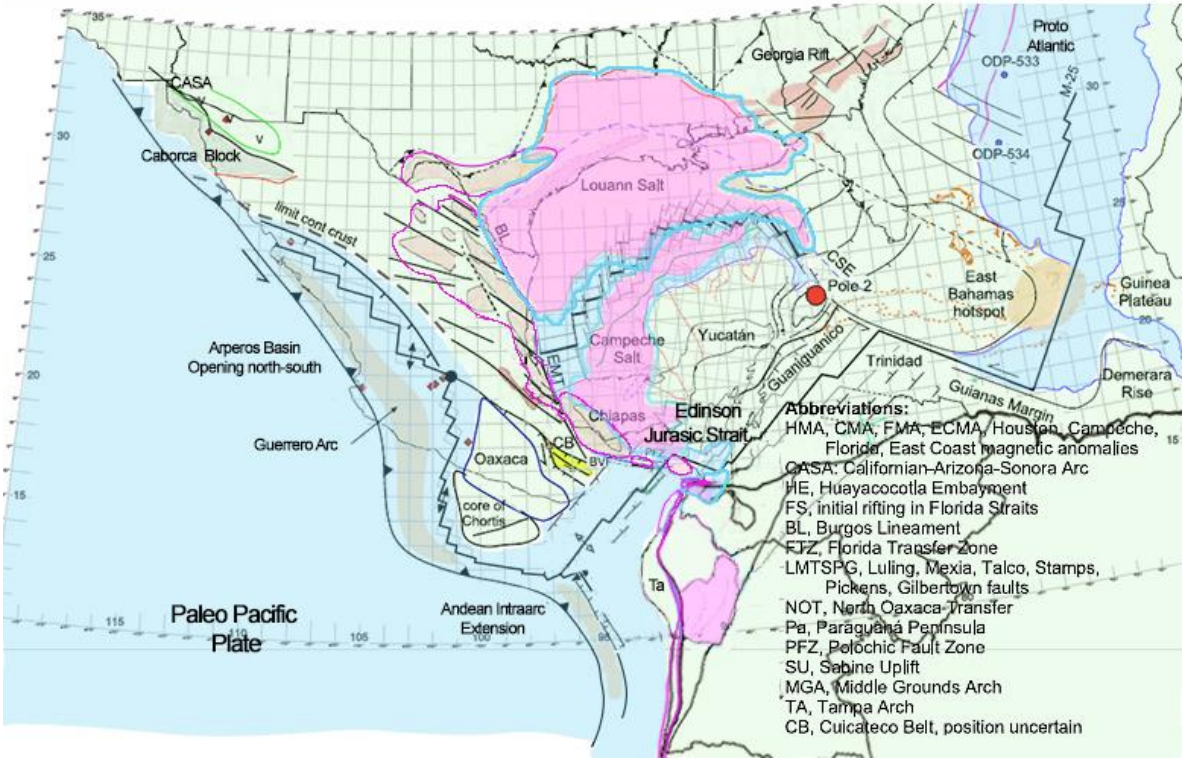


Fig 7. Mexican Gulf Tectonic Evolution - 159 m.a. Late Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

Fig 8. Mexican Gulf Tectonic Evolution - 154 m.a. Late Jurasic

Edinson Alavarez-Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.



3. Giants

The following are the Giants that we will demolish in this chapter. **We will refer to Giants as (Concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unresolved questions, etc.).**

3.1 Giant No.1 (Giant No. 8 Knocked Down this series), **With more than 500 years of history, we will resolve it in the Conclusions of this work.**

This corresponds to the questions by the Spaniards who arrived in Colombia in 1525 with the founding of Santa Marta, and later their entry into the interior of the territory, founding the city of Bogotá in 1538.

3.2 Giant No.2 (Giant No. 9 Knocked Down in this Series) :

Alarcón CM et al 2020. (Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020).

de arcos magmáticos marginales (**Rodríguez, *et al.***, 2018). Uno de los retos actuales es la reconstrucción de la historia geológica del Jurásico en los Andes del norte, no solo desde el punto de vista geoquímico y geocronológico de las rocas plutónicas y volcánicas, sino porque deben entenderse de forma integral las relaciones del magmatismo con la formación de cuencas y la acumulación de sucesiones sedimentarias. Como lo sugieren **Bayona,**

3.3 Giant No.3 (Giant No. 10 Knocked Down in this Series):

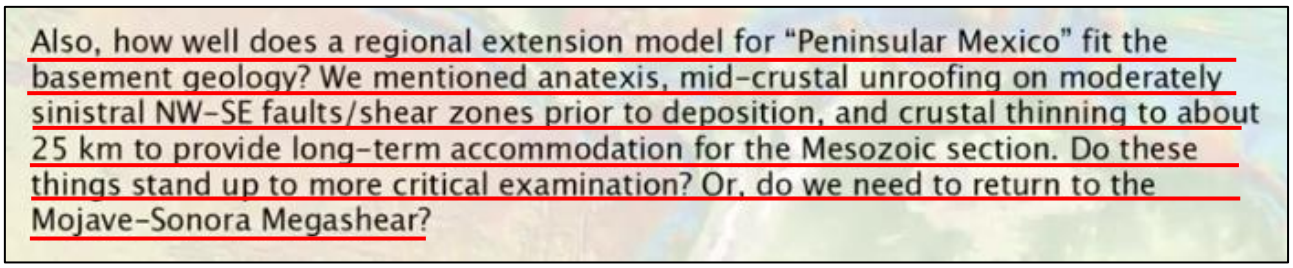
Mildred Del Carmen Zepeda Martinez - Tesis Doctoral UNAM. 2021

evolución tectónica de México durante el Jurásico siguen siendo ampliamente debatidos. La dificultad en reconstruir con detalle la evolución tectónica del *rift* en México se debe principalmente a que resulta muy complicado identificar las fallas maestras que acomodaron la extensión continental durante el Jurásico. En efecto, los eventos tectónicos que caracterizan la historia geológica Cretácica

propuesta. Por consiguiente, el problema de traslape cortical sigue sin tener aparentemente una solución satisfactoria y aceptada de manera conjunta por la comunidad científica. A continuación, se

3.4 Giant No.4 (Giant No. 11 Knocked Down in this Series):

Youtube Conference **Cátedra Selecta.- James Pindell-2021** (James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020).



3.5 Giant No.5 (Giant No. 12 Knocked Down in this Series):

Filina et al 2022. (Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022.)

> 1) The nature of the Triassic redbed basin preceding GoM opening - whether these units represent a successor basin to the Ouachita-Marathon orogeny or precursor rifting to GoM formation. The issue is tied to the challenge of identifying firm evidence of pre-breakup rifting, which is currently sparse compared to other rifted margins;

3.6 Giant No.6 (Giant No. 13 Knocked Down in this Series):

Filina et al 2022.

> 2) The timing of salt deposition with respect to the Middle Jurassic seafloor spreading – specifically whether the salt predated, was synchronous with, or just postdated the initial spreading;

> subdivision. Where salt exists (Fig. 2a), seismic imaging of underlying (i.e., syn-opening) sequences is difficult. Whether salt was deposited during the last stages of continental rifting, over oceanic crust, and/or concurrent with the first stages of seafloor spreading, remains unclear.

3.7 Giant No.7 (Giant No. 14 Knocked Down in this Series):

Filina et al 2022.

> 3) Whether GoM opening was facilitated by magma-rich breakup associated with SDRs, or it was mantle-poor and resulted in exhumed mantle close to the ocean-continent boundary;

3.8 Giant No.8 (Giant No. 15 Knocked Down in this Series):

Filina et al 2022. (Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022.)

> 4) The related issue of continental restoration of pre-GoM crustal blocks. The newly mapped geological structures within and adjacent to the OCT, such as interpreted SDR complexes with adjacent presalt sedimentary basins and outer troughs, in addition to magnetic anomalies may further constrain tectonic reconstruction of the basin.

3.9 Giant No.9 (Giant No. 16 Knocked Down in this Series):

Pindell et al 2020-2021.

Two unresolved issues stand out as most significant. One is the tectonic process by which the highs and lows in the top-rift unconformity were created along the west Florida margin, which records ther-

3.10 Giant No.10 (Giant No. 17 Knocked Down in this Series):

Pindell et al 2020-2021.(James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020).

Florida Peninsular Arch and hence may terminate against a poorly understood 'Florida Transfer Zone' (Erlich and Pindell 2020). The second issue

3.11 Giant No.11 (Giant No. 18 Knocked Down in this Series):

In Colombia, the oil sector and the geoscientific world have traditionally assumed that the salt corresponds to Lower Cretaceous deposition.

Juan Camilo Ruiz Amaya. 2021

➢Se propone un desacople entre la secuencia basal interpretada como Paleozoica y los pliegues observados en superficie, debido a la formación salina del Cretácico Inferior.

3.12 Giant No.12 (Giant No. 19 Knocked Down in this Series):

Juan Camilo Ruiz Amaya. 2021

Un problema por resolver…

Hasta la fecha, entre la Sabana de Bogotá y el Páramo de Sumapaz no hay un modelo tectónico actualizado que tenga en cuenta las principales características del estilo estructural y proporcione argumentos para definir el rol de la sal y la cronología del plegamiento.

Answers can be found in the Final Conclusions of this study.

4. Spatiotemporal Relationship of Sedimentary Deposits During the Jurassic Period of the Gulf of Mexico with Respect to the Jurassic Sedimentary Deposits of the Colombian Basins.

4.1 Paleogeographic Correlation

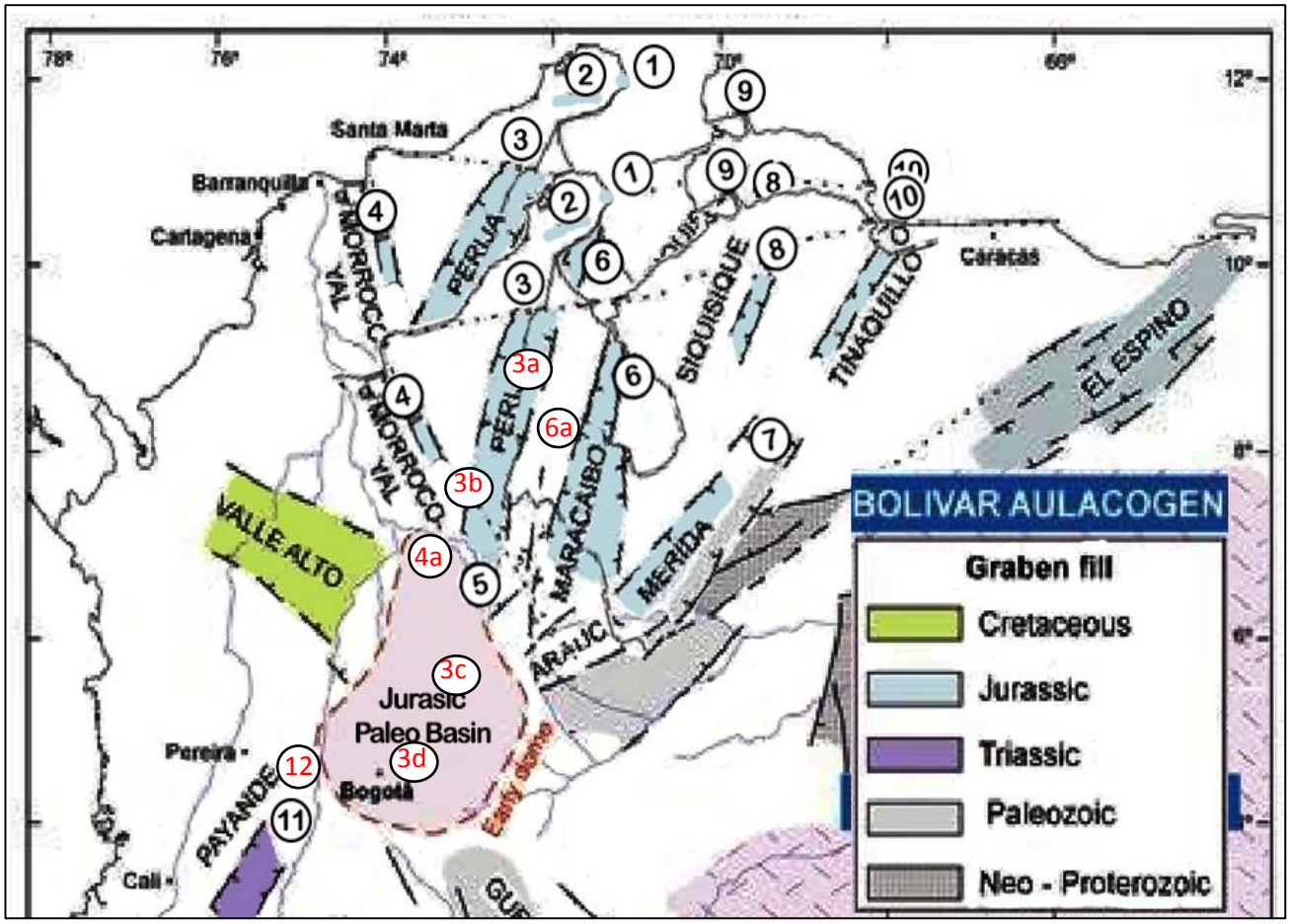


Figure 9. Approximate paleogeographic map of Colombia showing the main structures by geological age. Numbers 1 to 4 (including sub-items) correspond to Jurassic marine sedimentation. Stations 3C, 4, and 5 show erosion in the stratigraphic column during the Lower and Middle Jurassic periods. See supplementary **figures 10, 11, 12, 13, 14, 15, and 16.**

Figures 9 y 11. Modified from Fabio Cediel, Robert Peter Shaw 2019. (Compiled after Bartok et al. (1985), Sung Hi Choi et al. (2017), Geyer (1973), Cediel (1969), Maze (1984), Mendi et al. (2013), Schubert (1986), Leal-Mejía et al. (2018), Edinson Alvarez (2025))

4.2 Chronostratigraphic-Sedimentological Correlation

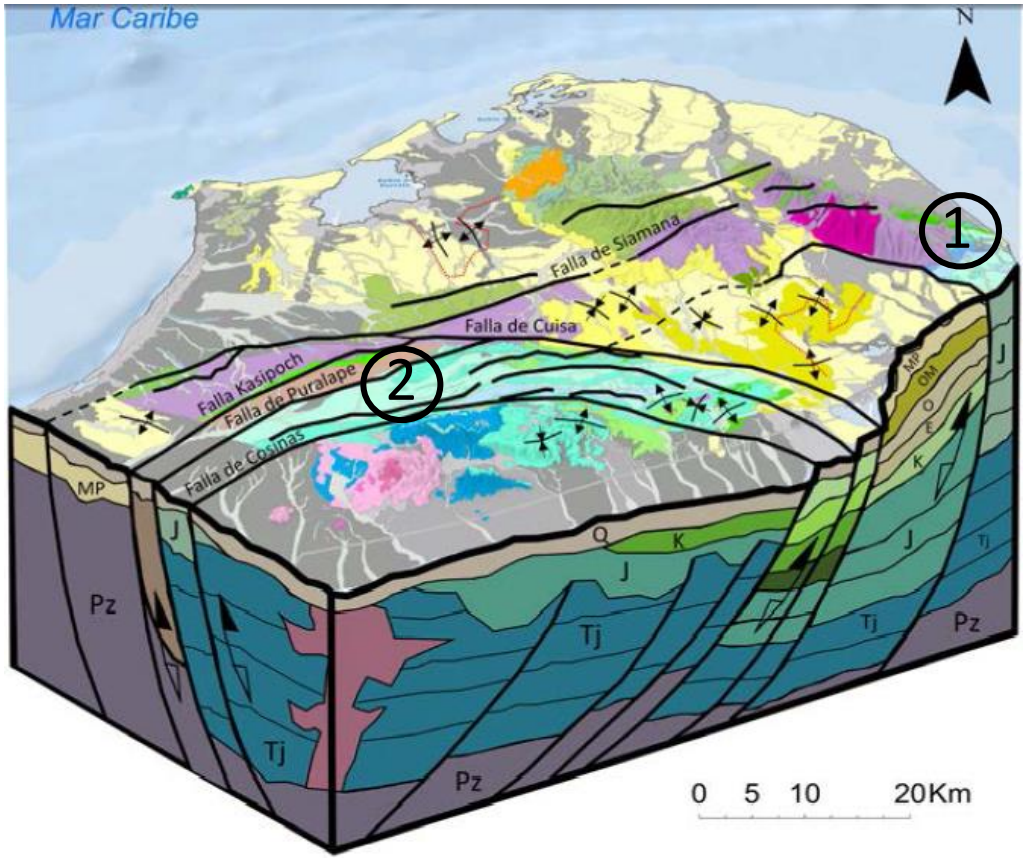


Figure 10. 3D geological map of the Guajira Peninsula, Colombia, showing Jurassic marine sedimentation. ANH-UPTC 2024. And the direction of deformation-erosion of the Jurassic deposits. 1. Serranía Macuira 2. Serranía Cosinas.

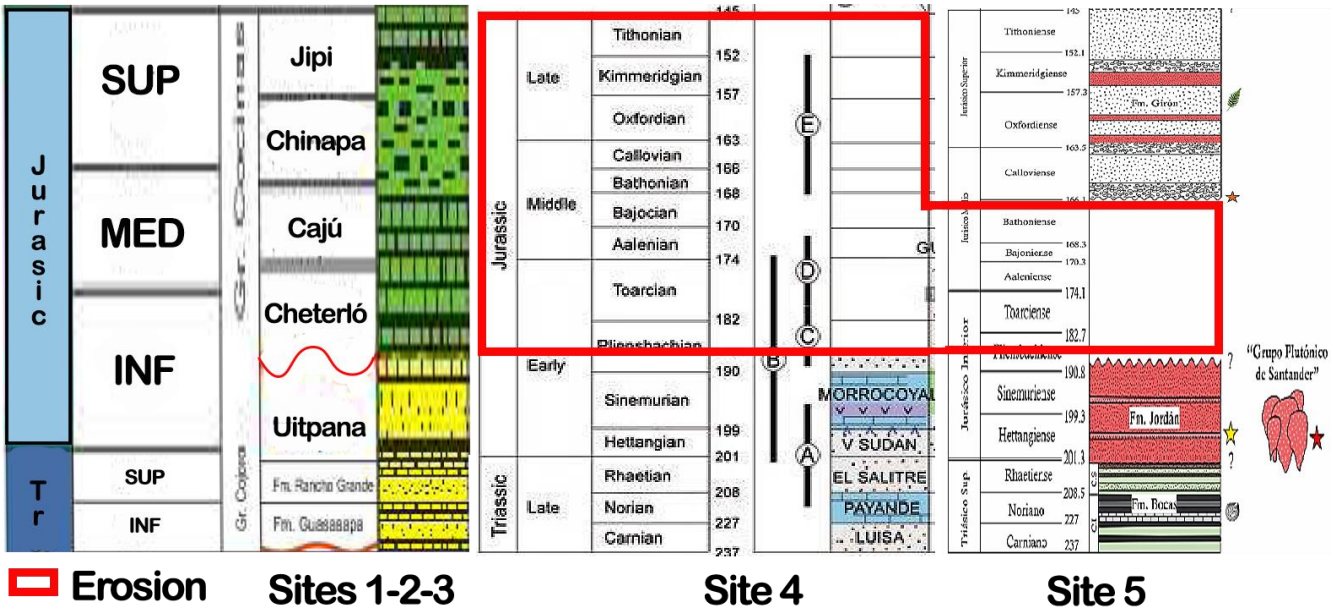


Figure 11. Stratigraphic Columns of the Triassic-Jurassic, stations 1-2-3-4-5 Sector of the Santander Massif, Sierra Nevada de Santa Marta-Guajira and Perijá, Colombia. Modified from ANH-UIS-2008, Fabio Cediel, Robert Peter Shaw 2019, Alarcon CM et al 2020. Location **figures 9 and 10.**

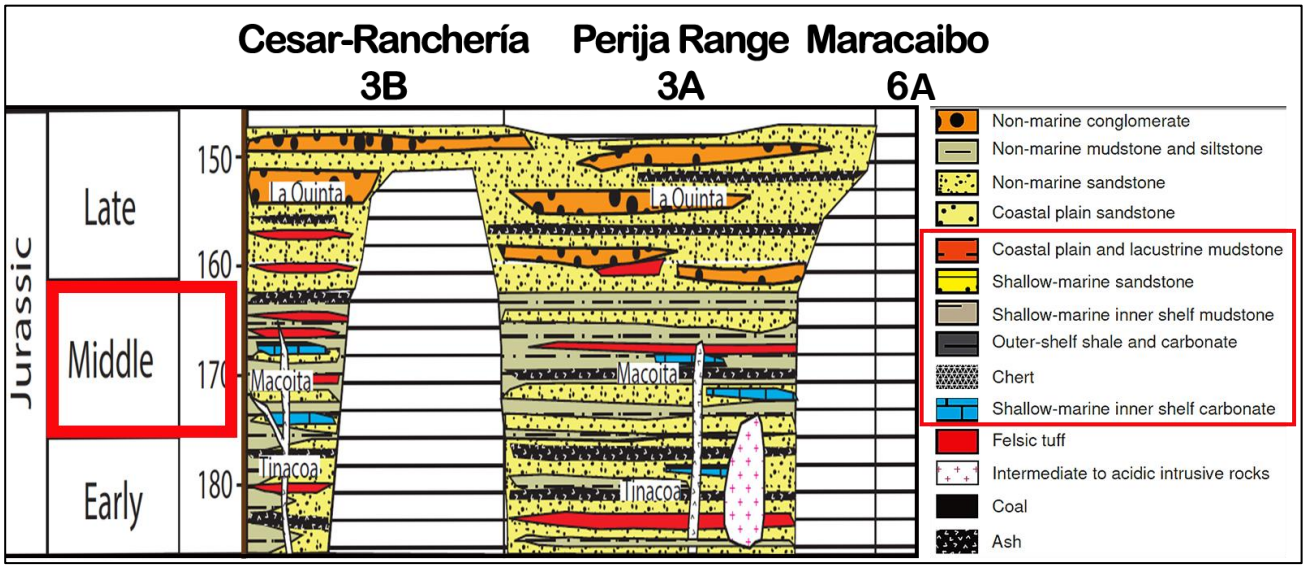


Figura 12. Jurassic Stratigraphic Columns, Exclusive Marine Deposition in the Middle Jurassic, Salt Deposition Time. Stations 3A-3B-6A, Location **Figure 9**. Serranía de Perijá Sector, Cesar Ranchería and Maracaibo Basin. Modified from Sanchez, Javier and Paul Mann, 2015. Stratigraphic data were compiled fromMiller (1962), Forero (1970), Caceres et al. (1980), Kellogg (1984), Maze (1984), Parnaud et al. (1995), Mann et al. (2006), Vence (2008), and Ayala (2009).

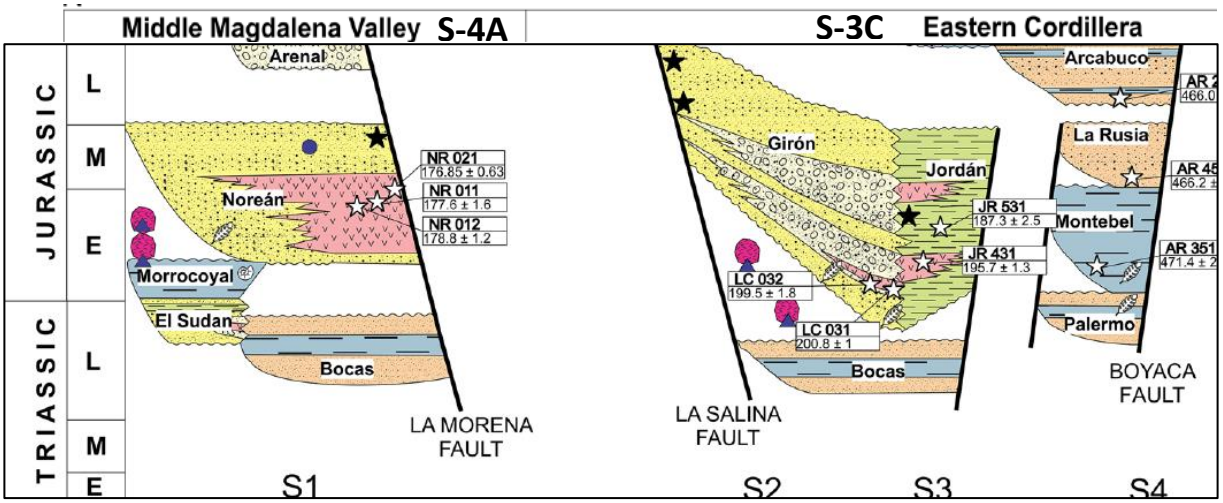


Figura 13. Stratigraphic Columns of the Triassic-Jurassic, stations 4A and 3C **figure 9**. Modified from Martin Reyes et al 2024 (Data compiled from Renzoni (1962), (1967), Cediel (1968), Cooper et al. (1995), Clavijo (1996), Mojica et al. (1996), Sarmiento (2001), Sarmiento-Rojas et al. (2006), Kammer and Sanchez (2006), Mora et al. (2006, 2009, 2013), Clavijo et al. (2008), Caballero et al. (2013), Horton et al. (2010, 2015), Moreno et al. (2013), Bayona et al.(2020), Rodriguez-Garcia et al. (2020). Central Axial Zone paleobasin Eastern Cordillera of Colombia (Boyaca Fault-Soapaga Fault).

When performing the tectonic restoration of Colombia for the Jurassic period, stations 1,2,3,4,5 **(Figure 9)**, Sierra Nevada de Santa Marta, Baja-Alta Guajira, Cesar Rnachería and Serrania de Perijá, descend to the height of the Gulf of Maracaibo, putting all these structures in direct contact **(Perijá Graben, Cesar Ranchería, Bucarmanga Fault, closer to the paleobasin Eastern Cordillera of Colombia),** which are proposed as corridors through which the Jurassic sea of the Pacific Ocean entered to fill the Paleobasin of the Eastern Cordillera **(Figure 9).**

From the analysis of the previous stratigraphic columns **(Figures 9, 10, 11, 12, 13),** the following conclusions can be drawn: **There were two Jurassic corridors of influx waters from the Pacific Ocean** that flowed respectively into the paleobasin of the Eastern Cordillera in Colombian territory:

1. **Marine Lower Jurassic Corridor**: Corresponding to marine deposits in locations adjacent to the western Sierra Nevada de Santa Marta, the Middle Magdalena Valley (Morrocoyal Formation), and the axial portion of the Eastern Cordillera paleobasin (Montebel Formation), locations **4-4a-3c (Figures 9, 11, and 13).** These deposits are capped by a late Middle Jurassic unconformity that erased or eroded the Middle Jurassic stratigraphic column. These events are related to block uplift associated with the Bucaramanga Fault, the Boyacá Fault, and the Soapaga Fault, factors that controlled Jurassic deposition in their area of influence.

2. **Marine Middle Jurassic Corridor:** This corresponds to the marine deposits of the Macoita Formation, Cheterló-Cajú-Chinapa, of the Middle Jurassic, located in the Upper Guajira, Lower Guajira, Serranía de Perijá, Cesar Ranchería corridor, extending to the Bucaramanga fault and the periphery of the paleobasin of the Eastern Cordillera of Colombia. Locations **1, 2, 3, 3a, 3b Figures 9, 10, 11, 12.**

3. **Figures 9, 10, 11, 12, and 13** clearly show structural control of Jurassic deposition through the arrangement of sediments on adjacent horsts and grabens in an approximately northeast-southwest direction. Within the structural highs, no deposition and/or erosion is observed, while the missing depositional sequence appears in the adjacent grabens **(Figure 12).** Note also that in **Figure 13,** a large area appears uplifted and/or eroded, leaving the presence of Lower and Middle Jurassic deposition uncertain.

4. The previous uncertainty is resolved by the deposition of the sequence at the **3d location shown in Figures 9, 14, and 16.** The existence of the stratigraphic sequence **(Figure 16C)** indicates that Jurassic corridors 1 and 2 were active during the Jurassic period, feeding the paleobasin of the Eastern Cordillera of Colombia, consistent with the structural orientation of the rift (horst and graben northeast-southwest direction) and the positive slope direction (greater depth and subsidence towards the Bogotá-Cundinamarca Basin area). **Figures 9 and 14.**

5. There is a possibility of a third corridor for Colombia, called the **Independent Milenar Jurassic Strait**: a rupture or strait created southwest of the Cundinamarca Basin (southwestern part of the Eastern Cordillera paleobasin) controlled by the Ibagué Fault **(Figure 14).** This corridor fed the Eastern Cordillera Jurassic paleobasin through the Ibagué Fault corridor, as shown in **Figures 9 and 14**. It most likely crossed the volcanic arc, creating the channel for water to enter the basin. However, there is no sedimentary record as such in this area, most likely due to the uplift of the Central Cordillera and subsequent erosion of the sequence. (Discussion of the Cajamarca Complex, next edition).

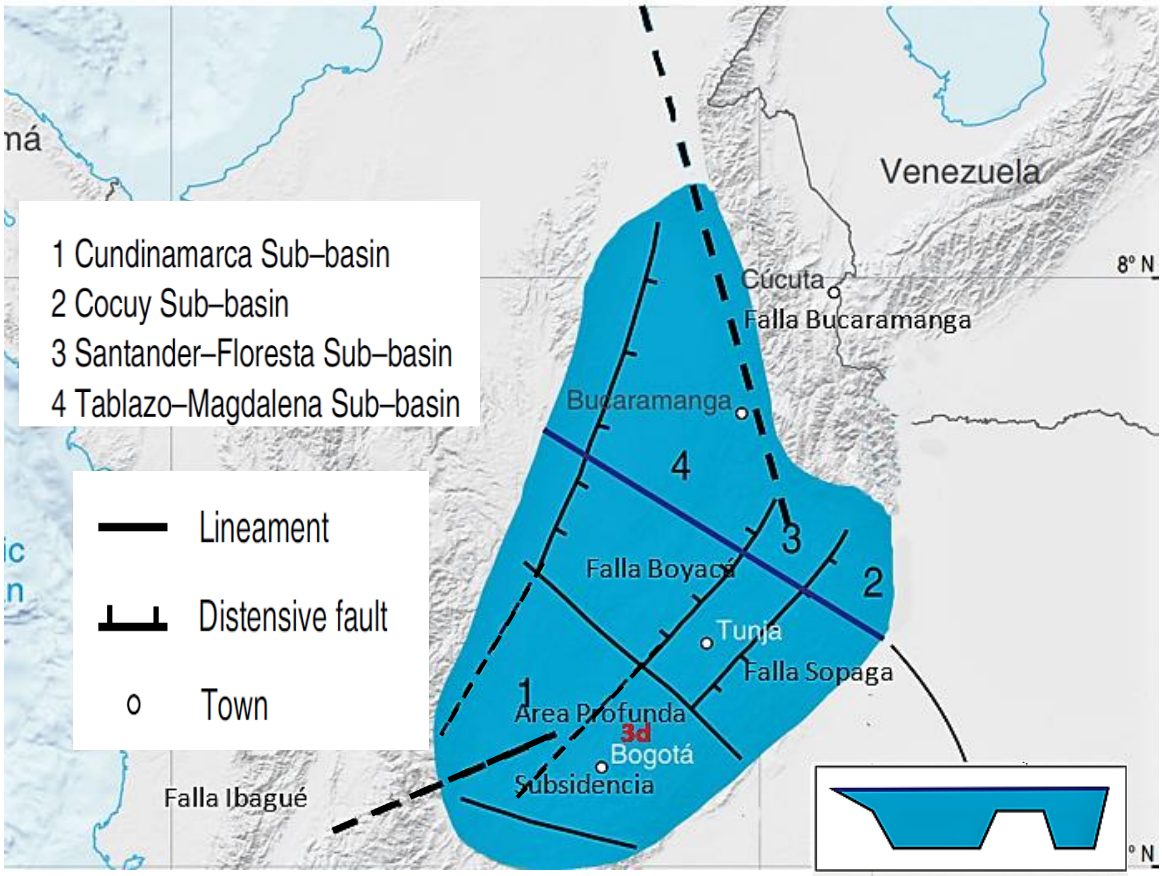


Figure 14. Approximation of Structural Elements of the Paleobasin of the Eastern Cordillera of Colombia. Modified from Patarroyo, P. 2020, (Without reconstruction). The blue area represents a very general outline of the paleobasin. 3d approximate location intersecting the seismic line of the **Figure 2 y 16c.**

4.3 Paleontological Correlation

The known Jurassic sedimentary deposits in Colombia are primarily continental-fluvial-volcanic, poorly dated, and belong to the Girón Formation. However, the study presented by **Alarcón Gómez, C. M., et al. (Estratos-UIS-2019)** identified a new fossiliferous horizon containing the fern species *Phlebopteris polypodioides*, identified by Pons (1982). This discovery allowed researchers to assume a Late Jurassic age for the section found in the Lebrija River. The study also indicated a wide geographic distribution of this species along the equator, with similar deposits also found in countries such as Mexico, Cuba, Honduras, and Egypt during the same period **(Figure 15).**

Although the preceding paleontological analysis corresponds to the Late Jurassic, it clearly indicates the proximity and similarity of paleoclimatic conditions between northwestern South America and southern North America (Mexico-Honduras). Providing evidence of proximity within the entire work of reconstruction and tectonic evolution of the Gulf of Mexico, a central part of this article.

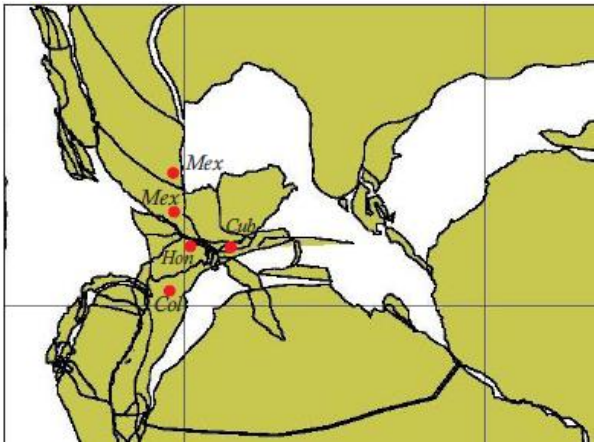


Figure 15. Geographic distribution of the Phlebopteris polypodioides fern. Modified from **Alarcón Gómez, C. M, et al. Estratos-UIS- 2019.**

4.3 Morphological, Sedimentary, Chronological and Structural correlation

To complete our spectacular, wonderful and cinematic journey through the Colombian Jurassic period, we arrive at the **3d station figures 2, 9 and 16.**

Here, all the pieces, tests, and evidence that confirm our marvelous journey come together, from the tectonic reconstruction and evolution of the Gulf of Mexico developed in **Figures 3 to 8**, with the opening of the **Edinson Strait** and the deposition of the Salt in the Middle Jurassic **(Figure 6)** both in the Gulf of Mexico and Colombia; the paleogeographic reconstruction and evolution of Colombia for the Jurassic period **(Figure 9),** which demonstrate the proximity of the main structures, the Perijá Rift, Cesar Ranchería, and the Bucaramanga Fault, to the paleobasin of the Eastern Cordillera of Colombia. The evidence of the existence of marine deposition from the Lower and Middle Jurassic (before and during the deposition of the Salt) through these channels—the Serranía de Cosinas-Macuira (Upper and Lower Guajira), the Perijá Rift, Cesar Ranchería and the Bucaramanga, Boyacá, and Soapaga Faults **(Figures 9, 10, 11, 12, 13, 14);** Additional paleontological evidence of the proximity of the territories **(Figure 15),** culminating in the great salt deposition event in the Cundinamarca Basin (South of the Jurassic paleobasin of the Eastern Cordillera) **Figures 2, 6, 9, and 16.**

According to studies and numerical models, the salt was deposited rapidly, reaching a thickness of 3 km in one million years. **Filina et al 2022.**

> It is believed that the salt was deposited very rapidly, in less than a million years (e.g., Warren, 2006). This estimate is consistent with numerical modeling of salt deposition in the South Atlantic (Montaron and Tapponnier, 2010), and also with estimates from stratigraphy of the Santos Basin, Brazil (Dias, 2005). The hypothesis of rapid deposition also matches modern rates from the few regions of current salt deposition (see Davison et al., 2012) and with the known ~640,000-year duration of up to 3 km thick Messinian salt deposition in the Mediterranean (e.g., Krijgsman et al., 1999). If GoM salt deposition was

From the analysis of the items in section 4.0 above, we can conclude that we have identified two new unexplored plays and/or petroleum systems in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Paleocordillera of Colombia.

1. **Jurassic Play**: Formed by the deposition of organic shales from the Lower Jurassic - Hypothetical **Zipa Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Morrocoyal and Montebel formations. Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and a 3 to 4 km seal of salt deposited during the Middle Jurassic.
2. **Cretaceous play associated with salt seal:** Source Rock: Fómeque Formation, Reservoir Rock: Une Formation, Seal Rock: Migrated Salt. The same applies to higher sequences.

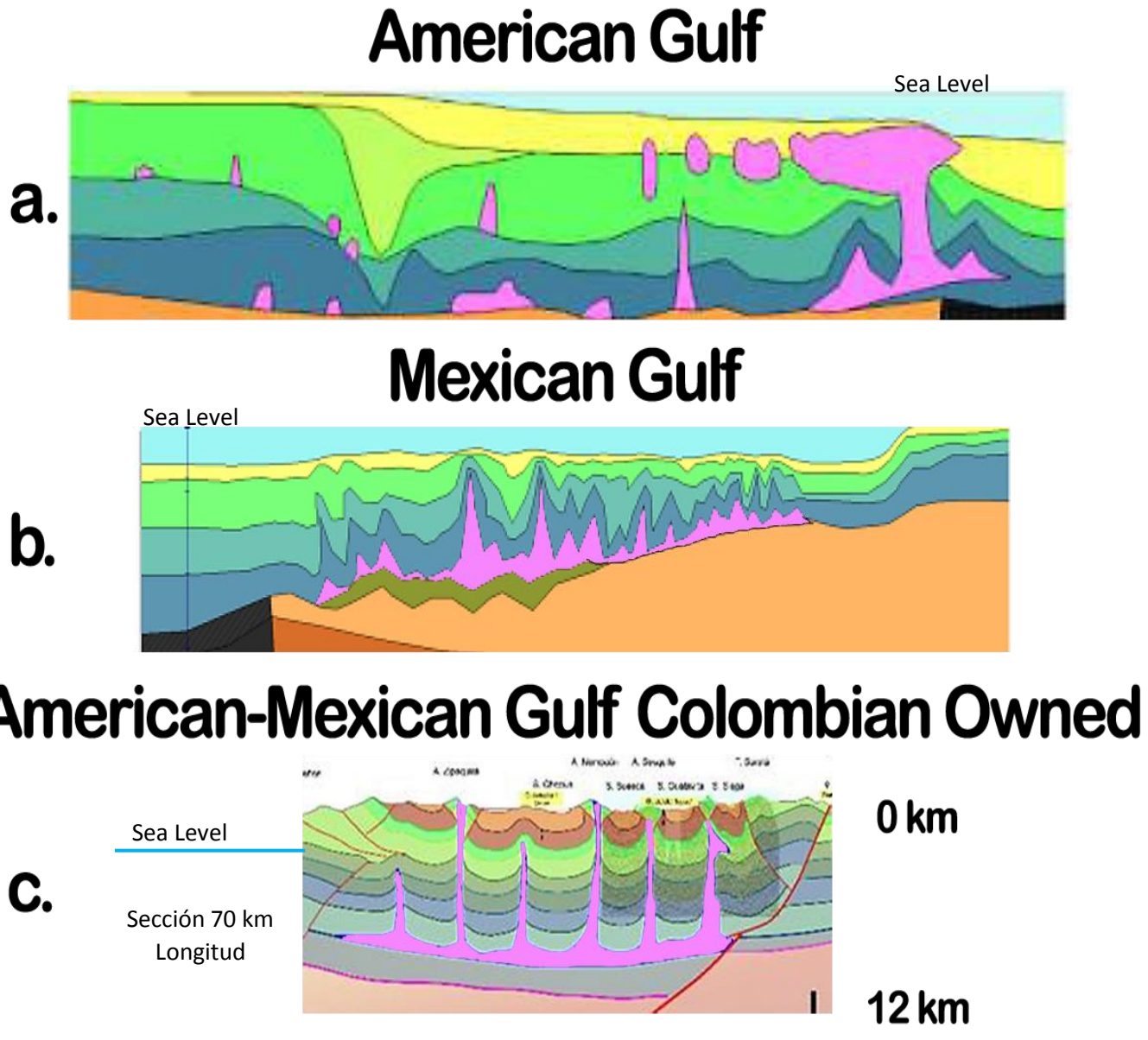


Fig. 16. Comparative Salt Structures, Depth Sediments , and Basins, American Gulf-MexicanGulf-Cundinamarca Basin (Colombia)
Modified From **Irina Filina and Erin Beutel. 2022. Y ANH-UPTC 2020. Location Figure 2,14-3d.**

Figure 16 is the key evidence for the previous interpretations. **The Great Chibcha Terrane of Restrepo and Toussaint (2020)** constitutes, according to this study, the westernmost part of the large continental structural escarpment of Laurentia **(Figures 1 and 3).** It is closed to the south by the **Great Rudabet Rift-Lineament System (Honor Ruben Dario Alvarez Betancourt, Father. Figure 1**). It occupies approximately one-third of the size of the basin that gave rise to the Gulf of Mexico-Gulf of America (including the Paleobasin of the Eastern Cordillera of Colombia) during the Jurassic period. In the Bajocian-Bathonian period (170-166 Ma, Middle Jurassic), the Edinson strait opened **Figure 6**, made up of three openings **Edinson strait North, JhonEdi strait center, Floris Strait South, an optional independent Milenar Strait at southwest from** Paleobasin of the Eastern Cordillera of Colombia, where the Pacific Ocean flowed and entered to fill the paleobasins of the Gulf of Mexico (Gulf of Mexico-Gulf of America) and paleobasin of the eastern mountain range of Colombia, depositing the salt existing in the basin, key to the development and origin of the World Class petroleum systems of the Gulf of Mexico-Gulf of America.

The separation of the South American continent (Colombia-Venezuela, among others) from Laurentia continued after the aforementioned events, with the Gulf of Mexico basin and the Eastern Cordillera paleobasin taking different paths, moving away from each other. Subsequently, the incursion of the Cretaceous sea generated different events for each basin. While the Jurassic to Recent sedimentary basins remain submerged in the Gulf of Mexico, the Eastern Cordillera paleobasin developed and underwent Eocene-Miocene and subsequent uplift events, raising the sedimentary sequence 2,500 meters above sea level, with the city of Bogotá serving as a primary reference point. **(Figures 9, 14, and 16)**

To continue correlating the Gulf of America-Gulf of Mexico basins and the Paleobasin of the Eastern Cordillera of Colombia, we will review the similarity of the interpretation of the Seismic Sections made in the works of **Irina Filina and Erin Beutel. 2022. Y ANH-UPTC 2020. We can observe the following aspects that they have in common:**

1- Thickness of the Sedimentary Sequence 8 to 14 km (General 10 km) **Figura 16.**
2- Thickness of the salt sequence 3-4 km. **(Figura 6-16)**
3- Structural deformation of the salt sequence (Extending almost and in some cases the entire sedimentary sequence. For this to occur, not only is active tectonic deformation needed, but also a powerful salt deposit, in this case close to 3-4 km) **Figura 16.**
4- Paleogeographic point of common origin. **(Figura 1 y 3)**

In Colombia, the oil sector and the geoscientific community have traditionally assumed that the salt corresponds to Cretaceous deposition, as shown on all cornostratigraphic maps of the country up to 2025. However, there are several points that do not support this thesis and, on the contrary, contradict this theory, among them are:

1- Since the Cretaceous play is one of the most studied and drilled in the country due to the interest in its petroleum systems, there is no significant report of salt or saline deformation in the Llanos basin, Catatumbo, upper-middle Magdalena valley, Maracaibo Basin, where Cretaceous deposition was also recorded.

2- The Jurassic paleobasin of the Eastern Cordillera of Colombia has been little studied and almost unexplored, according to **ANH-UPTC 2020.**

> La cuenca Cordillera Oriental es una de las cuencas frontera colombianas que mayor interés exploratorio a generado a lo largo de los últimos 25 años. Este interés condujo al descubrimiento de hidrocarburos en los campos Gibraltar, Bolívar, Corrales y Guando. Sin embargo a pesar de estos campos con producción comercial teniendo en cuenta el tamaño de la cuenca, la cantidad de sísmica disponible y el número de pozos exploratorios se trata de una provincia geológica inexplorada.

3- The few wells drilled in the Eastern Cordillera basin of Colombia mostly only reach the Cretaceous sequence, leaving the Jurassic record unknown. This is especially true in the Cundinamarca basin.

The existence of the aforementioned phenomenon regarding Jurassic salt in Colombia is not merely anecdotal, but has an impact that has not been widely related and studied on the **Petroleum, Mining, and Social Systems of the area.**

Implications of Jurassic Salt in Colombia's Petroleum, Mining, and Social Systems.

Implications of Jurassic Salt in Petroleum Systems.

Having demonstrated in this article the origin of the salt existing in the stratigraphic sequence of the Eastern Cordillera of Colombia, the following impacts are generated.

We can conclude that we have identified two new unexplored plays and/or petroleum systems in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Paleocordillera of Colombia.

1. **Jurassic Play**: Formed by the deposition of organic shales from the Lower Jurassic - Hypothetical **Zipa Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Morrocoyal and Montebel formations. Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and a 3 to 4 km seal of salt deposited during the Middle Jurassic.
2. **Cretaceous play associated with salt seal:** Source Rock: Fómeque Formation, Reservoir Rock: Une Formation, Seal Rock: Migrated Salt. The same applies to upper sequences.

Implications of Jurassic Salt for Mining Systems

Salt has been important since pre-Hispanic times for the development of indigenous cultures and later during the colonial period after the Spanish conquest. Few salt mines are currently operational, and most are not technologically advanced. Salt springs are abundant in the eastern mountain range basin.

But the most notable and worthy fact in this article is the role of salt and its participation in the mixing of hydrothermal fluids that gave rise to the eastern (Cretaceous age) and western (Oligocene age) emerald belts of the Eastern Cordillera of Colombia (age debate) **(Andres M. Ravelo 2020).** According to **Andres M. Ravelo (2020),** some trace elements, such as the V/Cr ratio, and trace elements like Fe, Na, and Mg, help differentiate the beauty, color, and brilliance of Colombian emeralds. (Sodium is probably contributed by salt, among other minerals.) This distinguishes Colombian emeralds from others around the world. (**Figure 17**. Fura, one of the largest rough emeralds in the world - Muzo - Boyacá, Colombia. Tablazo Sub-basin, **Figure 14**).

Figure 17. Fura, one of the largest rough emeralds in the world - Muzo - Boyacá, Colombia. Taken from https://www.las2orillas.co/el-dia-en-que-victor-carranza-encontro-a-fura-una-de-las-esmeraldas-mas-grandes-del-mundo/#

Implications of Jurassic Salt in Social Systems.

The largest and most important salt dome in Colombia, located in the city of Zipaquirá, Cundinamarca, houses the **underground Salt Church**, one of the most important in the world. **In 2024, it received over 700,000 tourists.** (**Figure 18**. Note from the newspaper El Tiempo, 2025; **Figure 19.** Facilities of the Zipaquirá Salt Church). It is boosting the economy of the region and the country.

NOTICIA

Más de 700.000 turistas visitaron la Catedral de Sal de Zipaquirá en el 2024

Con esta nueva cifra, este tesoro turístico rompió un nuevo récord, siendo así el año con más visitantes en toda su historia.

Figure 18. Record number of tourists visit the Salt Church of Zipaquirá. Article from El Tiempo newspaper, 2025.
https://www.eltiempo.com/bogota/mas-de-700-000-turistas-visitaron-la-catedral-de-sal-de-zipaquira-en-el-2024-3415793

Figure 19. Facilities of the Salt Church of Zipaquirá. Taken from https://www.catedraldesal.gov.co/.

DISCUSSION

This work unlocks several existing limitations in the geoscientific world related to the tectonic evolution of one of the main oil sources in the world, the Gulf of Mexico (Gulf of America-Gulf of Mexico) and in parallel the Jurassic petroleum system of the Colombian basins.

One of the main geological features is **the discovery of the Rudabet Great Fault System-Lineament (Honor to Ruben Dario Alvarez Betancourt (Father), Figures 1 and 3)**. This system controls the base of the large continental structural scarp of Laurentia **(Figure 3).** This discovery helps resolve several contemporary questions, which are central to this study, and which address uncertainties raised by leading geoscientists worldwide.: **James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020-2021; Mildred Del Carmen Zepeda Martinez - Tesis Doctoral UNAM. 2021; Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020; Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022. And others.** This feature demonstrates that the **Restrepo and Toussaint 2020 Chibcha Terrane constitutes**, according to this study, the westernmost part of the large Laurentian structural escarpment **(Figure 3).** It occupies approximately one-third of the size of the basin that gave rise to the Gulf of Mexico-Gulf of America (including the Paleobasin of the Eastern Cordillera of Colombia) during the Jurassic period.

Although improvements, refinements, and modifications can be made to the proposal presented in this study, the fact remains that the perfect tied up obtained through **the Rudabet Fault-Lineament System (Honor Ruben Dario Alvarez Betancourt-Father., Figures 1 and 3)** is and will be the starting point for future reconstructions of tectonic evolution forward or backward from this tie-down point or constraint in geological time. The issue that still warrants review is determining whether this tie-down point corresponds to the 200 Ma age of the Dr. Pindell et al. 2020-2021 model, or to a slightly earlier age between 200 and 210 Ma. This would require considering the travel velocities of the Chortis-Oaxaca blocks and their implications for past reconstructions, a topic beyond the scope of this work.

In Colombia, the oil sector and the geoscientific community have traditionally assumed that the salt corresponds to Cretaceous deposition, as shown on all cornostratigraphic maps of the country up to 2025. However, there are several points that do not support this thesis and, on the contrary, contradict this theory, among them are:

1- Since the Cretaceous play is one of the most studied and drilled in the country due to the interest in its petroleum systems, there is no significant report of salt or saline deformation in the Llanos basin, Catatumbo, upper-middle Magdalena valley, Maracaibo Basin, where Cretaceous deposition was also recorded.

2- The Jurassic paleobasin of the Eastern Cordillera of Colombia has been little studied and almost unexplored, according to **ANH-UPTC 2020.**

3- The few wells drilled in the Eastern Cordillera basin of Colombia mostly only reach the Cretaceous sequence, leaving the Jurassic record unknown. This is especially true in the Cundinamarca basin.

4- The analysis of the facts, indications, evidence, and previous records clearly shows us that while the Cretaceous transgression to the South American continent has been widely studied and analyzed, we find that the entry of the sea or flooding into the territory was extensive and massive, that is, there was direct communication with the open sea, therefore there were normal salinity conditions unsuitable for the deposition of salt.. While the analysis of the facts, clues, evidence, and records provided in this work demonstrates that during the Middle Jurassic period **(Bajocian-Bathonian, 166-170 Ma)**, the Naza Arch of Mexico was in collision with the northwestern corner of South America (Gondwana), breaking the Jurassic Great Estelar Ridge, creating the Edinson Strait (Edinson Strait-Noth, JhonEdi Strait–Center, and Floris Strait-South) entering the Pacific Ocean to flood the Gulf of Mexico (Gulf of America and Gulf of Mexico), also flooding the paleobasin of the Eastern Cordillera of Colombia, **Demonstrated by the marine corridors of the lower and middle Jurassic, defined from the stratigraphic columns 1,2,3,3a,3b,3d and 3d; 4, 4a, 3c, (later eroded), Figures 6,9,10,11,12,13,14,15,16.** This generated a restricted flow of seawater, causing low circulation and therefore hypersalinity, which, combined with the large extent of the Basin and the high atmospheric conditions of high temperatures, favored the rapid deposition of salt. **(Filina et al 2022),** which reached a thickness of 3 to 4 km. **We can clearly conclude that the salt from the Eastern Cordillera of Colombia is part of the same environment, time and conditions as those that formed in the Gulf of Mexico during the Middle Jurassic.**

The integration of knowledge developed through the Complex Source Theory (CST) and its various advanced tools allows us to shed light on and answer all the questions that, for more than five hundred years (the Spanish Conquest era) and one hundred years (the contemporary era), have troubled geoscientists and petroleum explorers regarding the tectonic, sedimentary, stratigraphic, and structural evolution of the Gulf of Mexico (Gulf of America-Gulf of Mexico and the paleo-Eastern Cordillera of Colombia). **Figures 1 to 16. (The same treatment has been applied to all other oil and mining basins in Colombia.)**

The answers become logical, simple, and gain value in light of Complex Source Theory (CST) and its tools, as you will see in the concluding part of this study.

If your company faces a highly complex geoscientific problem with significant economic implications, Complex Source Theory (CST) and its tools are here to solve it. For a more detailed analysis and solution to complex tectonic, structural, and stratigraphic problems, please consult with the author of this article.

CONCLUSION

The SCT Complex Source Theory and its advanced tools demonstrate their value in this report, contributing to the knowledge and understanding of the tectonic evolution of the Gulf of Mexico (Gulf of America-Gulf of Mexico and the Paleobasin of the Eastern Cordillera of Colombia) during the Jurassic Period. This contributes to geoscientific knowledge and development, which will help guarantee the country's energy, economic, and social sustainability.

Through this analysis, we have demonstrated how the SCT's postulates have been corroborated and proven over time, revealing their predictive power. And in this article, dedicated to Miguel de Cervantes Saavedra and his work, **we verify the demolition of twelve (12) giants in the field (we will refer to giants as: concepts, techniques, technologies, methodologies, procedures, tools, uncertainties, unanswered questions, etc.).**

Giant No.1 (Giant No. 8 Knocked Down from this series):

This corresponds to the question the Spanish posed to the Indigenous people of the Colombian interior (Sabana de Bogotá) about the origin of the salt they traded in the region, given the absence of a nearby sea. **The Indigenous people's response** at the time was: (It comes from Mother Earth, from the interior of the Earth). **The scientific answer after 500 years of history by Edinson Alvarez-Geoscientist**: It comes from the marine deposition of the Gulf of Mexico (including the Gulf of America, Gulf of Mexico and Paleobasin of the Eastern Cordillera of Colombia), deposited in the Middle Jurassic period (Bajocian-Bathonian, 166-170 Ma).

Giant No.2 (Giant No. 9 Knocked Down from this series) :

Alarcón CM et al 2020. (Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020).

de arcos magmáticos marginales (**Rodríguez, *et al.***, 2018). Uno de los retos actuales es la reconstrucción de la historia geológica del Jurásico en los Andes del norte, no solo desde el punto de vista geoquímico y geocronológico de las rocas plutónicas y volcánicas, sino porque deben entenderse de forma integral las relaciones del magmatismo con la formación de cuencas y la acumulación de sucesiones sedimentarias. Como lo sugieren **Bayona,**

Answer: The spatio-temporal relationship of subduction processes, the generation of volcanic-plutonic arcs, rifting, and basin filling and deposition is largely clarified, providing the general framework for subsequent and prior processes in the tectono-stratigraphic formation and evolution of Mexican, American, and Colombian basins during the Jurassic Period and part of the Late Triassic. (For further details regarding the events and implications in the oil, gas, and mining exploration cycle, consult the author of this article.)

Giant No.3 (Giant No. 10 Knocked Down from this series):

Mildred Del Carmen Zepeda Martinez - Tesis Doctoral UNAM. 2021

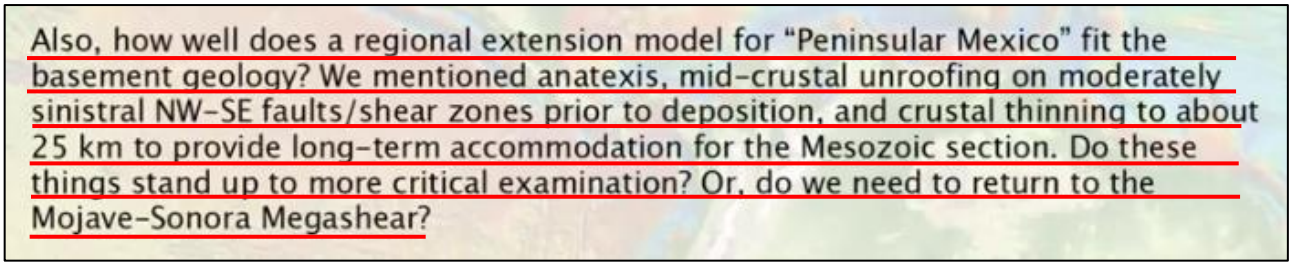
> evolución tectónica de México durante el Jurásico siguen siendo ampliamente debatidos. La dificultad en reconstruir con detalle la evolución tectónica del *rift* en México se debe principalmente a que resulta muy complicado identificar las fallas maestras que acomodaron la extensión continental durante el Jurásico. En efecto, los eventos tectónicos que caracterizan la historia geológica Cretácica

> propuesta. Por consiguiente, el problema de traslape cortical sigue sin tener aparentemente una solución satisfactoria y aceptada de manera conjunta por la comunidad científica. A continuación, se

Answer: With this new proposal by **Dr. Edinson Alvarez (2025) (Modified from Pindell et al. (2020-2021)),** not only is the problem of crustal overlap between Mexico and Colombia (Laurentia-Gondwana) resolved, but a large number of questions related to the structural and stratigraphic tectonic evolution of the Gulf of Mexico during the Jurassic period are also answered. (For further details about the events and implications in the O&G&M exploration cycle, consult the author of this article.)

Giant No.4 (Giant No. 11 Knocked Down from this series):

Youtube Conference **Cátedra Selecta.- James Pindell-2021** (James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020).



Answer: Regarding the question posed by **Dr. Pindell et al. (2020-2021),** the answer is Adopt this new model with the corresponding adjustments, which resolves the majority of questions existing in the geoscientific community, as demonstrated by the supporting evidence of this research study. (For further details regarding the events and implications in the oil, gas, and mining exploration cycle, please consult the author of this article.)

Giant No.5 (Giant No. 12 Knocked Down from this series):

Filina et al 2022. (Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022.)

> 1) The nature of the Triassic redbed basin preceding GoM opening - whether these units represent a successor basin to the Ouachita-Marathon orogeny or precursor rifting to GoM formation. The issue is tied to the challenge of identifying firm evidence of pre-breakup rifting, which is currently sparse compared to other rifted margins;

Answer: The Triassic Redbed Deposits are related to the two events mentioned: the final stages of the Ouachita-Marathon Orogeny and the opening of the Gulf of Mexico. (For further details about the events and implications for the oil, gas, and mineral exploration cycle, please consult the author of this article.)

Giant No.6 (Giant No. 13 Knocked Down from this series):

Filina et al 2022.

> 2) The timing of salt deposition with respect to the Middle Jurassic seafloor spreading – specifically whether the salt predated, was synchronous with, or just postdated the initial spreading;

> subdivision. Where salt exists (Fig. 2a), seismic imaging of underlying (i.e., syn-opening) sequences is difficult. Whether salt was deposited during the last stages of continental rifting, over oceanic crust, and/or concurrent with the first stages of seafloor spreading, remains unclear.

Answer: The solution to this problem is called the **EAST-P Method-Tool of the SCT (Processing and Seismic Treatment, Edinson Alvarez, 2025)**, which has been used to solve complex structural tectonic problems where seismic imaging is poor, to bad quality. See Articles 2 and 3 of this series. (For further details about the events and implications in the O&G&M exploration cycle, consult the author of this article.)

Giant No.7 (Giant No. 14 Knocked Down from this series):

Filina et al 2022.

> 3) Whether GoM opening was facilitated by magma-rich breakup associated with SDRs, or it was mantle-poor and resulted in exhumed mantle close to the ocean-continent boundary;

Answer: The initial opening phase of the Gulf of Mexico was Magma-Poor type, migrating to a Magma-Rich type event, with the continuous generation of oceanic crust, ending with the termination of the mantle feeder at the end of the Jurassic-Early Cretaceous. (For more details about the events and implications in the oil, gas, and mining exploration cycle, consult the author of this article.)

Giant No.8 (Giant No. 15 Knocked Down from this series):

Filina et al 2022.

> 4) The related issue of continental restoration of pre-GoM crustal blocks. The newly mapped geological structures within and adjacent to the OCT, such as interpreted SDR complexes with adjacent presalt sedimentary basins and outer troughs, in addition to magnetic anomalies may further constrain tectonic reconstruction of the basin.

Answer: Multiple authors and proposals for the location of blocks, the basis for reconstructing the tectonic evolution of the Gulf of Mexico, have been published; however, none is definitive, as they lack sufficient evidence to prevail over the others. This paper provides a solution to this problem, which has preoccupied geoscientists worldwide for over 100 years. (For further details regarding the events and implications of the oil, gas, and mineral exploration cycle, please consult the author of this article.)

Gigante No.9 (Giant No. 16 Knocked Down from this series):

Pindell et al 2020.

> Two unresolved issues stand out as most significant. One is the tectonic process by which the highs and lows in the top-rift unconformity were created along the west Florida margin, which records ther-

Answer: The tectonic reconstruction in **Figures 3, 4, and 5** reveals the mechanism that triggered the development of these structures. (For further details on the events and implications of the oil, gas, and mining exploration cycle, please consult the author of this article.)

Giant No.10 (Giant No. 17 Knocked Down from this series):

Pindell et al 2020. (James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020)

> Florida Peninsular Arch and hence may terminate against a poorly understood 'Florida Transfer Zone' (Erlich and Pindell 2020). The second issue

Answer: In the tectonic reconstruction of **Figures 3, 4, 5,** one can better understand how Florida Transformation Zones (FTZ) work. (For further details about the events and implications in the O&G&M exploration cycle, consult the author of this article).

Giant No.11 (Giant No. 18 Knocked Down from this series):

Juan Camilo Ruiz Amaya. 2021

> ➢Se propone un desacople entre la secuencia basal interpretada como Paleozoica y los pliegues observados en superficie, debido a la formación salina del Cretácico Inferior.

In Colombia, the oil sector and the geoscientific community have traditionally assumed that the salt corresponds to Cretaceous deposition, as shown on all cornostratigraphic maps of the country up to 2025.

Answer: The analysis of the facts, indications, evidence, and previous records clearly shows us that while the Cretaceous transgression to the South American continent has been widely studied and analyzed, we find that the entry of the sea or flooding into the territory was extensive and massive, that is, there was direct communication with the open sea, therefore there were normal salinity conditions unsuitable for the deposition of salt.. While the analysis of the facts, clues, evidence, and records provided in this work demonstrates that during the Middle Jurassic period **(Bajocian-Bathonian, 166-170 Ma)**, the Naza Arch of Mexico was in collision with the northwestern corner of South America (Gondwana), breaking the Jurassic Great Estelar Ridge, creating the Edinson Strait (Edinson Strait-North, JhonEdi Strait–Center, and Floris Strait-South) entering the Pacific Ocean to flood the Gulf of Mexico (Gulf of America and Gulf of Mexico), also flooding the paleobasin of the Eastern Cordillera of Colombia, **Demonstrated by the marine corridors of the lower and middle Jurassic, defined from the stratigraphic columns 1,2,3,3a,3b,3d and 3d; 4, 4a, 3c (later eroded), Figures 6,9,10,11,12,13,14,15,16.** This generated a restricted flow of seawater, causing low circulation and therefore hypersalinity, which, combined with the large extent of the Basin and the high atmospheric conditions of high temperatures, favored the rapid deposition of salt. **(Filina et al 2022),** which reached a thickness of 3 to 4 km. **We can clearly conclude that the salt from the Eastern Cordillera of Colombia is part of the same environment, time and conditions as those that formed in the Gulf of Mexico during the Middle Jurassic.** (For further details about the events and implications in the O&G&M exploration cycle, consult the author of this article).

Giant No.12 (Giant No. 19 Knocked Down from this series):

Juan Camilo Ruiz Amaya. 2021

Un problema por resolver…

Hasta la fecha, entre la Sabana de Bogotá y el Páramo de Sumapaz no hay un modelo tectónico actualizado que tenga en cuenta las principales características del estilo estructural y proporcione argumentos para definir el rol de la sal y la cronología del plegamiento.

Answer: This study lays the groundwork for understanding the Sumapaz and Bogotá Savannah areas, which are key to reconstructing the area's tectonic model. (For further details about the events and implications of the oil, gas, and mining exploration cycle, please consult the author of this article.)

All of the above, integrated, can be applied to the following problem basins, reported by Dr. **Filina et al 2022.**

Furthermore, there are many other sediment-filled extensional basins around the world that need to be better understood, such as the Caspian Sea, the Black Sea, the Aleutian Basin, the Baltic Sea, and the Sea of Japan. The approach of combining the perspectives of both in-

The existence of the above phenomenon is not only anecdotal, but has an impact that has not been widely related and studied **on the Petroleum, Mining, and Social Systems of the area.**

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We can conclude that we have identified two new unexplored plays and/or petroleum systems in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Cordillera of Colombia.

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This methodology is also applicable to complex areas such as pre-salt belts, the Gulf of Mexico, Gulf of America, Brazilian coast, African coast, Mediterranean, the coasts of Alaska and Canada, the mountain ranges and foothills of the Rocky Mountains, Andes, Atlas Mountains, Himalayas, and the Arabian Peninsula, among others, as well as areas of low or minimal tectonic structural complexity. **It also helps increase production in complex reservoirs by confirming and refining the geological and geomechanical models of reservoirs that present this problem of double or even triple interpretations and models**.

Some of the tools of the SCT Complex Source Theory, such as the SCT EAST-P method, were proposed to Ecopetrol in April 2024, for a value comparable to the transactions of large technology companies. This value logically exceeded the company's economic and financial capacity; **therefore, we invite to @Pötus, Forbes List and giant Companies to participate in this development.**

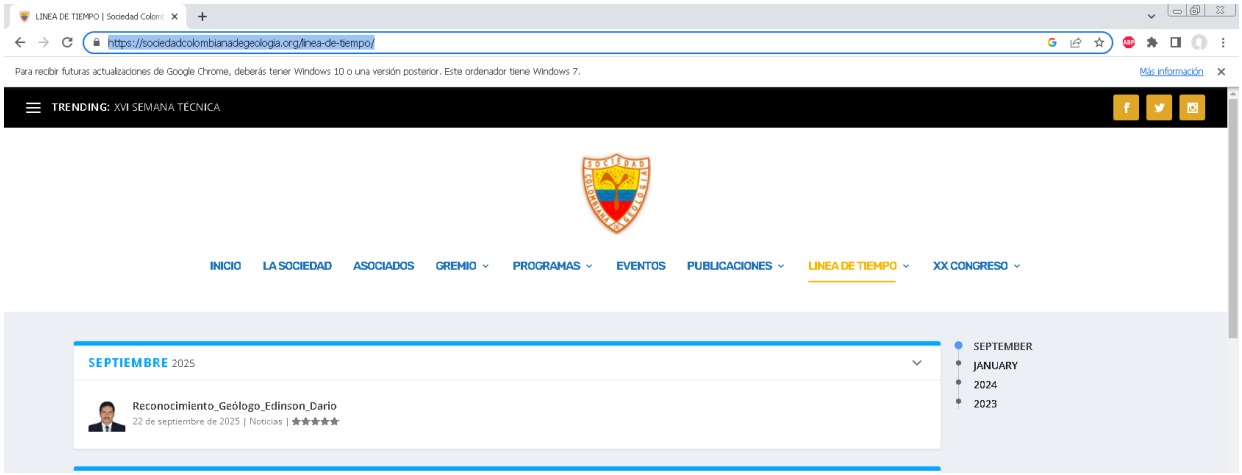
Analysis of the technical support has deserved him recognition for his contributions to geoscientific knowledge of Colombia by important personalities and entities.. (Maya journal of geosciences September edition 2025, pag. 154, Art-1/10), https://revistamaya.com/wp-content/uploads/2025/08/Revista-Maya-Geociencias-Septiembre-2025.pdf,

Article-2(Páginas-37-47): https://revistamaya.com/wp-content/uploads/2025/09/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXV-2025.pdf.

Article-3(páginas-76-98):https://revistamaya.com/wp-content/uploads/2025/10/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXVI-2025.pdf

Article-4(páginas-169-180): https://revistamaya.com/wp-content/uploads/2025/11/Revista-Maya-Geociencias-Diciembre-2025.pdf

The prestigious **Colombian Geological Society (SCG)** has joined in disseminating the recognition and results of the research work through publication on its website. https://sociedadcolombianadegeologia.org/reconocimiento_edinson_dario/



Note1: The Colombian Geological Society (SCG) and **the Colombian Association of Petroleum Geologists and Geophysicists (ACGGP)** are private organizations that fulfill a similar social function - public functions: To disseminate, publicize, and support everything related to knowledge of Geosciences and Earth Sciences.

We reject the institutional blockade and censorship applied to this research work by **Jaime Gonzalo Checa Jimenez, President of ACGGP, and Flover Rodriguez Portillo, Executive Director**, who have on three occasions denied the publication of both the recognition granted by prestigious entities for the research work in geosciences and the informative articles presenting the results of the work classified as being of national interest. **In addition to denying the recognition granted for contributions to the country's geosciences, they are arbitrarily attempting to impose a prior review of the informative articles, which is prohibited by law and international agreements and treaties, violating freedom of expression and freedom of information, fundamental and supreme values in a democracy. (Art 13 CADH)**

"Censorship is inherently discriminatory (...)" (Judgment T 539 of 1994). Based on the premise, the application of censorship discriminates against the affected person, by the same way Furthermore, through their actions, **Mr. Jaime Gonzalo Checa Jimenez, President of the ACGGP, and Mr. Flover Rodriguez Portillo, Executive Director**, would be discriminating against the President of the United States of America, who is one of the many individuals and audience members to whom this informational message is directed. In addition, they are concealing information of national interest from the Colombian people by obstructing the free flow of information and public debate regarding the results of this geoscience research. **(Art 13 Convención Americana Derechos Humanos).**

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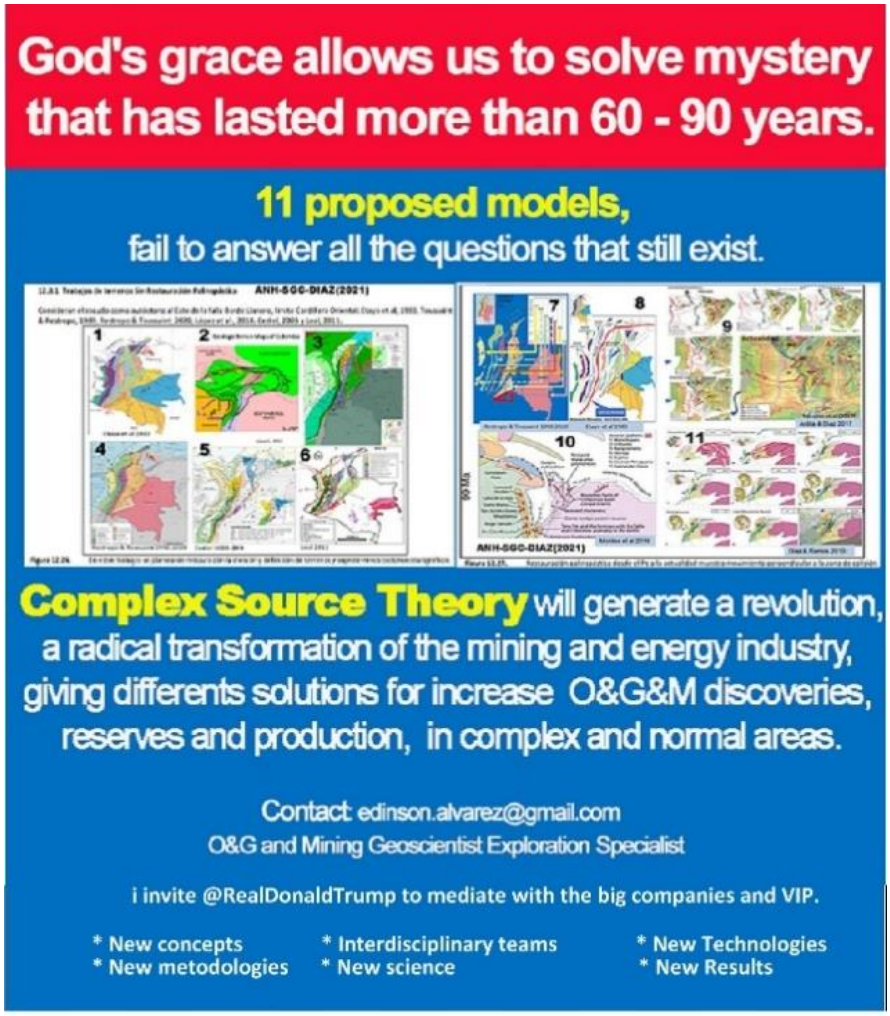

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Exploration Geologist Specialist - Geophysicist, expert in O-&-G-Mining integrated studies (Colombia, Perú and México), Giving solutions to geoscientific problems, which have been in uncertainty for more than 5 decades. With important + economic implications.

The God´s grace guide us to develop the ¨Complex Source Theory¨, a new mechanism that allow us increasing traditional O&G&M discoveries, production, reserves, as new energies and CCUS.

Geological mapping, surveys design, acquisition, processor PSTM (Conv-3C-4C-TZ-OBC), geomodeller, seismic interpreter and reservoir characterization (Conventional-and-Unconventional Reservoirs). Stratigraphic sequence, seismic attributes, AVO analysis, fluids substitution, seismic inversion, risk and uncertainty, leads and prospects, reserves.

Discovery of New prospective corridors and O&G prospects, in Foothills, Llanos, Putumayo, VIM, VMM, VSM, COR, CR, CAT, GuajiraOff-Guajira, SSJFB, Sinú-Sinu Off, Cayos basin, Colombia basin.

THE FIVE GIGANUCLEAR GEOLOGICAL AND TECTONIC FORCES
THAT GAVE RISE TO THE GULF OF MEXICO. (The Third Part Of The Gulf Of Mexico That Belongs To Colombia.)

Told By Edinson Alvarez Geocientífico Especialista. (Nota De Prensa)

Artícle Part 1/2: https://revistamaya.com/wp-content/uploads/2025/12/Revista-Maya-Geociencias-EDICION-ESPECIALXXVII-2025.pdf
Parr2?2: https://revistamaya.com/wp-content/uploads/2026/02/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXVIII-2026.pdf

This research paper answers 18 questions of the renowned Geoscientist: **James Pindell, Diego Villagómez, Roberto Molina-Garza,Rod Graham and Bodo Weber 2020-2021; Mildred Del Carmen Zepeda Martínez - Tesis Doctoral UNAM. 2021; Alarcón CM, Clavijo-Torres J, Mantilla-Figueroa LC, Rodríguez JG.2020; Irina Filina,James Austin,Tony Dor´e, Elizabeth Johnson, Daniel Minguez, Ian Norton, John Snedden , Robert J. Stern. 2022, Spikings, R. & Paul, A. 2019, Camilo Bustamante Londoño 2020. (Grupo de Investigación Tectónica-estratigráfica Egeo-Universidad Unal, Grupo Tectónica-Universidad Eafit), entre otros.** Related to the Origin and Tectonic Evolution of the Gulf of Mexico-Gulf of America, Including USA-México-Colombia y Venezuela; With its strong and valuable Oil, Gas and Mining World Industry implications. Valuable for the interpretation, analysis and understanding of the Petroleum and Mining Systems of related sedimentary basins and adjacent regions. (See the Articles 5 and 6 of this series, **Figures 1,2,3**).

To corroborate the model presented, we have a robust arsenal of tests, technical and scientific evidence that ratify and strengthen the validity of the model, including:

1. Evidence with Paleogeographic Tie-Down
2. Geomorphological Tie-Down
3. Structural Tie-Down
4. Paleontological Tie-Down
5. Sedimentological-Mineralogical and Facial Tie-Down
6. Stratigraphic Tie-Down
7. Tectonic Tie-Down
8. Geochemical Tie-Down
9. Geophysical Tie-Down
10. Geologycal Tie-Down
11. Volcanical Arc Tie-Down
12. Magmatic Arc Tie-Down
13. Geochronological Tie-Down (Radiometric Dating in Granitoids)
14. Geochronological Tie-Down (Radiometric Dating on Detrital Zircons)
15. Roll Back Tie-Down Plate Farallones in Mexico-USA (Laurentia), Colombia-Venezuela (Gondwana)

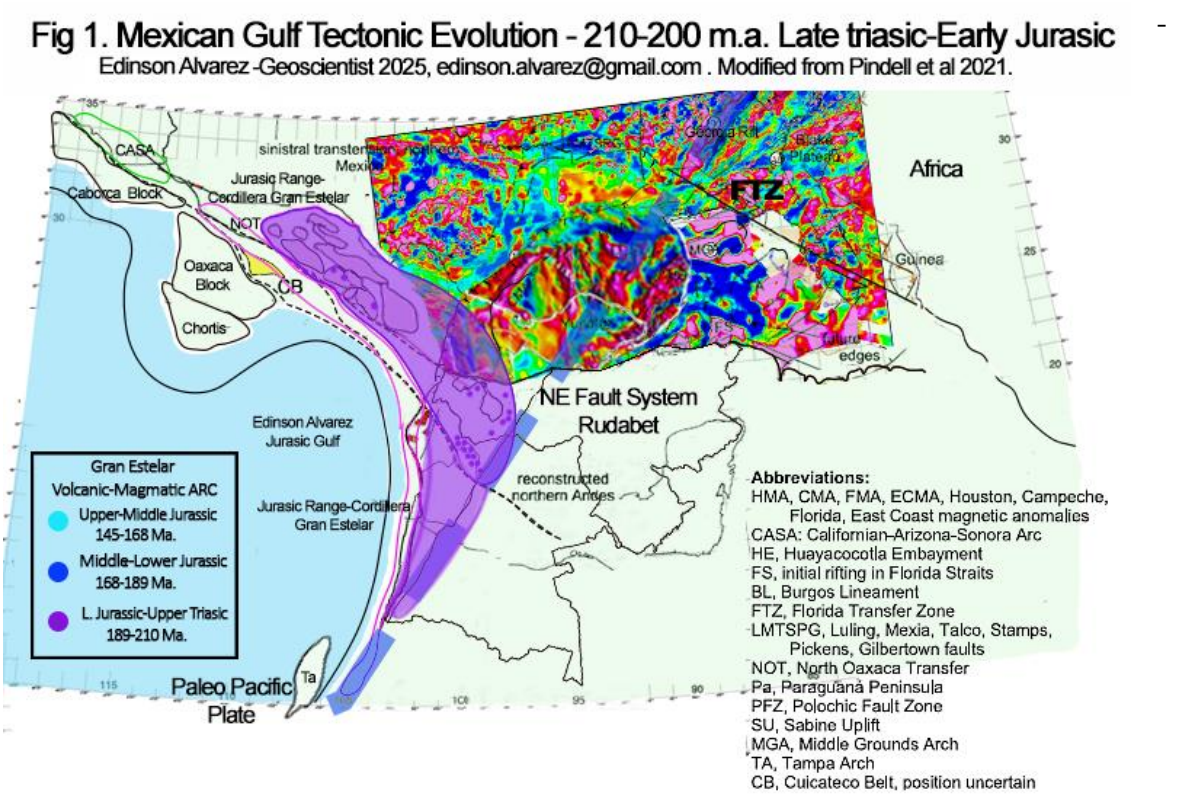

Figure 1. Main Geological, Morphological and Tectonic-Structural Features for Laurentia-Gondwana during the Late Triassic Early Jurassic Period. 200-210 Ma. Close to 10 Structural Lineaments Control Yucatan's Position.

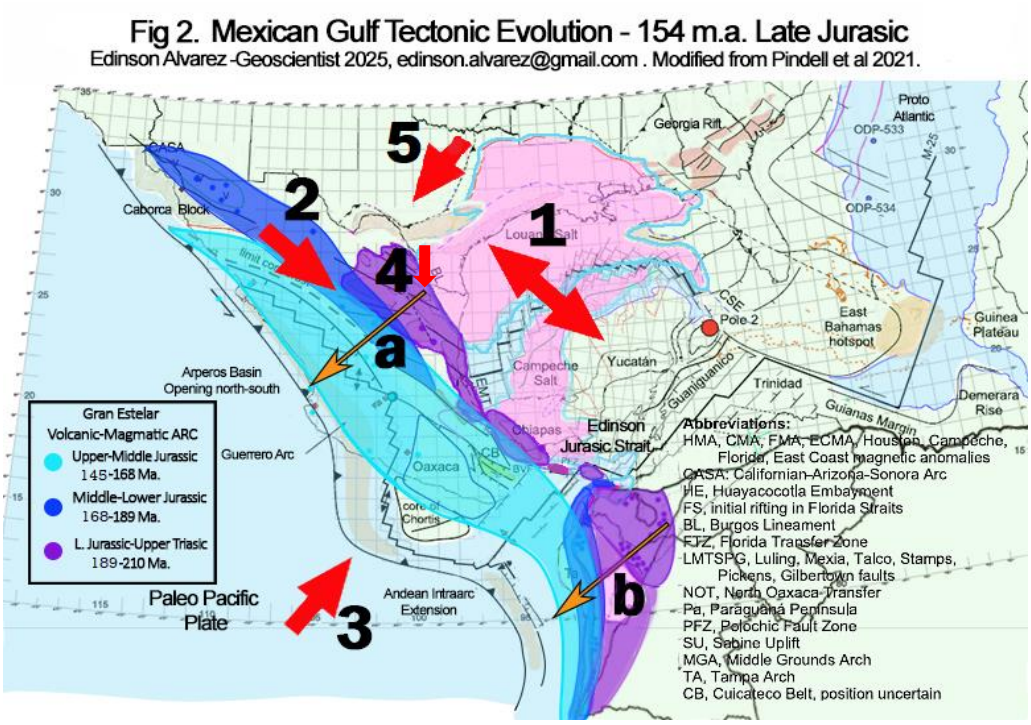

Figure 2. Distribution and Location of the East-Central-West Gran Estelar Magmatic-Volcanic Arcs, a.b. E-W Roll Back Direction Paleo Pacific Plate-FarallonesPlate, Laurentia-Godwana. **1, Pluma Mantelar 2,Fallas Transformantes 3,Subducción 4,Colapso Gravitacional 5. Deriva Continental Placa NorteAmericana,** Giganucleares Forces that Gave Origin to the Gulf of Mexico. Described in Item 4-5 of this study.

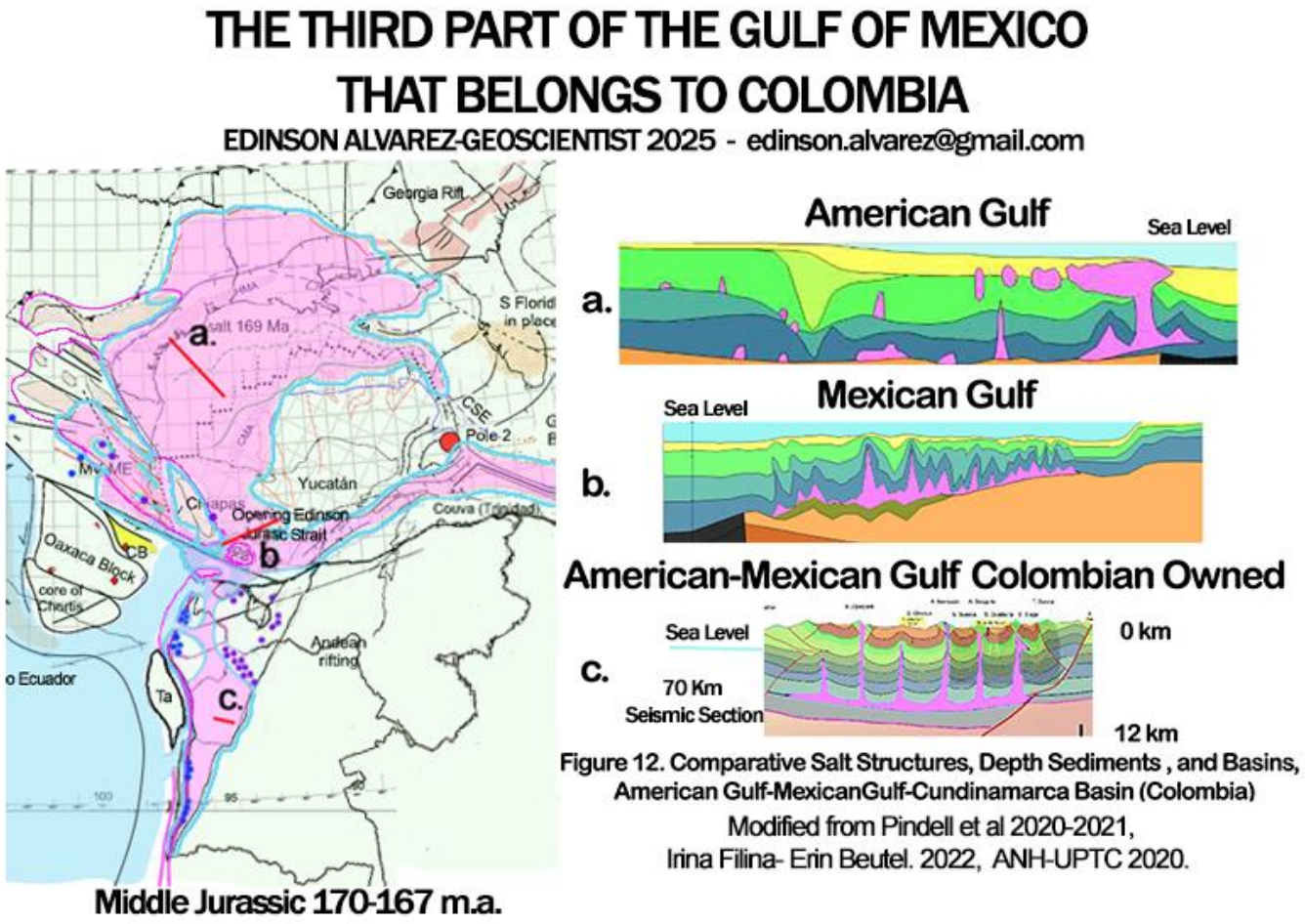

Figura 3. Correlación Formación de Sal Golfo de México con la Sal de Colombia, Formación Sal de Zipaquirá, Elevada a Rango de Formación por Edinson Alvarez 2025.

2. Considerations for the Nobel Prize in Science-Geosciences

According to the report **HISTORY OF OIL EXPLORATION IN MEXICO**, https://www.facebook.com/groups/tampicoantiguo/posts/2373490346009997/ : The beginning of the global oil industry took place with the success of the Drake well, in Oil Creek, Pennsylvania, in the year 1859. approximately 170 years ago).

And according to Google.com, the first mobile offshore drilling rig (MODU) to drill in the Gulf of Mexico was the Mr. Charlie in 1954, near Louisiana, USA, a global pioneer of offshore drilling. (Approximately 70 years ago).

In the important contributions of Dr. Josh Rosenfeld. 2002. He states:

> Muchos geocientíficos y empresas han gastado energía y recursos para proveer los datos e interpretaciones que apoyan el entendimiento actual del Bloque de Yucatán.

The above indicates that despite having made important contributions to the knowledge of the Basin, **by more than Ten Thousand (10.000) Geoscientists from around the world, in more than 100 years of History (Public-Private-Independent-Academic)**; uncertainties still persist about the Origin andTectonostratigraphic Evolution of the Gulf of Mexico (Related as Giants in Articles 5 and 6 of this Series):

This is a topic that we have happily resolved through the Advanced Tools of Complex Source Theory (SCT- Edinson Alvarez 2025), with important implications for the global oil, gas and mining production exploration cycle. (Figures 1,2,3,4,5,6,7,8,13,14,15).

A question with nearly 500 years of history has been successfully answered, along with 24 other questions, most of them over 100 years old, through a series of articles 1 through 6. These articles respond to questions posed by the world's leading contemporary geoscientists. This valuable and important work, a significant contribution to the global geosciences, allows us to humbly put forward for consideration the nomination and awarding of the Nobel Prize in Science, Based on the discoveries made in this study…

Figures 13, 14, and 15 below show a comparison with the geological and tectonic evolution models for the Gulf of Mexico-Gulf of America, proposed by renowned Geoscientists and Universities from around the world, Mexico, the United States of America-USA and Colombia (9 models proposed in the last decade, out of many more).

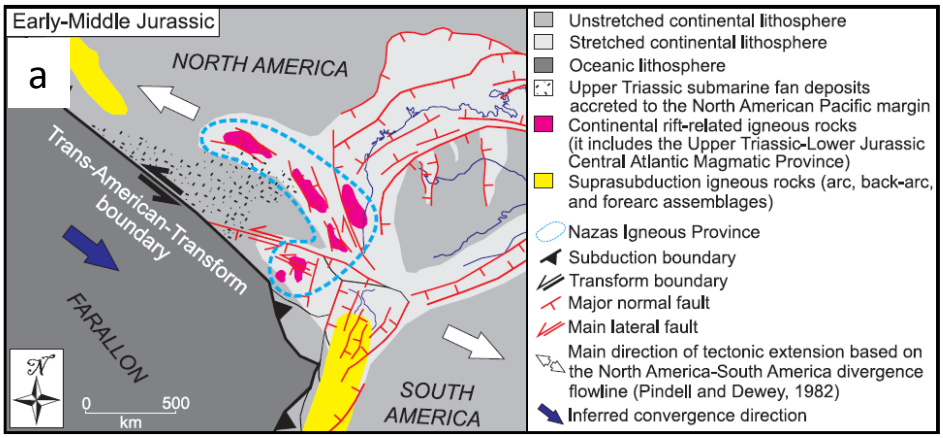

Fig. 13. (Colour online) Geotectonic reconstruction of the North America – South America divergent boundary during Early–Middle Jurassic time (~190–170 Ma; after Boschma *et al.* 2014; Bayona *et al.* 2020; Erlich & Pindell, 2021 and Pindell *et al.* 2021). The reconstruction shows the novel interpretation of the Nazas province as a magmatic provinc related to the continental rift between North and South America. In this new scenario, we propose that the Mexican segment of the North American margin was a transfori boundary.

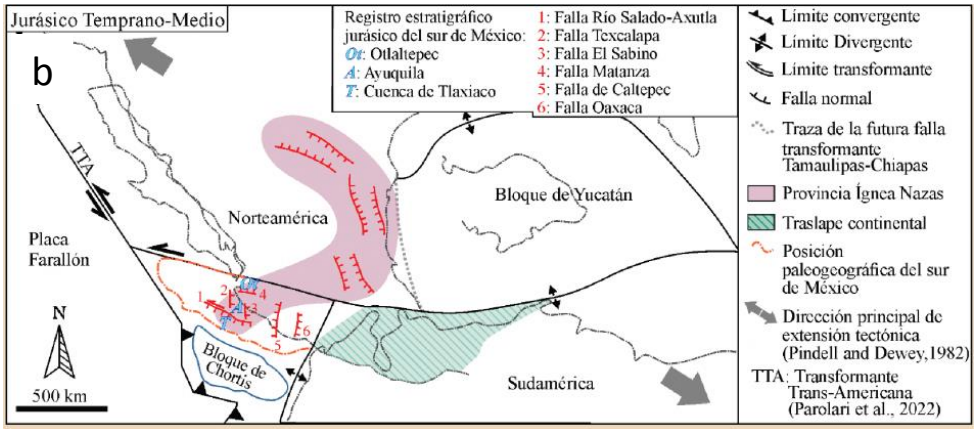

Figura 2. Reconstrucción paleogeográfica del margen oeste ecuatorial de Pangea durante el Jurásico Temprano–Medio, mostrando la posición paleogeográfica del sur de México en una posición más noroccidental y la localización de las fallas mayores que delimitaron las cuencas desarrolladas durante el desarrollo del rift de Pangea. Adaptado de Parolari et al. (2022) y Zepeda-Martínez et al. (2021).

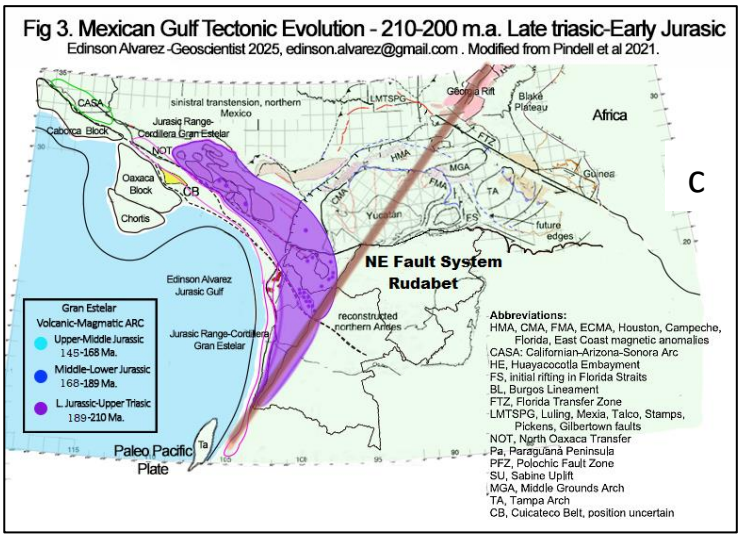

Figure 13. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Parolari M, Martini M. et al 2022. b. María Patricia Velasco de León 2024. c. Edinson Alvarez 2025-2026.**

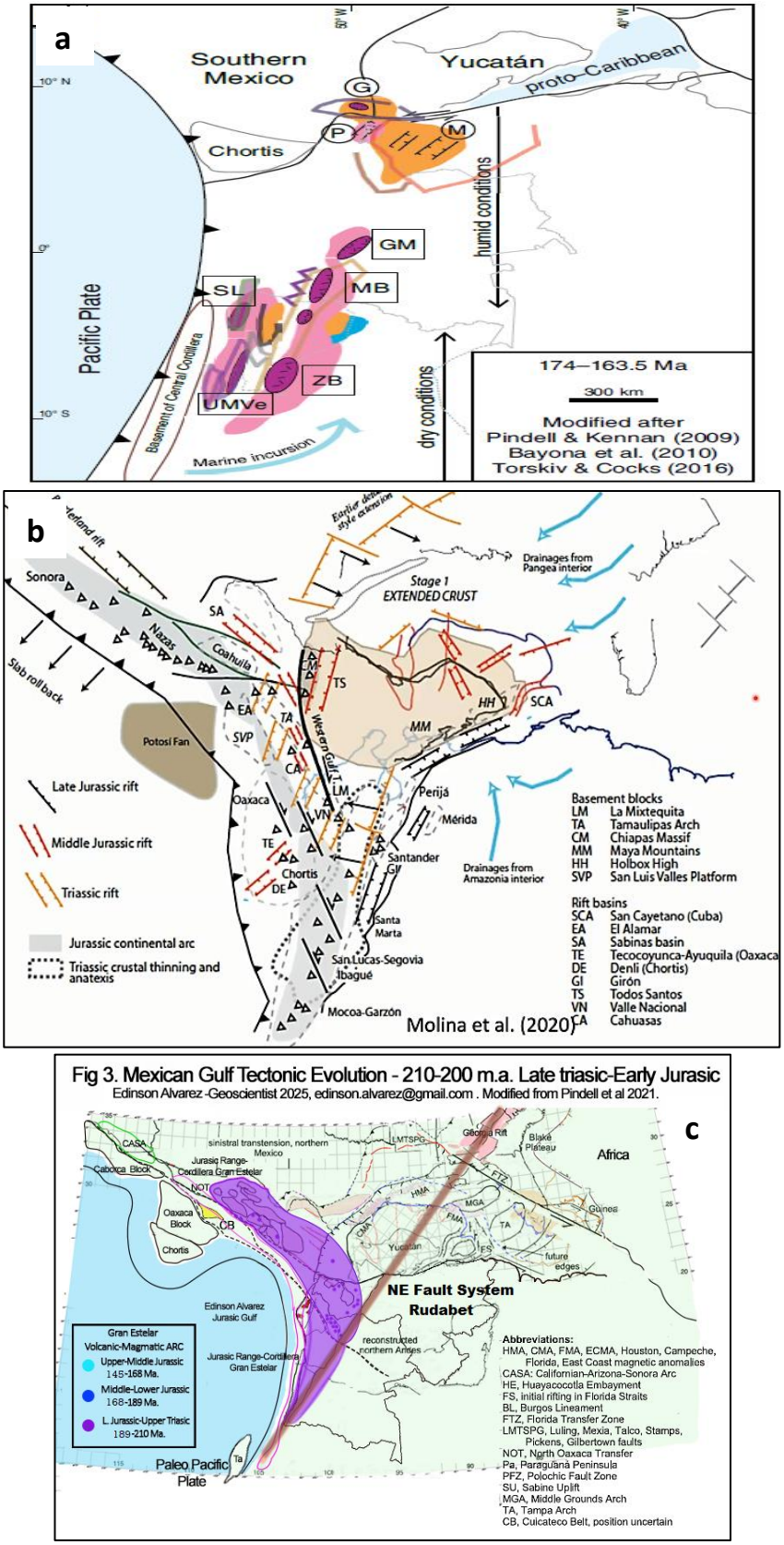

Figure 14. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a.** Modified from **Bayona et al 2019-20. b. Molina et al 2020, taken from Bayona 2021. c. Edinson Alvarez 2025-2026.**

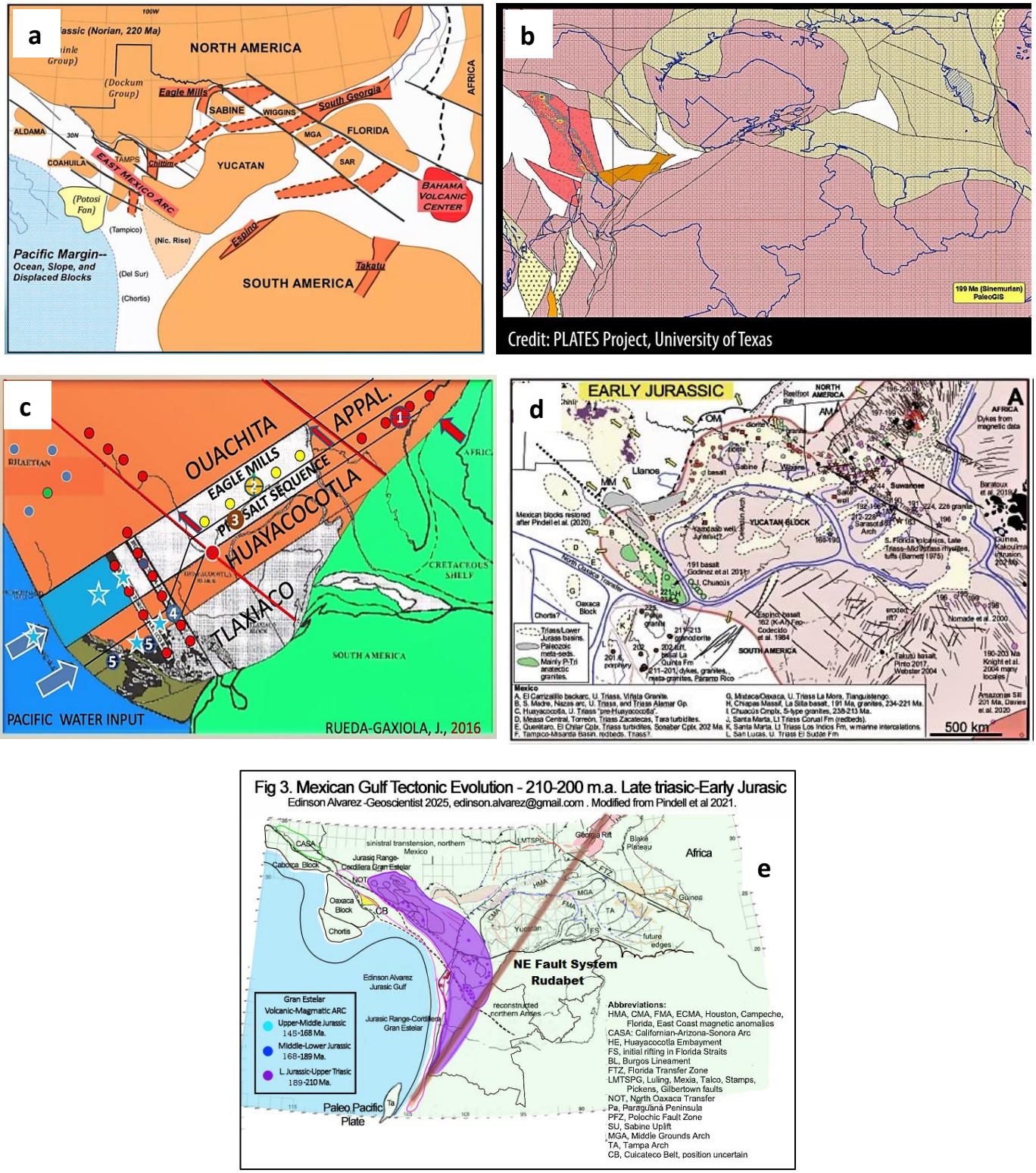

Figure 15. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Tom Ewing- 2016. b. Plates Project Texas University, taken from** Robert J. Stern and Randy Keller **2018. c. Rueda-Gaxiola J. 2016-2019 d. Pindell and Heyn 2022 e. Edinson Alvarez 2025-2026, Upper Triassic-Lower Jurassic.**

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GEOLOGIST- GEOPHYSICIST- GEOSCIENTIST SPECIALIST

Exploration Geologist, Geophysicist, Geoscientist. Expert in integrated oil-gas and mining studies with significant economic implications. Working for various multinational companies in Mexico, Peru, and Colombia.

The God Grace allow us to Develop The ¨Complex Source Theory¨, a new technique help us increasing traditional Oil, Gas and Mining discoveries – production - reserves. Providing answers to more than 100 questions of the world's most renowned Geoscientists. Twenty five (25) of them published in six articles. Uncertainties have been unresolved for more than 100 Years. **Key to finding the Giants Oil, Gas and Mining Fields for Energetic Transition.** Seeking investors and large multinational corporations for the current technological development.

Geólogist – Caldas University. (Manizales-Col.1998)

International Petroleum Industry Multimedia System (IPIMS-2011-2012)- Schlumberger Co (2013-2014). Gedco Canadian – (Texas-USA, Bogotá Col). Acquisition and processing of 2D-3D seismic data, Advanced geophysical interpretation, Petroleum Systems, Reservoir Characterization, Oil and Gas Reservoir Engineering.

Autonomous University of Bucaramanga (Mar-Dec,2022)
Software development Labor technician.

IBM – Distrital University of Colombia (Sep23-Nov2024)
Data science, Big Data, Data Analytic, Artificial Intelligence-AI, Deep Learning, Machine Learning, Python.

Diplomaed HSEQ-Certified Auditor. Colombian School of Safety - Bogotá,08.