

**SOLUTION TO THE PUZZLE OF THE ORIGIN OF THE GULF OF MEXICO-GULF OF AMERICA
DURING THE BREAKUP OF PANGEA, 200 MILLION YEARS AGO.
TOLD BY EDINSON ALVAREZ.**

**IMPORTANT CONTRIBUTIONS IN GEOSCIENCES
PROMISE TO REVOLUTIONIZE O&G&M EXPLORATION. No. 8/20.**

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- 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.

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Citas Artículos 1,2,3,4,5,6,7 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.**

Solving the 18 specific uncertainties or unanswered questions raised by renowned contemporary geoscientists and researchers worldwide, posed over more than 100 years of history and development of the petroleum industry in the Gulf of Mexico region, and resolved in this research (Articles 5 and 6 of this series). We will proceed to expand the number of scientific tests (from 15 to 19) that corroborate, support, and strengthen the presented model. We will also examine the implications of this problem for petroleum systems in a very general way.

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), And Texas University.**

This work incorporates new information of strategic relevance, which will allow us to delimit, refine, calibrate, and/or strengthen the geological and tectonic evolution model for the Gulf of Mexico-America during the Late Triassic-Jurassic period, presented in **Articles 5 and 6 of this series.** This will allow 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 a history spanning nearly 100 years, has yet to receive a satisfactory answer, and it is solved Chapters 5 and 6 and further complemented in this chapter or article.**

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.

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. The figures for this item can be seen in **Articles 5 and 6**. Some are based on the incorporation of new data into the model **(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, 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, Ruben Dario-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).

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**). **See Articles 5 and 6.**

Fig 1. Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triassic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

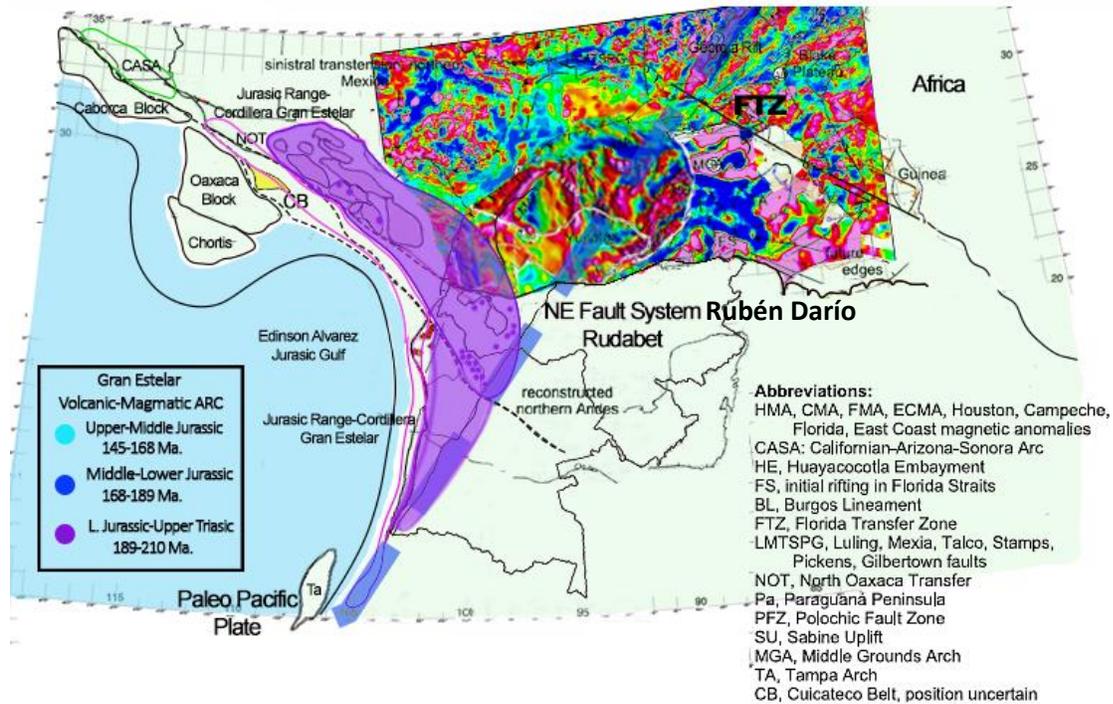


Figure 1. Main Geological, Morphological and Tectonic-Structural Features for Laurentia-Gondwana during the Late Triassic- Early Jurassic Period. 200-210 Ma. Close to 10 Structural Lineaments Control Yucatan's Position.

Fig 2. Mexican Gulf Tectonic Evolution - 154 m.a. Late Jurassic

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

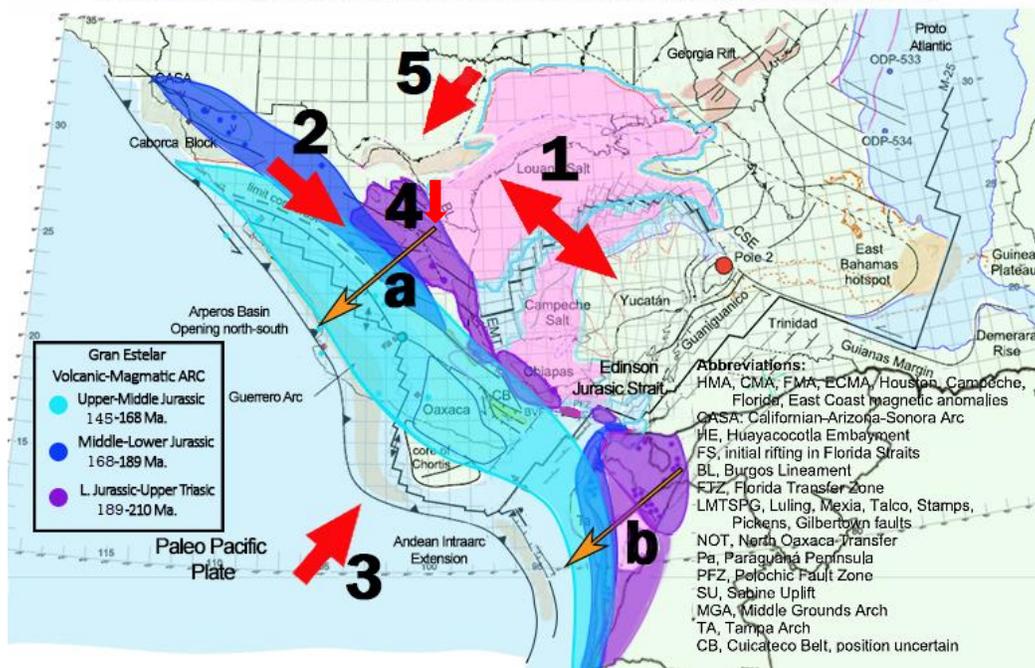


Figure 2. Distribution and Location of the East-Central-West Gran Estelar Magmatic-Volcanic Arcs, a,b. E-W Roll Back Direction Paleo Pacific Plate-FarallonesPlate, Laurentia-Godwana. **1,Pluma Mantelar 2,Fallas Transformantes 3,Subducción, 4,Colapso Gravitacional 5. Deriva Placa Norte Americana** Giganucleares Forces that Gave Origin to the Gulf of Mexico Item 4-5 Art. 6.

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, we incorporate valuable structural mapping data from rift zones, related to the works of:

Diego Osorio-Afanador, Francisco Velandia. 2021; Fabio Cediél, Robert Peter Shaw 2019, Andreína García Reyes 2018, Thesis Doctoral-Sorbonne University; Germán Bayona 2018; Pemex 1994, cited in Hernandez Martinez Oscar 2014. Tesis de Grado UNAM.

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 1,2,7,8,9,10**, for the Upper Triassic period (201.3 to 210 million years ago) –Early Jurassic. 190 million years ago, in this article.

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). The upper Magdalena valle was applying an equivalent stretch towards West. Presal sediments are not shown in this reconstruction, nor is the Tahami (Ta)-Colombia block discussed (Part of a forthcoming edition).

It is clarified that the salt deposit for Colombia mapped in **Figure 6,11 of Article 6** was largely eroded at the Middle to Upper Jurassic unconformity, with this deposit being preserved mainly in the Eastern Cordillera of Colombia, and its most outstanding expression found in the Cundinamarca Basin. **Figure 7,8 of Article 6.**

Based on the above premises, we will focus in this chapter on reconfirming our theory of the origin and evolution of the Gulf of Mexico, Gulf of America, adding four new pieces of evidence to the **15 existing pieces of evidence, referred to in article 7-Summary Articles 5 and 6 of this series (Four new pieces of the Puzzle):**

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. Geological 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)
- 16 Map of Rifts Mexican Gulf-American Gulf- Pemex 1994 (Hernandez Martinez Oscar 2014)**
- 17 Map of Rifts Península Yucatán México (Andreína García Reyes 2018)**
- 18 Map of Rifts Colombia-Venezuela N. FallaBucaramanga (FabioCediel,RobertP.Shaw 2019)**
- 19 Map of Rifts Colombia-Venezuela (Diego Osorio-Afanador, Francisco Velandia. 2021)**

The evidence presented in this **article No. 8** of this series will be referred to as pieces of the puzzle of the Origin of the Gulf of Mexico-Gulf of America, which help to reconfirm the model presented in this series to the international scientific community, corresponding to **items 16, 17, 18, 19 of the list of evidence.** The aforementioned maps have been rescaled, since the work was done on different base maps; preserving and maintaining the spatial relationships of their structural elements. **The four pieces of the Rift Puzzle and/or maps underwent restoration and fit together perfectly, like a jigsaw puzzle, in the Gulf of Mexico origin model presented by Dr. Edinson Alvarez in 2025-2026. His Complex Source Theory transformed a century-old problem into a simple board game for children.**

2.1 Pieces of the Puzzle of the Origin of the Gulf of Mexico, Gulf of America.

2.1.1 Pieces of the Puzzle No 1. Map of Rifts Mexican Gulf-American Gulf- Pemex 1994 (Hernandez Martinez Oscar 2014)

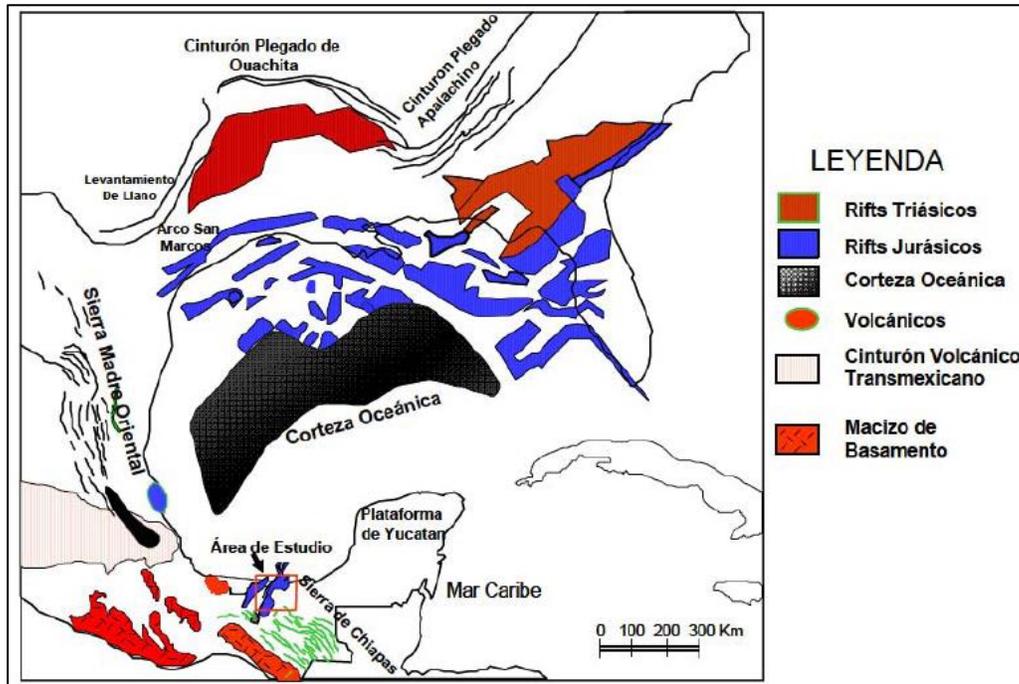


Figure 3. 16 Map of Rifts Mexican Gulf-American Gulf- Pemex 1994 (Hernandez Martinez Oscar 2014)

2.1.2 Pieces of the Puzzle No 2. Map of Rifts Península Yucatán México (Andreína García Reyes 2018-Tomado de Tectonic Analysis)

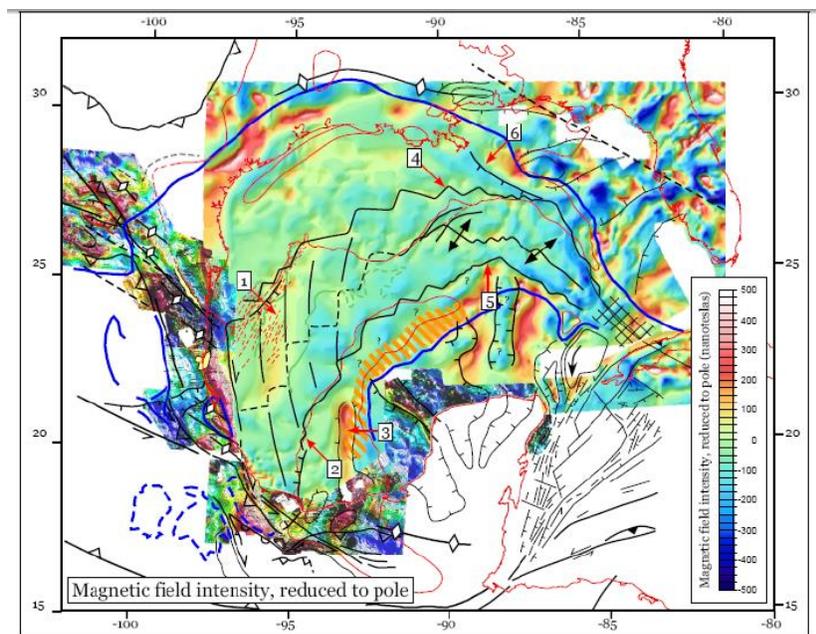


Figure 3.6 – Structural interpretation of the GoM from magnetic anomalies (from Tectonic Analysis)

Figure 4. Map of Rifts Península Yucatán México (Andreína García Reyes 2018-Taken from Tectonic Analysis)

2.1.3 Pieces of the Puzzle No 3. Map of Rifts Colombia-Venezuela N. FallaBucaramanga (Modified from Fabio Cediel, Robert Peter Shaw 2019)

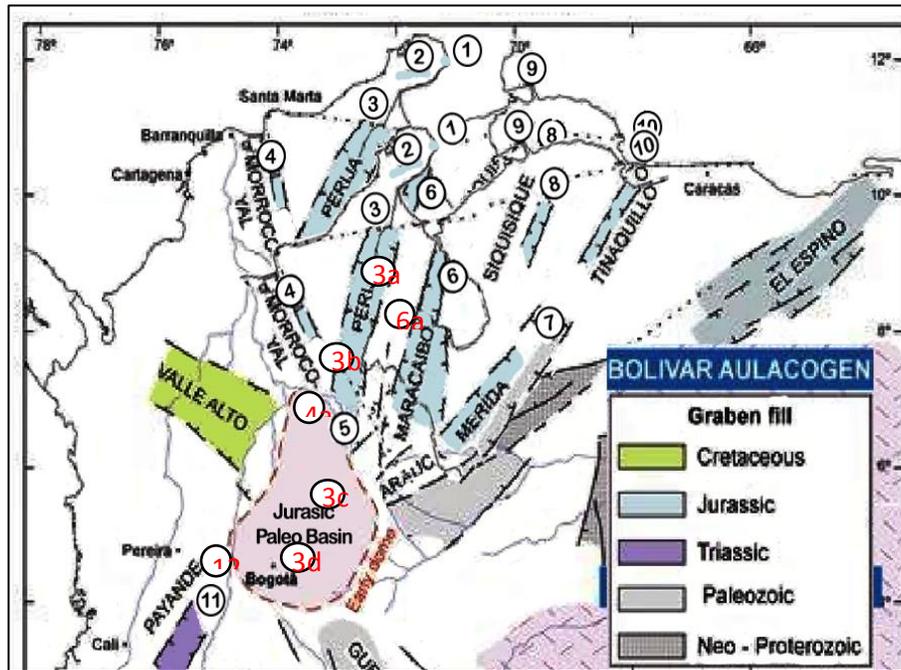
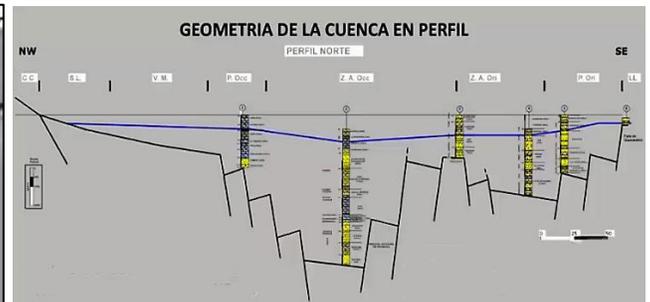
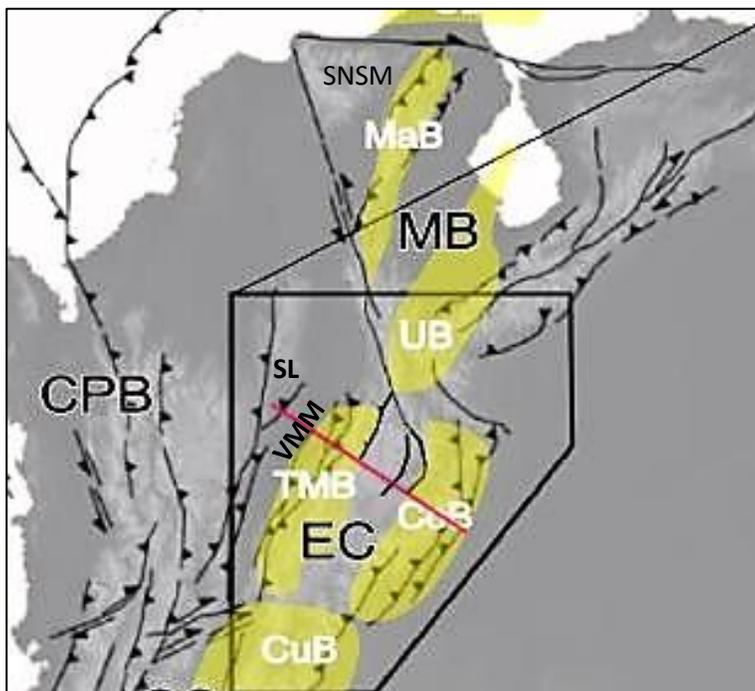


Figure 5. Map of Rifts Colombia-Venezuela N. FallaBucaramanga (Modified from Fabio Cediel, Robert Peter Shaw 2019)

2.1.4 Pieces of the Puzzle No 4. Map of Rifts Colombia-Venezuela (Modified from Diego Osorio-Afanador, Francisco Velandia. 2021)



Cretaceous stratigraphic correlation, Serrania San Lucas (SL), Valle Medio del Magdalena (VMM), Cordillera Oriental del Colombia EC (Tablazo Basin, Cucuy Basin, Cundinamarca Basin), Showing Rift Configuration of the Pre-Cretaceous Basement. Red Line Section NW-SE. Taken from Bayona 2018.

Figure 6. Map of Rifts Colombia-Venezuela (Modificado de Diego Osorio-Afanador, Francisco Velandia. 2021)

Fig.7 . Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

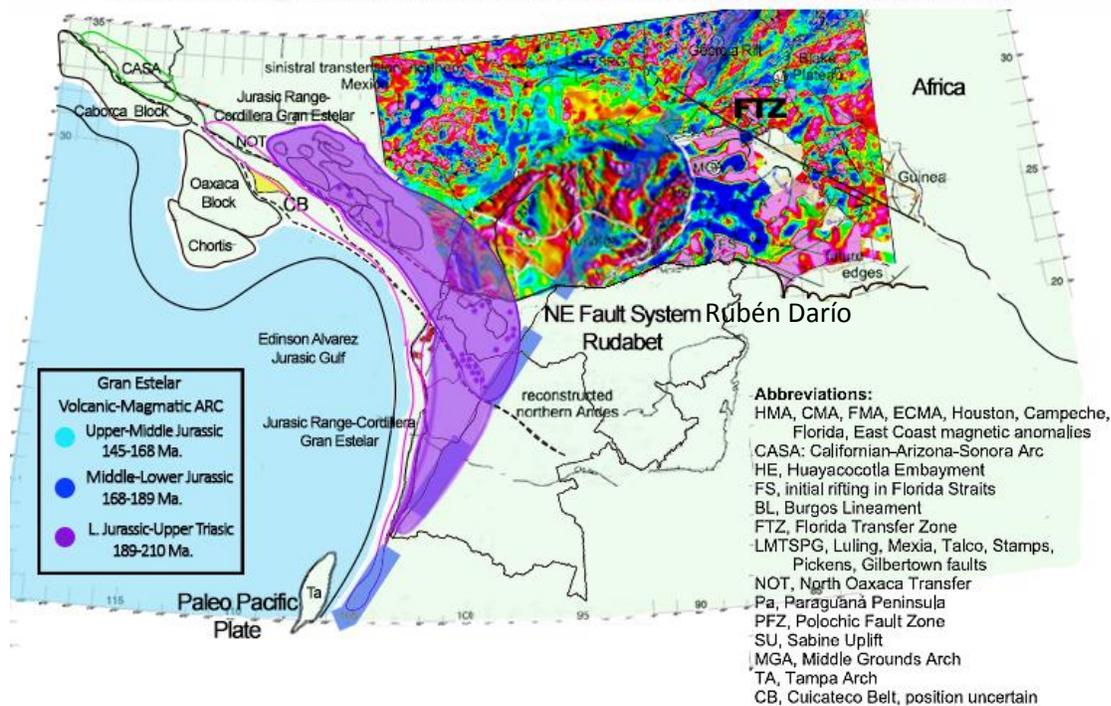


Figure 7. Main Geological, Morphological and Tectonic-Structural Features for Laurentia-Gondwana during the Late Triassic-Early Jurassic Period. 200-210 Ma. Close to 10 Structural Lineaments Control Yucatan's Position.

Fig.8 . Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

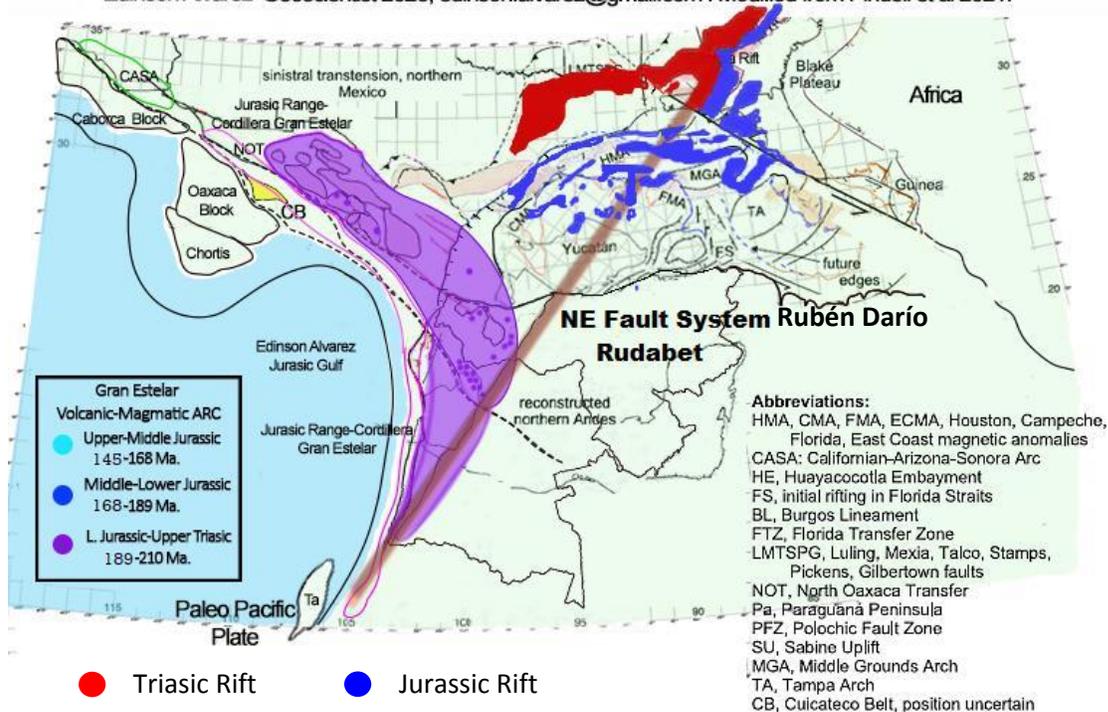


Figure 8. Triassic-Jurassic model loaded with the **puzzle piece No. 1**. 1. Map of Rifts Mexican Gulf-American Gulf Pemex 1994 (Hernandez Martinez Oscar 2014).

Fig.9 . Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

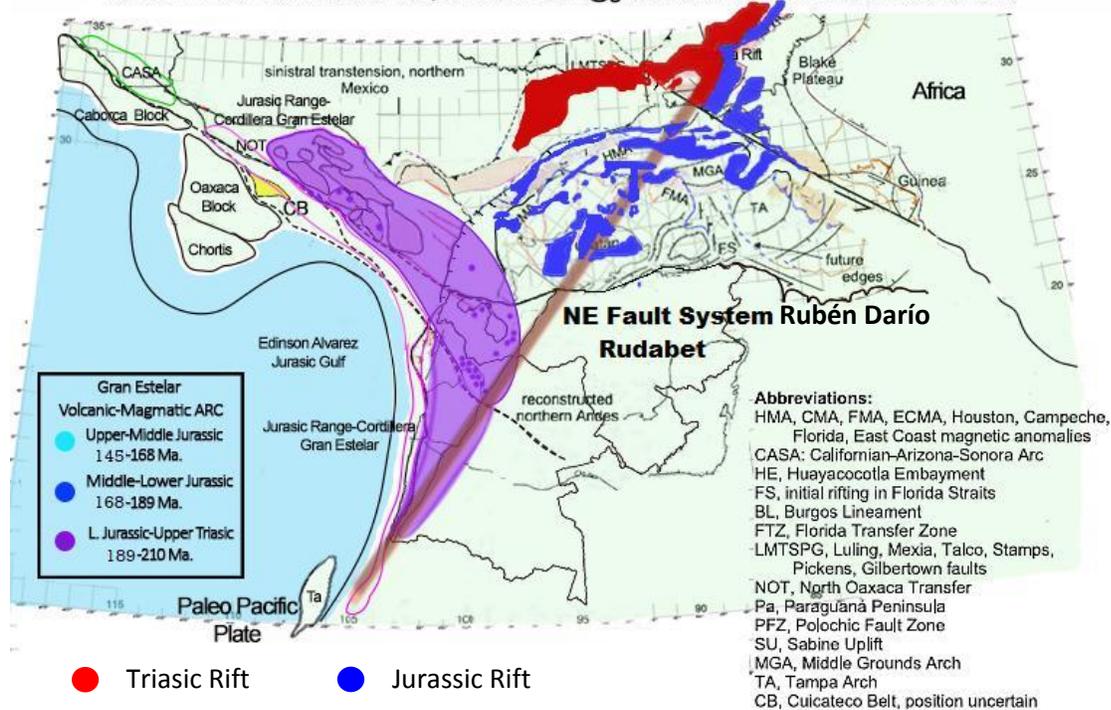


Figure 9. Triassic-Jurassic model loaded with the **puzzle piece No. 2**. 1. Map of Rifts Mexican Gulf-American Gulf Pemex 1994(HernandezMartinezOscar 2014),2. Map of Rifts Península Yucatán México (Andreína García Reyes2018-TomadodeTectonic Analysis)

Fig.10 . Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

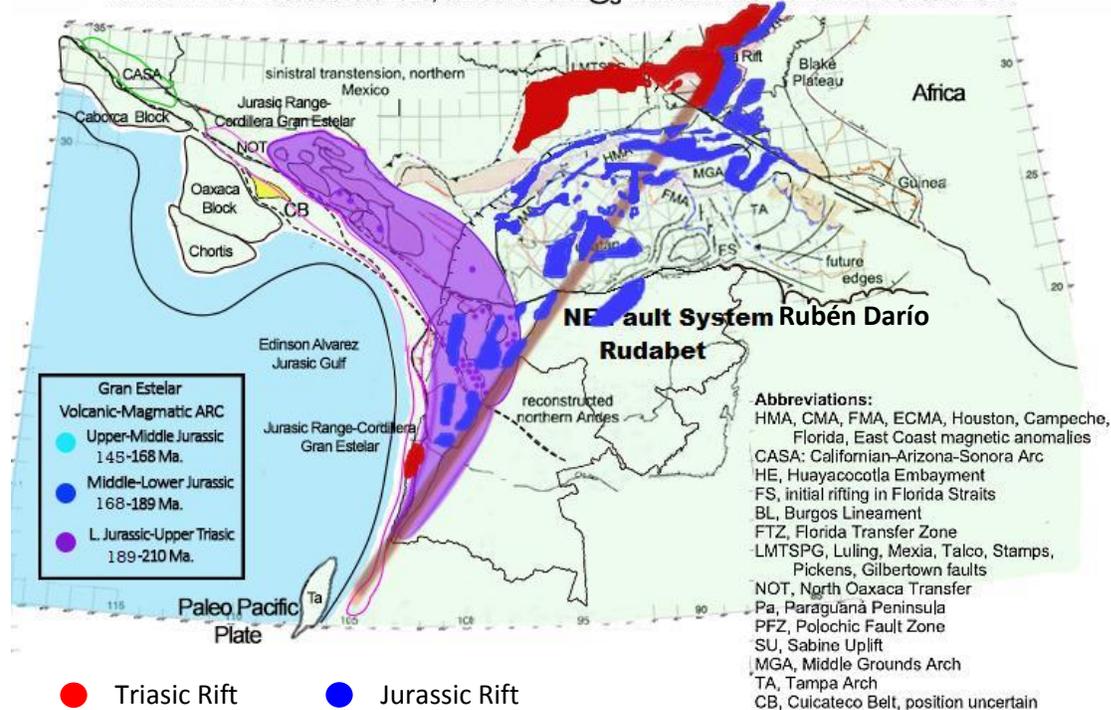


Figure 10. Triassic-Jurassic model loaded with the **puzzle piece No. 3 and 4**. 1. Map of Rifts Mexican Gulf-American Gulf Pemex 1994 (Hernandez Martinez Oscar 2014), 2. Map of Rifts Península Yucatán México (Andreína García Reyes 2018-Tomado de Tectonic Analysis), 3. Map of Rifts Colombia-Venezuela, FabioCediel,RobertPeterShaw 2019, 4. Map of Rifts Diego O. Afanador, Francisco Velandia. 2021.

In Figures 7, 8, 9, 10, it can be observed how the puzzle pieces fit together perfectly and harmoniously within the great structural escarpment of Laurentia (Gulf of Mexico-Gulf of America), controlled to the south by the Great System of Faults, Rifts, Lineaments Ruben Dario – Rudabet (Honor Ruben Dario Alvarez Betancourth Sr.)

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 Ruben Dario-Rudabet Great Fault System-Lineament (Honor to Ruben Dario Alvarez Betancourt (Father), Figures 1 and 7)**. This system controls the base of the large continental structural scarp of Laurentia (**Figure 1**). This discovery helps resolve several contemporary questions, which are central to this study Articles 5 and 6, 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 Doré, 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), 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 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 Triassic-Jurassic period.

Although improvements, refinements, and modifications can be made to the proposal presented in this study, the fact remains that the perfect tie up obtained through **the Ruben Dario-Rudabet Fault-Lineament System (Honor Ruben Dario Alvarez Betancourt-Father., Figures 1)** 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.

New and Additional Implications for Colombian Petroleum Systems

From the corresponding analysis of the items in section 4.0 of Article 5,6 of this Series, we can conclude that we are faced with **three new plays and/or hypothetical unexplored petroleum systems** in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Cordillera of Colombia.

1. **Lower Jurassic Play:** Formed by the deposition of organic shales, carbonates, chert 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. **Upper Jurassic Play:** Formed by the deposition of organic shales, carbonates, chert from the Upper Jurassic - Hypothetical **Toca or Tocancipá Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Mexican Gulf-American Gulf Oil Source Formations, (Marine and Marines Facies). Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and seal of Fomeque formation and allochthon salt. It is also the source rock for the Une Formation Reservoir Rock. (A more comprehensive analysis of evidence for this play can be obtained from the author of this article).
3. **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 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 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 we have just reconfirmed our model on the origin and tectonic evolution of the Gulf of Mexico-Gulf of America, with its positive implications for the processes of new discoveries, exploration, and production in the mining and oil fields of the countries that are part of this study.

The evidence presented in this **article No. 8** of this series will be referred to as pieces of the puzzle of the Origin of the Gulf of Mexico-Gulf of America, which help to reconfirm the model presented in this series to the international scientific community, corresponding to **items 16, 17, 18, 19 of the list of evidence**. The aforementioned maps have been rescaled, since the work was done on different base maps; preserving and maintaining the spatial relationships of their structural elements. **The four pieces of the Rift Puzzle and/or maps underwent restoration and fit together perfectly, like a jigsaw puzzle, in the Gulf of Mexico origin model presented by Dr. Edinson Alvarez in 2025-2026. His Complex Source Theory transformed a century-old problem into a simple board game for children. Fig 10.**

New and Additional Implications for Colombian Petroleum Systems

From the corresponding analysis of the items in section 4.0 of Article 5,6 of this Series, we can conclude that we are faced with **three new plays and/or hypothetical unexplored petroleum systems** in the Cundinamarca Basin, belonging to the Jurassic paleobasin of the Eastern Cordillera of Colombia.

1. **Lower Jurassic Play:** Formed by the deposition of organic shales, carbonates, chert 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. **Upper Jurassic Play:** Formed by the deposition of organic shales, carbonates, chert from the Upper Jurassic - Hypothetical **Toca or Tocancipá Formation** of Edinson Alvarez 2025 (Source Rock) contemporaries with Mexican Gulf-American Gulf Oil Source Formations, (Marine and Marines Facies). Interdigitated towards the edges of the Basin with detrital volcanosedimentary, slope deposits, debris flows, turbidites (Reservoir Rock) and seal of Fomeque formation and allochthon salt. It is also the source rock for the Une Formation Reservoir Rock. (A more comprehensive analysis of evidence for this play can be obtained from the author of this article).
3. **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.

3. 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 1,2,7,8,9,10. Twenty comparative Models in the last decade Fig. 11,12,13,14,15,16).

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...**

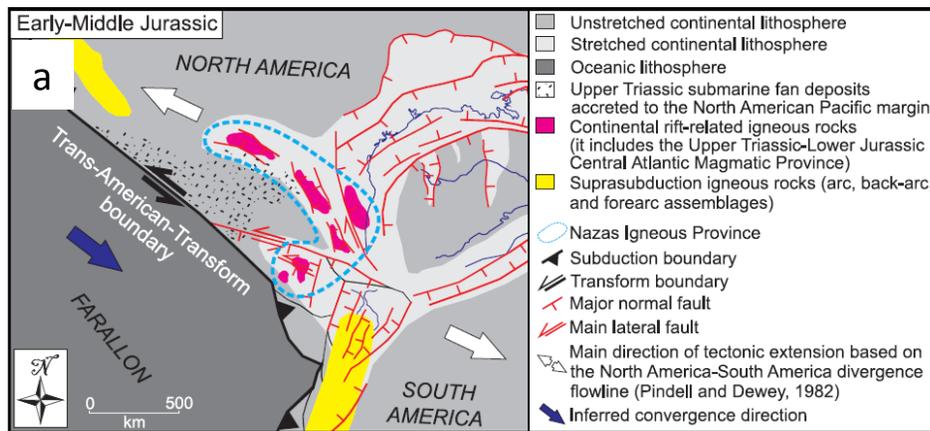


Fig. 13. (Colour online) Geotectonic reconstruction of the North America - South America divergent boundary during Early-Middle Jurassic time (~190-170 Ma; after Boschma et al. 2014; Bayona et al. 2020; Erlich & Pindell, 2021 and Pindell et al. 2021). The reconstruction shows the novel interpretation of the Nazas province as a magmatic province 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 transform boundary.

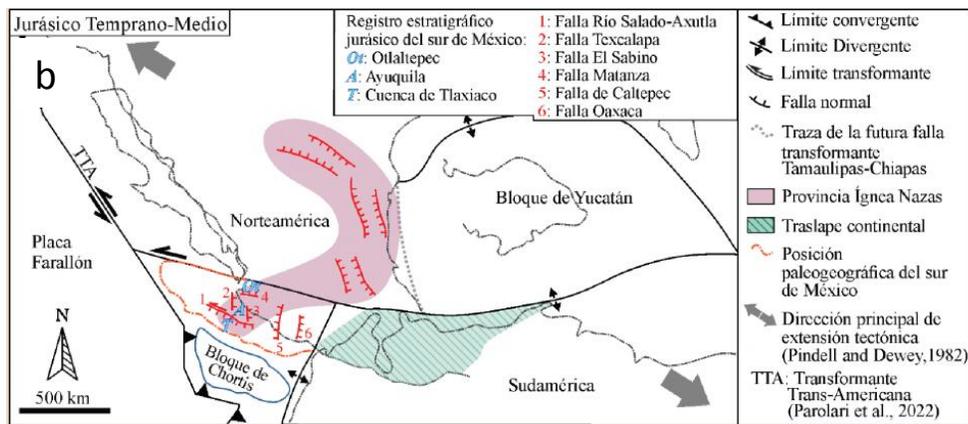


Figura 2. Reconstrucción paleogeográfica del margen oeste ecuatorial de Pangea durante el Jurásico Temprano-Medio, mostrando la posición paleogeográfica del sur de México en una posición más noroccidental y la localización de las fallas mayores que delimitaron las cuencas desarrolladas durante el desarrollo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

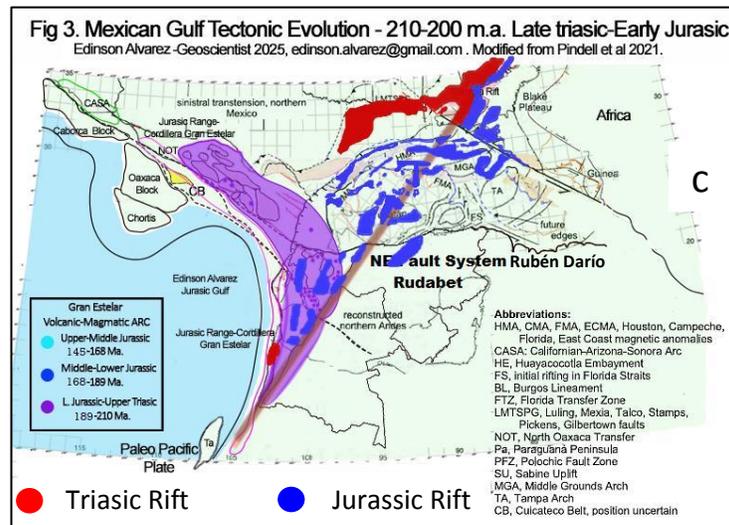


Figure 11. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in a. Parolari M, Martini M. et al 2022. b. María Patricia Velasco de León 2024. c. Edinson Alvarez 2025-2026.

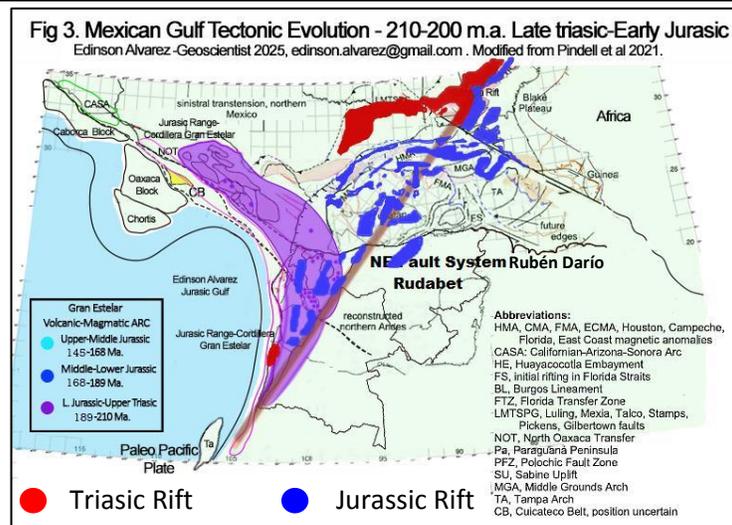
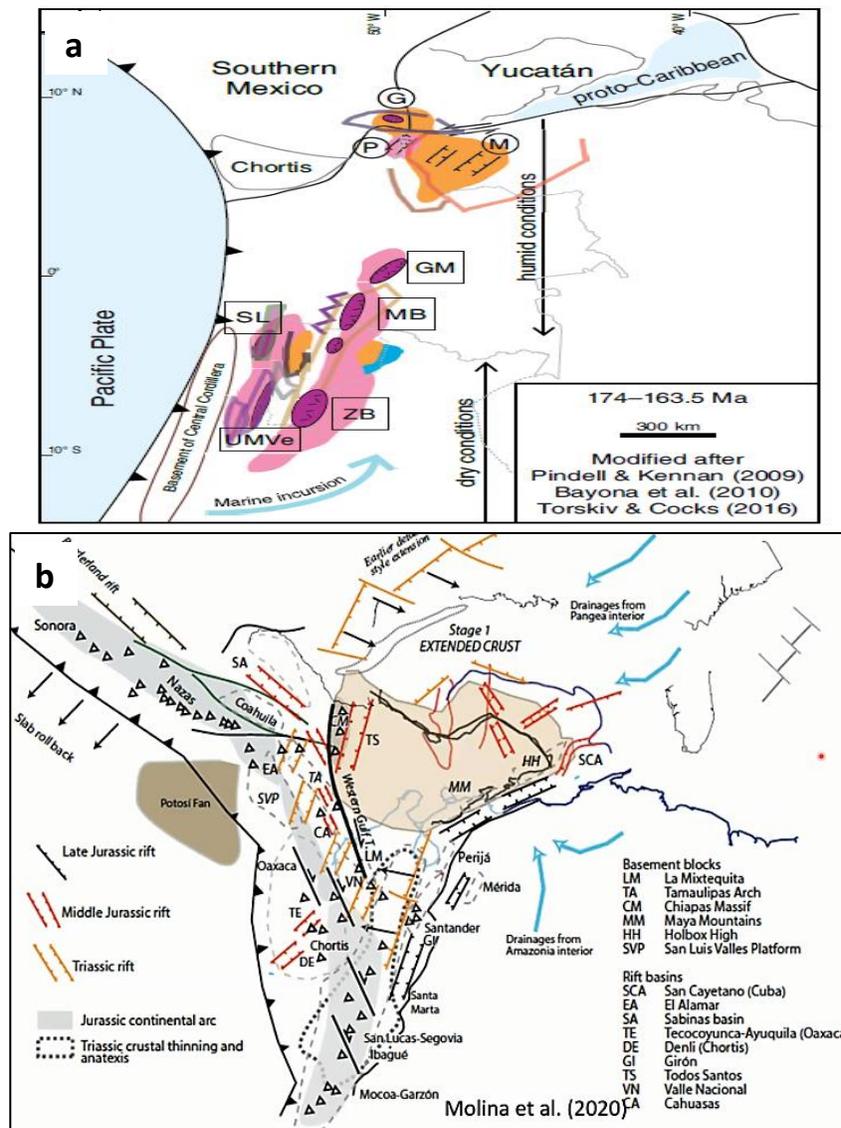


Figure 12. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a.** Modified from Bayona et al 2019-20. **b.** Molina et al 2020, taken from Bayona 2021. **c.** Edinson Alvarez 2025-2026.

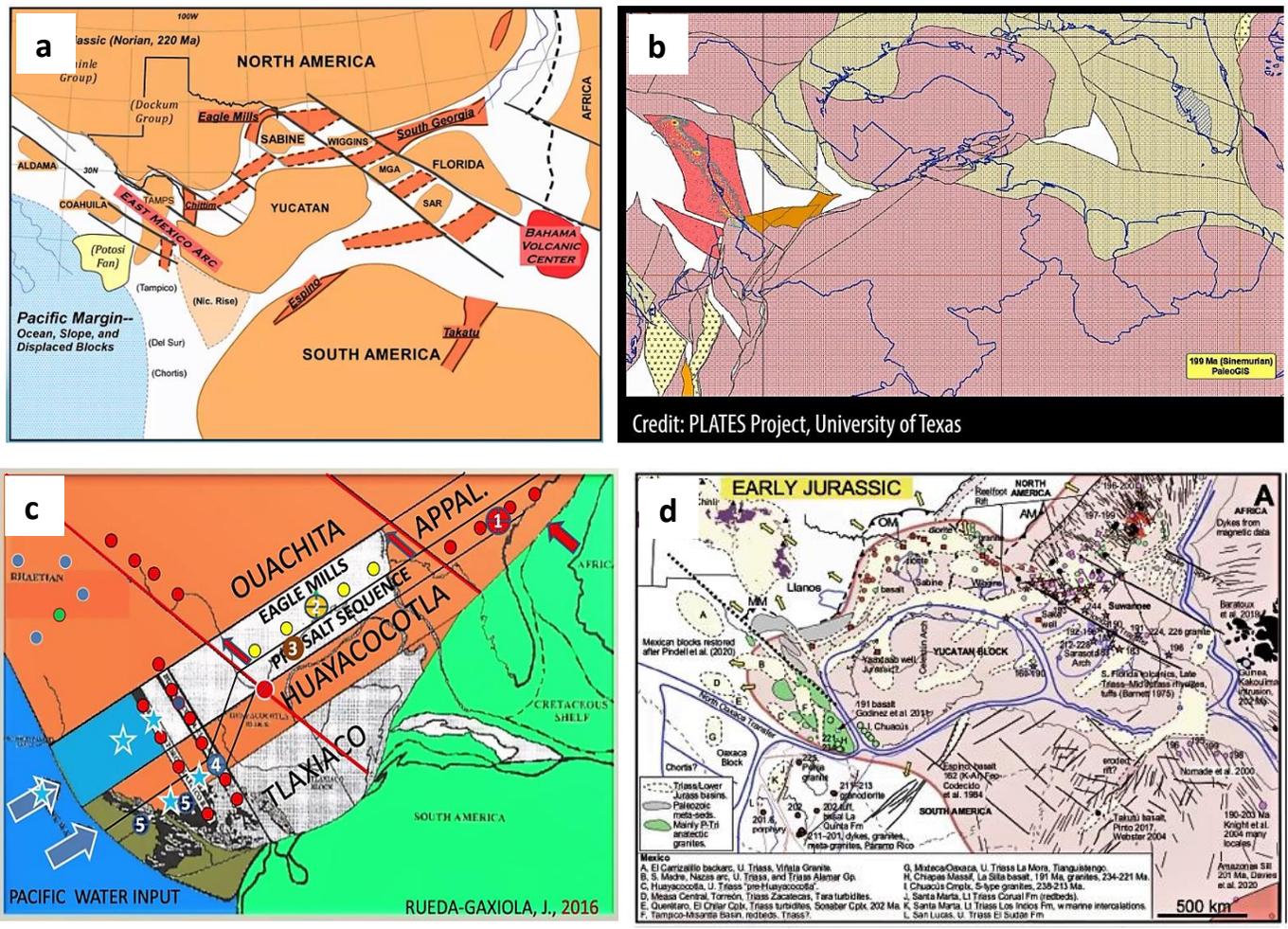


Fig 3. Mexican Gulf Tectonic Evolution - 210-200 m.a. Late triasic-Early Jurassic
 Edinson Alvarez -Geoscientist 2025, edinson.alvarez@gmail.com . Modified from Pindell et al 2021.

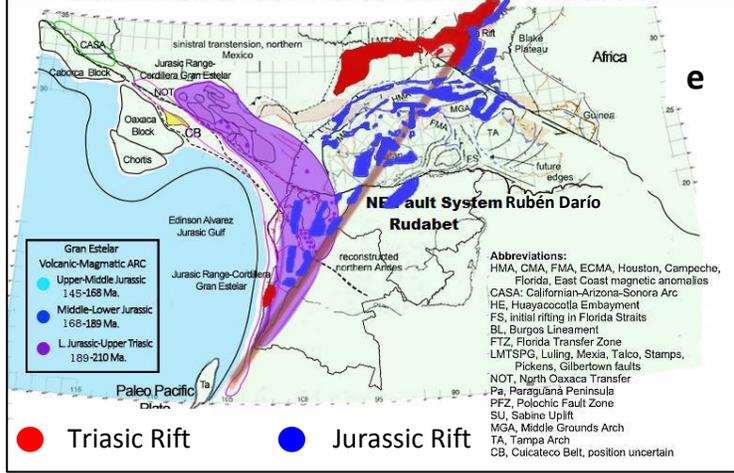
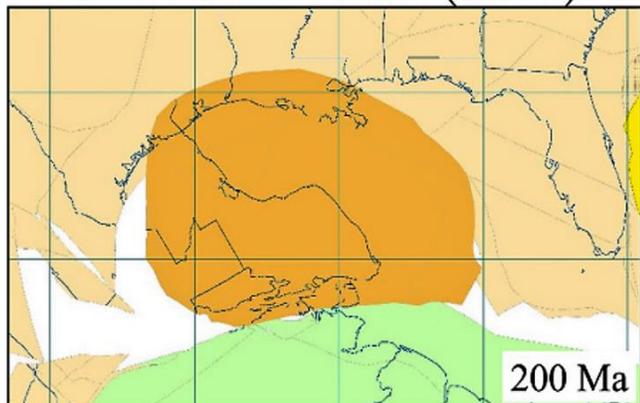
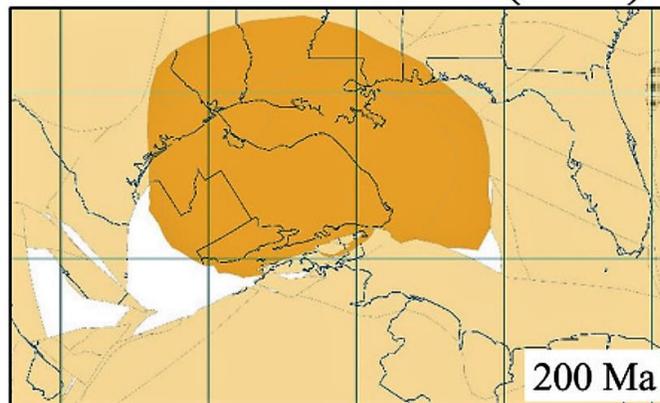


Figure 13. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Tom Ewing- 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.**

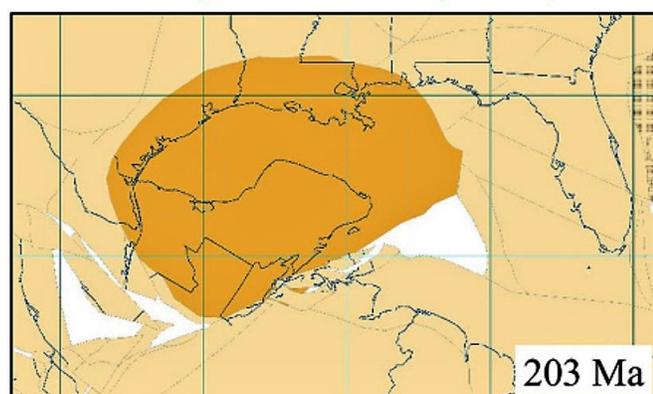
a Filina and Beutel (2021)



b Kneller and Johnson (2011)



c Minguez et al. (2020)



d Lundin and Doré (2017)

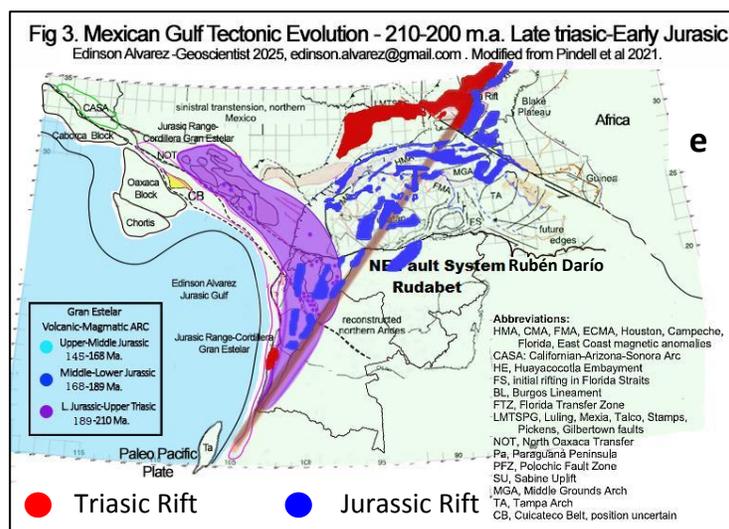
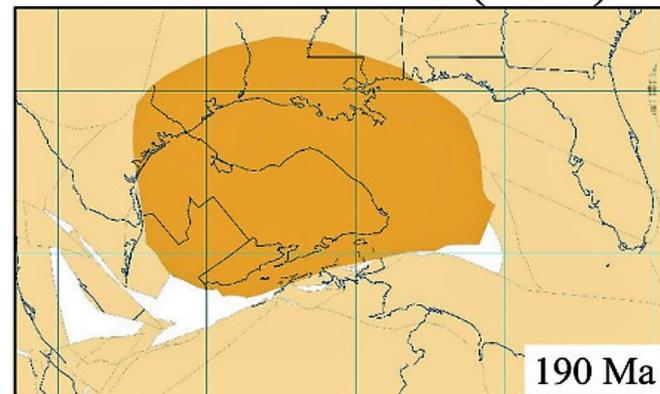


Figure 14. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Filina am Beutel 2021. b. Kneller and Jhonson 2021. c. Minguez et al 2020. d. Ludin and Doré 2017 e. Edinson Alvarez 2025-2026, Upper Triassic-Lower Jurassic. Taken from Irina Filina , James Austin, Tony Dor'e , Elizabeth Johnson , Daniel Minguez , Ian Norton , John Snedden , Robert J. Stern. 2022.**

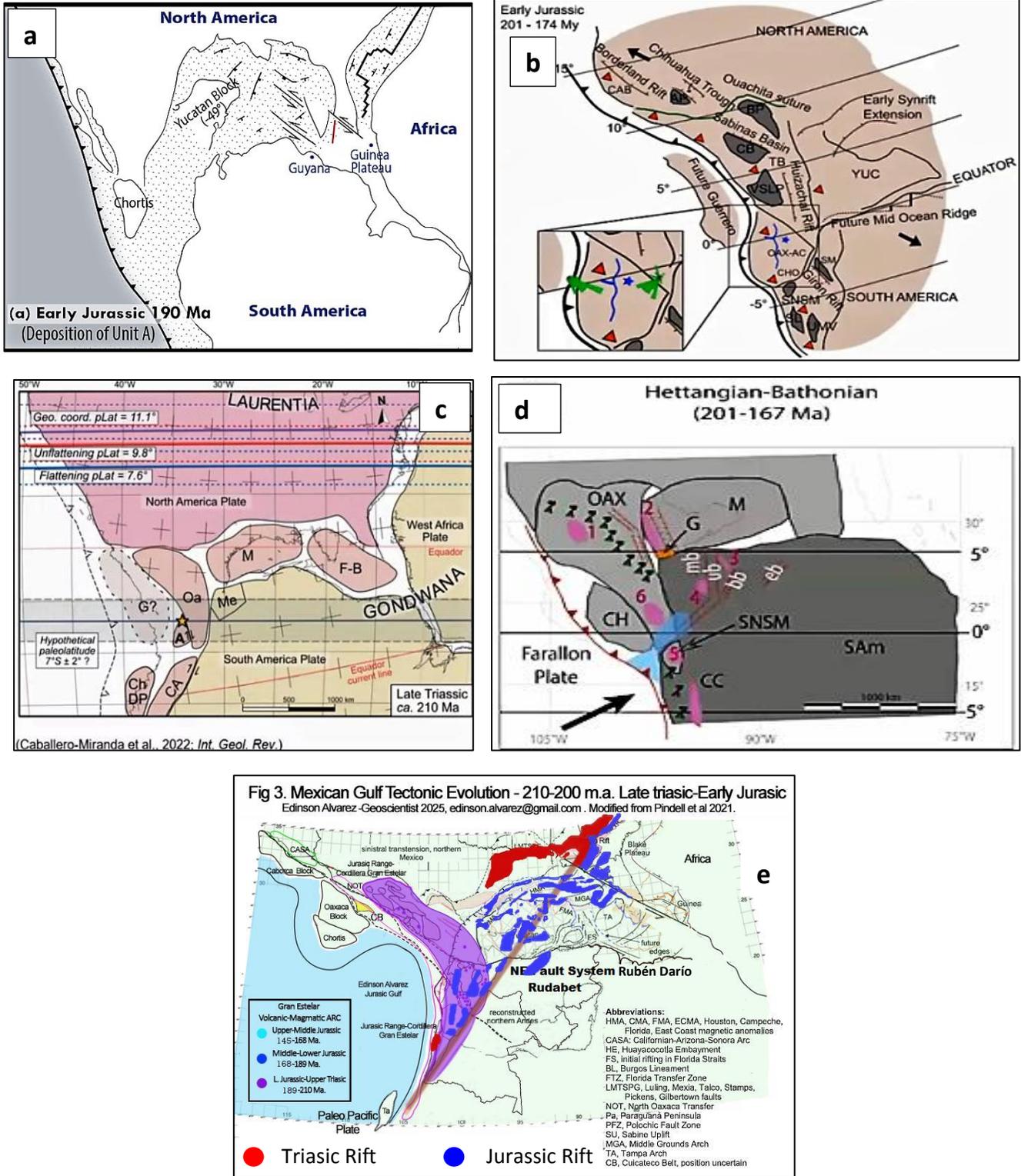


Figure 15. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a. Oliviera de Sa, A., et al 2024. b. - Diego Alberto Osorio-Afanador, 2020. c. Caballero-Miranda Et al 2022, Taken from Bernardo Ignacio García Amador-2024 d. Nova et al 2019 Taken from Bayona 2021-2022 e. Edinson Alvarez 2025-2026, Upper Triassic-Lower Jurassic.**

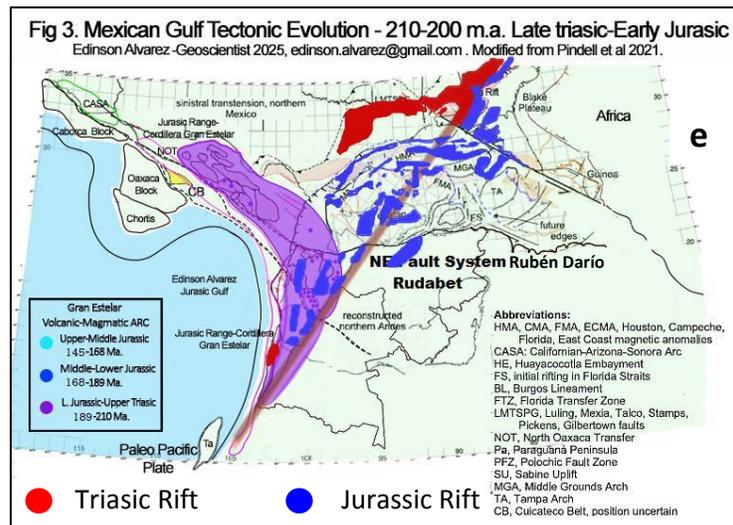
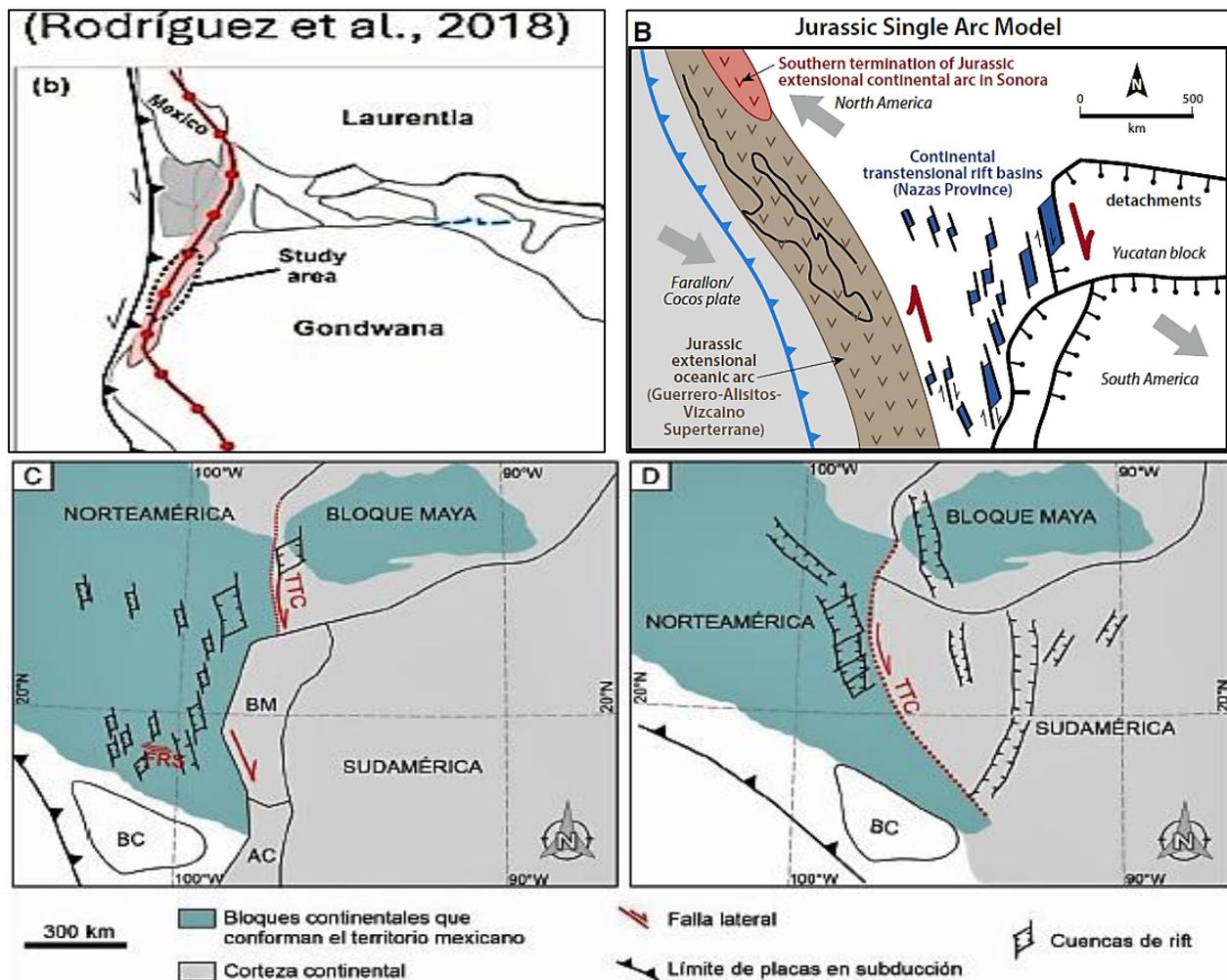


Figure 16. Comparison of the model presented in this work Edinson Alvarez 2025-26, with tie down structural, tectonic, geochronological, geochemical, stratigraphic, sedimentological, petrographic, paleontological, volcanological, among others, with respect to recent models published in **a, Rodríguez et al 2018 taken from Camilo Bustamante 2026 b. Martini an Ortega Gutierrez 2018, Taken from C.J. Busby and E. Centeno-García.2022 c. Martini y Ortega Gutierrez 2018 d. Nova et al 2019 (c.d. taken from Mildred Del Carmen Zepeda Martinez - Tesis Doctoral UNAM. 2021 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 August edition 2025, pag. 48-49), <https://revistamaya.com/wp-content/uploads/2025/07/Revista-Maya-Geociencias-Agosto-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/wp-content/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-175-192): 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. Diciembre 2025. 39 p. <https://revistamaya.com/wp-content/uploads/2025/12/Revista-Maya-Geociencias-EDICION-ESPECIALXXVII-2025.pdf>

Article-6(páginas-177-215): Alvarez Serrato Edinson Dario, 2026. The Five Giganuclear Geological And Tectonic Forces That Gave Rise To The Gulf Of Mexico. Told By Edinson Alvarez. 42 p. <https://revistamaya.com/wp-content/uploads/2026/02/Revista-Maya-Geociencias-EDICION-ESPECIAL-XXVIII-2026.pdf> Articles 5 and 6, Spanish and english versión.

Article-7(páginas-128-136): Alvarez Serrato Edinson Dario, 2026. Resume Art 5- 6. The Five Giganuclear Geological And Tectonic Forces That Gave Rise To The Gulf Of Mexico. And The third part of the Gulf of Mexico that belongs to Colombia. Told By Edinson Alvarez. 12 p. <https://revistamaya.com/wp-content/uploads/2026/03/Revista-Maya-Geociencias-Marzo-2026.pdf>

The prestigious **Colombian Geological Society (SCG)** has joined in disseminating the recognition through the delivery of this communication via email:

De: **Sociedad Colombiana de Geología** <asistente.scg.7@gmail.com>
Date: mié., 17 sep. 2025 9:48 a. m.
Subject: Asunto: Reconocimiento al geólogo Edinson Darío Álvarez Serrato
To: [Enviado a Miembros con Mensaje Oculto para edinson.alvarez@gmail.com](#)

Buen día,

Miembros de la Sociedad Colombiana de Geología y Comunidad Geológica en general.

La Sociedad Colombiana de Geología se complace en compartir con sus miembros el reconocimiento otorgado al geólogo **Edinson Darío Álvarez Serrato**, egresado de la Universidad de Caldas, por parte del **Instituto de Investigaciones en Estratigrafía (IIES)** y la **Maestría en Ciencias de la Tierra de la Universidad de Caldas**, así como por la **profesora Clemencia Gómez del Departamento de Geociencias de la Universidad Nacional de Colombia**.

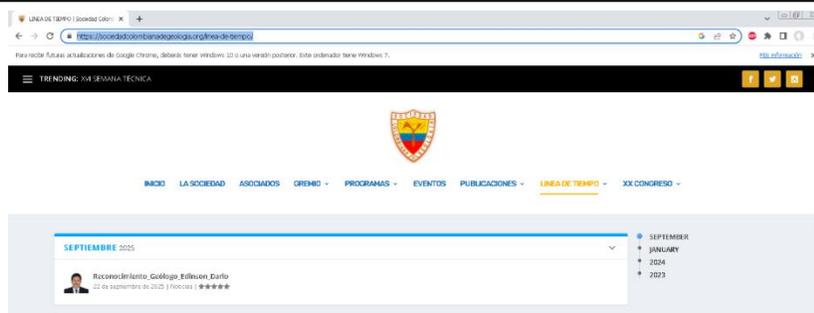
El geólogo Álvarez Serrato, especialista en exploración y con cédula profesional MP 1757 – CPG, ha desarrollado una destacada trayectoria profesional en los campos de la exploración y producción de petróleo, gas, minería y recursos ambientales (O&G&M&M). Sus aportes incluyen la integración de información geológica, geofísica y geoquímica en escenarios de alta complejidad geológica, tectónica y estructural.

Las instituciones que le otorgaron este reconocimiento resaltan la importancia de su trabajo en áreas estratégicas para el país y el mundo, tales como la energía (petróleo y gas), la minería, la geotecnia, la energía geotérmica, la transición energética, la biodiversidad y el cambio climático.

Con este mensaje, la Sociedad Colombiana de Geología se suma a difundir este reconocimiento y felicita al geólogo Edinson Darío Álvarez Serrato por los logros alcanzados en su trayectoria profesional y académica.

3 attachments

Download all ↓



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).**

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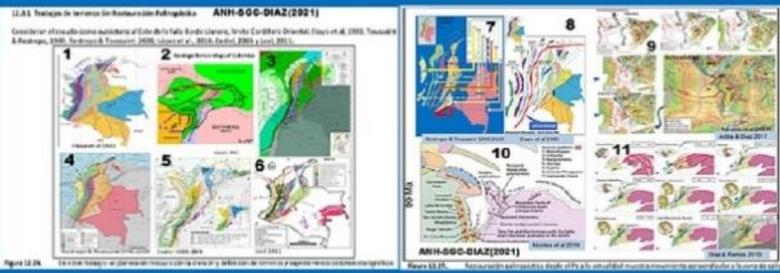
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