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# **Study on Distribution Features of Faults Based on Gravity Data in the Gulf of Mexico and its Adjacent Areas**

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## **1 Research purposes**



## **2 Faults identification method**



## **3 Distribution Features of Faults**

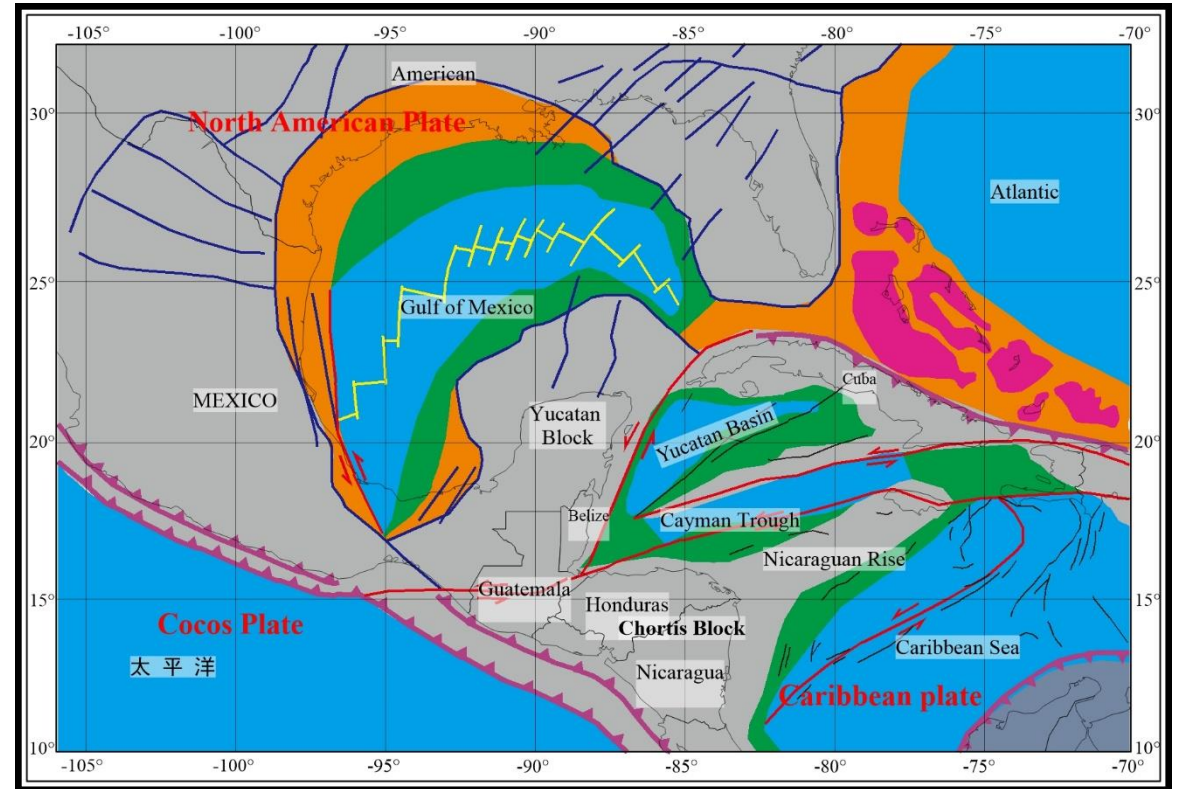


## **4 Conclusion**

# ■ 1 Research purposes——Research area



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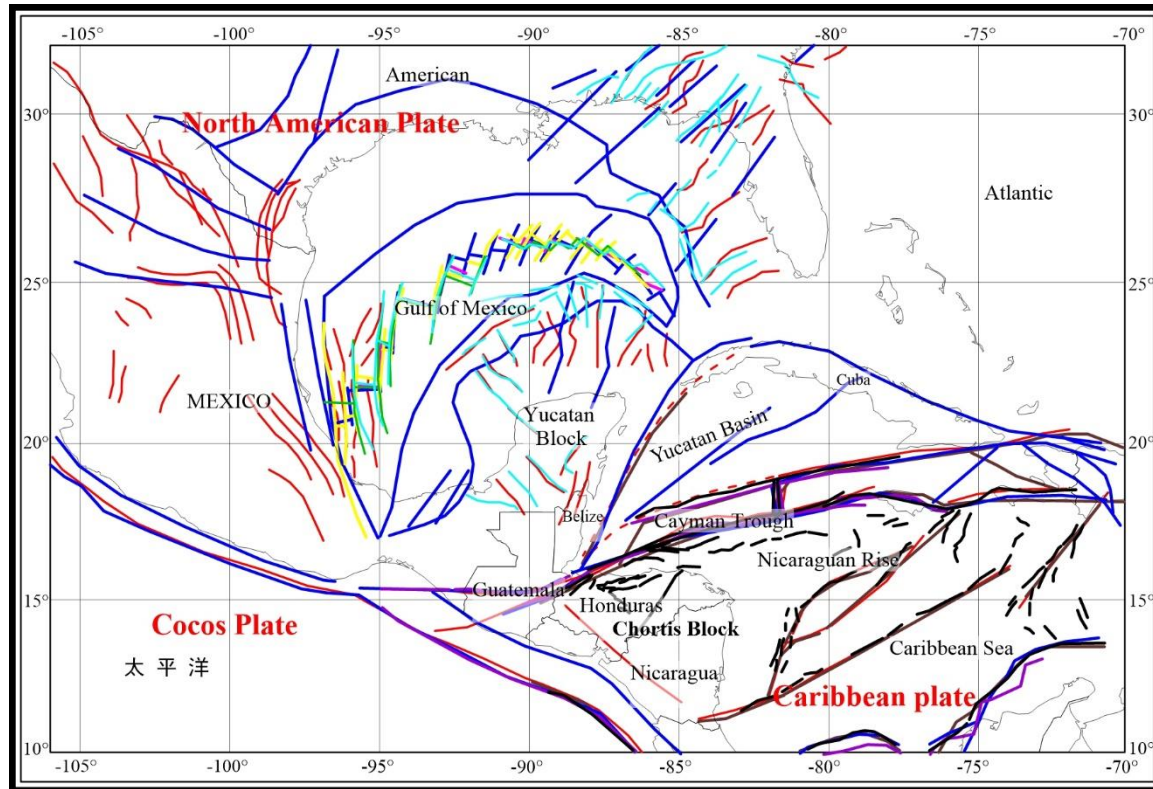
Tectonic framework in the Gulf of Mexico and its Adjacent  
(Murad Ismael , 2014)



# ■ 1 Research purposes



Faults can affect plate boundaries and sedimentary basins in study area.  
Faults is an effective way to study structural evolution in study area.



— Sanchez J, 2019	— Lin P, 2018	— Nguyen L C, 2016
— Pindell J, 2016	— Lücke OH, 2015	— Sandwell, 2014
— Ismael M, 2014	— Neill I, 2013	— Pindell J, 2009

Previous research results

## Distribution of multiple types of fractures:

According to the depth: sedimentary layer fault, supracrustal fault and lithospheric fault.

According to the origin: mid-ocean ridge system fault, transform fault, strike slip fault ;

## ➤ Existing problems

The type of fracture is less controversial. However, there is much controversy about the direction, extension length and location of some fractures



**1 Research purposes**



**2 Faults identification method**



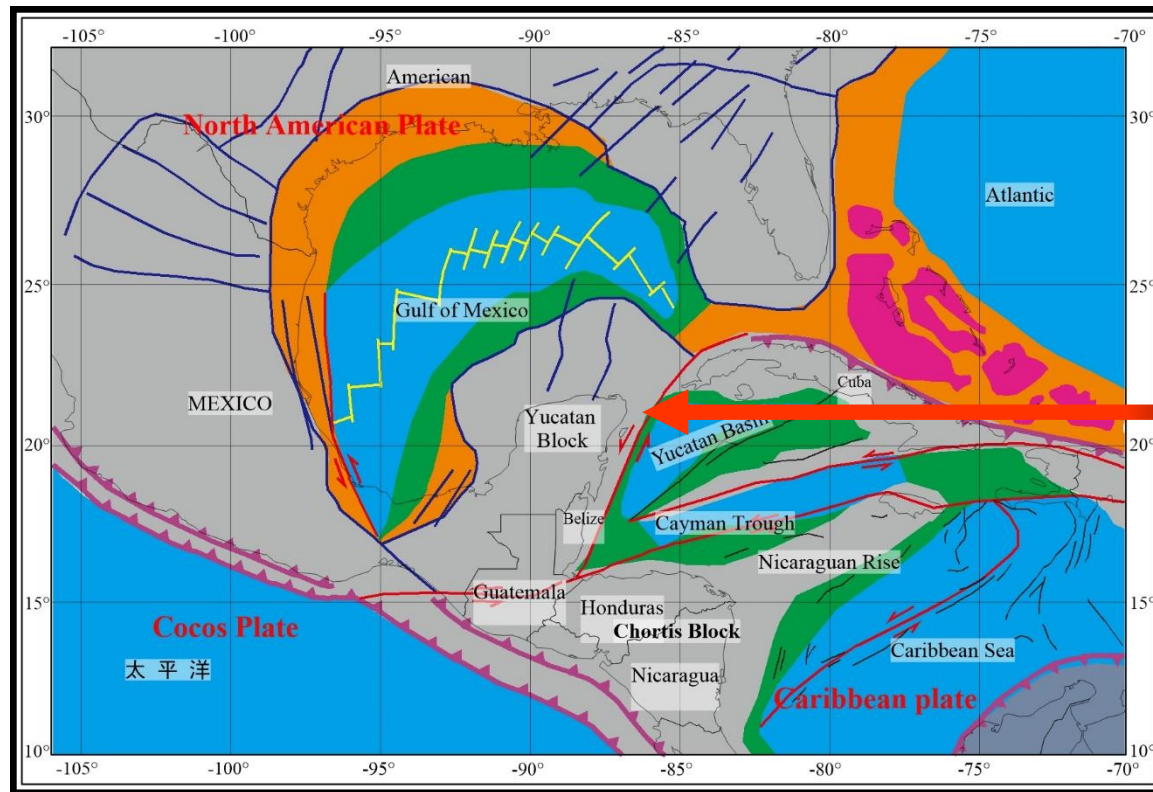
**3 Distribution Features of Faults**



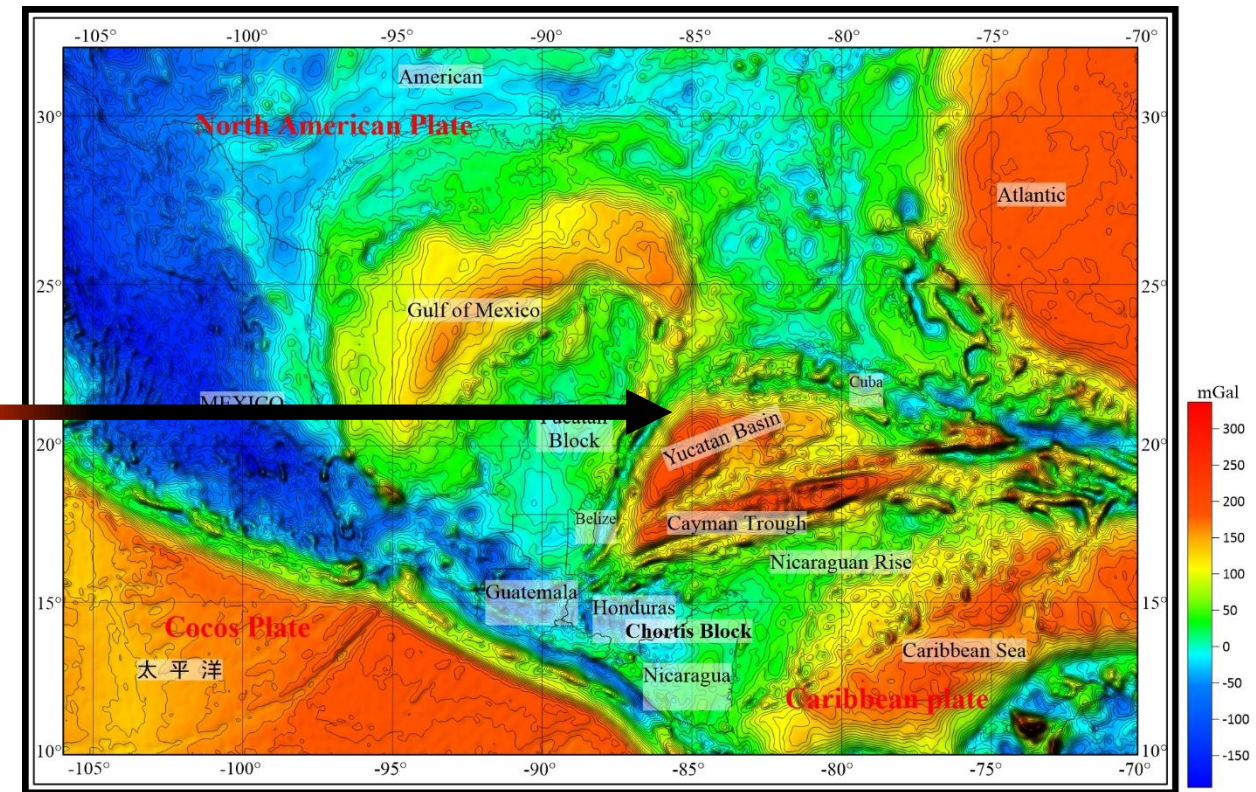
**4 Conclusion**

## ■ 2 Faults identification method

Because the fault divides different layer, the lateral density of the layer is different. On the gravity anomaly, there is the step belts between high gravity and low gravity.



Tectonic framework in the Gulf of Mexico and its Adjacent  
(Murad Ismael , 2014)



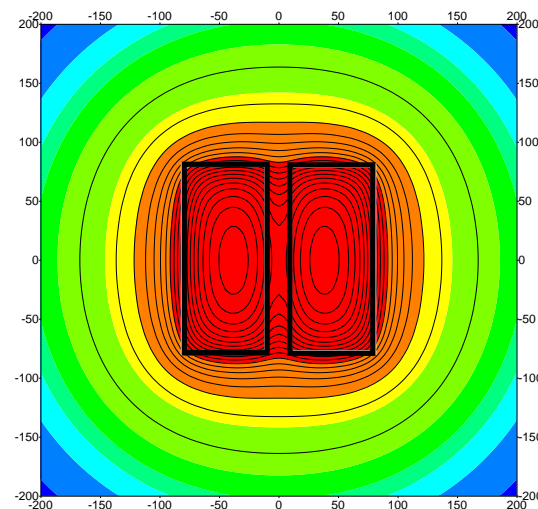
Bouguer Gravity Anomaly



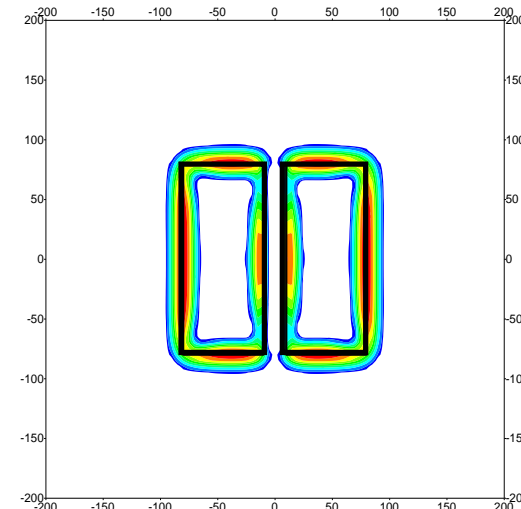
### Faults identification method :

Normalized Vertical Derivative of the Total Horizontal Derivation , NVDR-THDR

(Wang W Y, Pan Y, Qiu Z Y. 2009. A new edge recognition technology based on the normalized vertical derivative of the total horizontal derivative for potential field data. Applied Geophysics, 6(3): 226-233.)



Gravity Anomaly



Gravity Anomaly NVDR-THDR

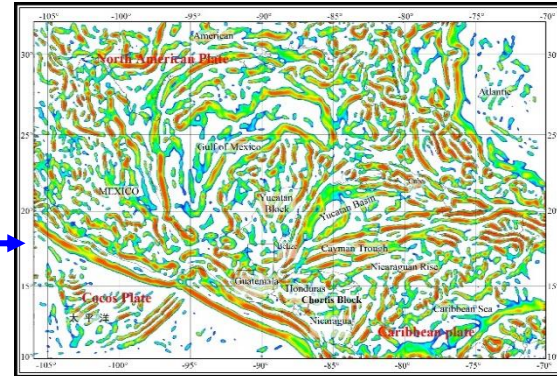
## ■ 2 Faults identification method



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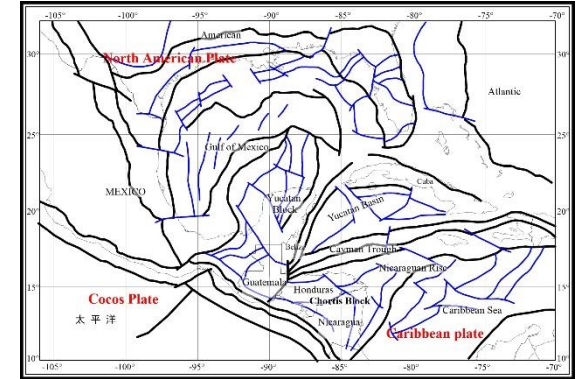
Previous research results

Faults  
identification  
method

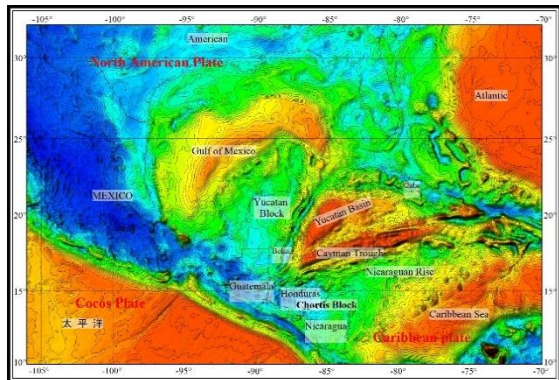


Bouguer Gravity Anomaly NVDR-THDR

The maximum  
value of the  
connection

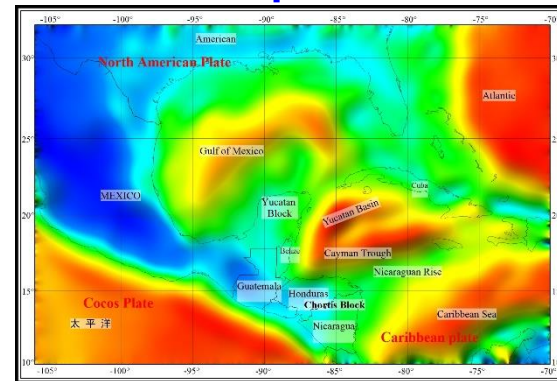


Distribution Features of the Fault

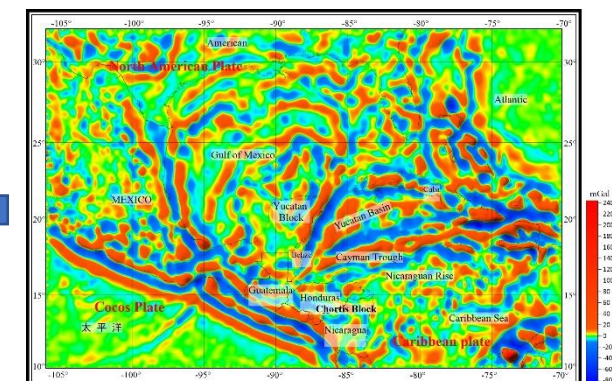


Bouguer Gravity Anomaly

The minimum curvature  
technique potential field data  
separation(Ji X L, Wang W Y,  
Qiu Z Y.2015)



Regional Bouguer Gravity Anomaly



Residual Bouguer Gravity Anomaly





**1 Research purposes**



**2 Faults identification method**

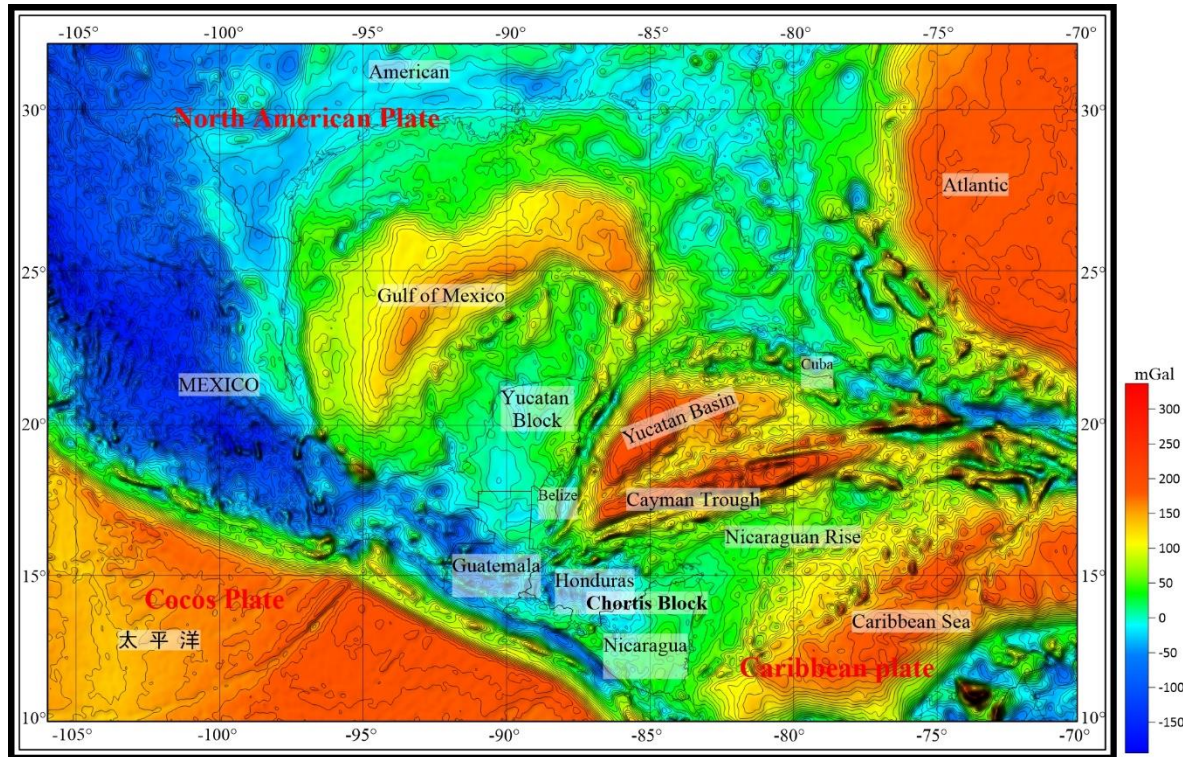


**3 Distribution Features of Faults**

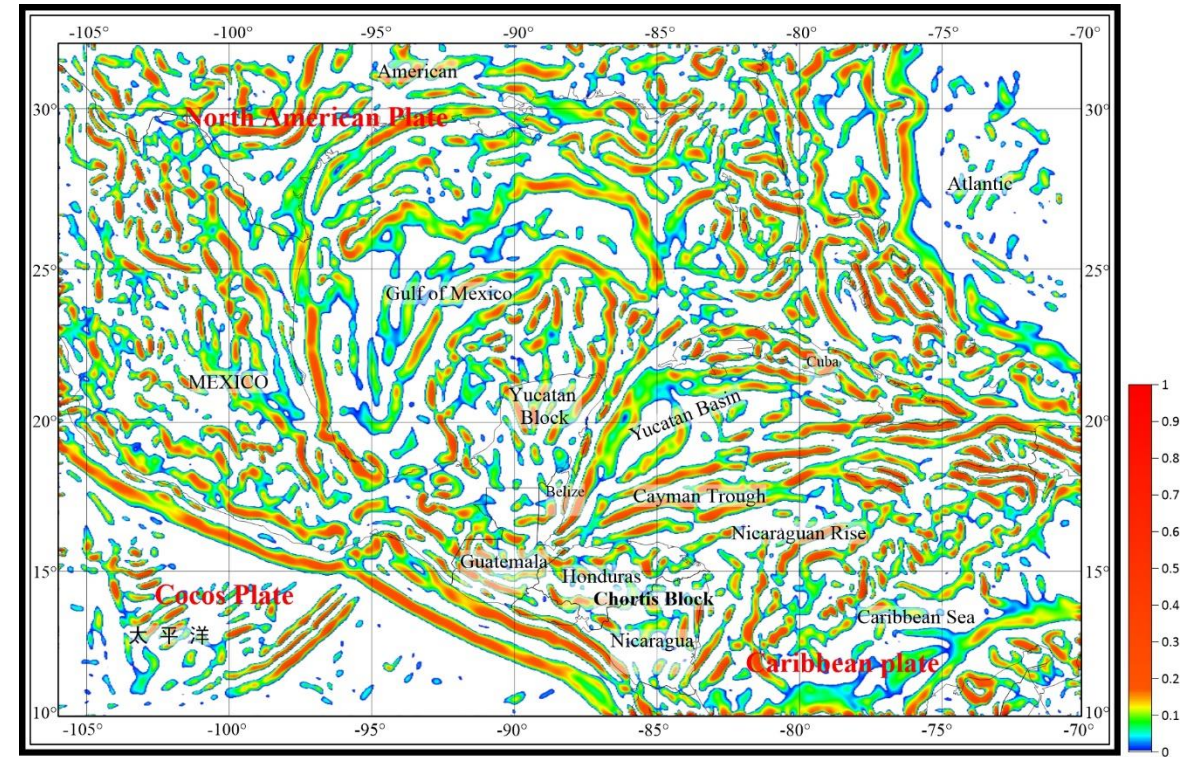


**4 Conclusion**

### ■ 3 Distribution Features of Faults



Bouguer Gravity Anomaly



Bouguer Gravity Anomaly NVDR-THDR

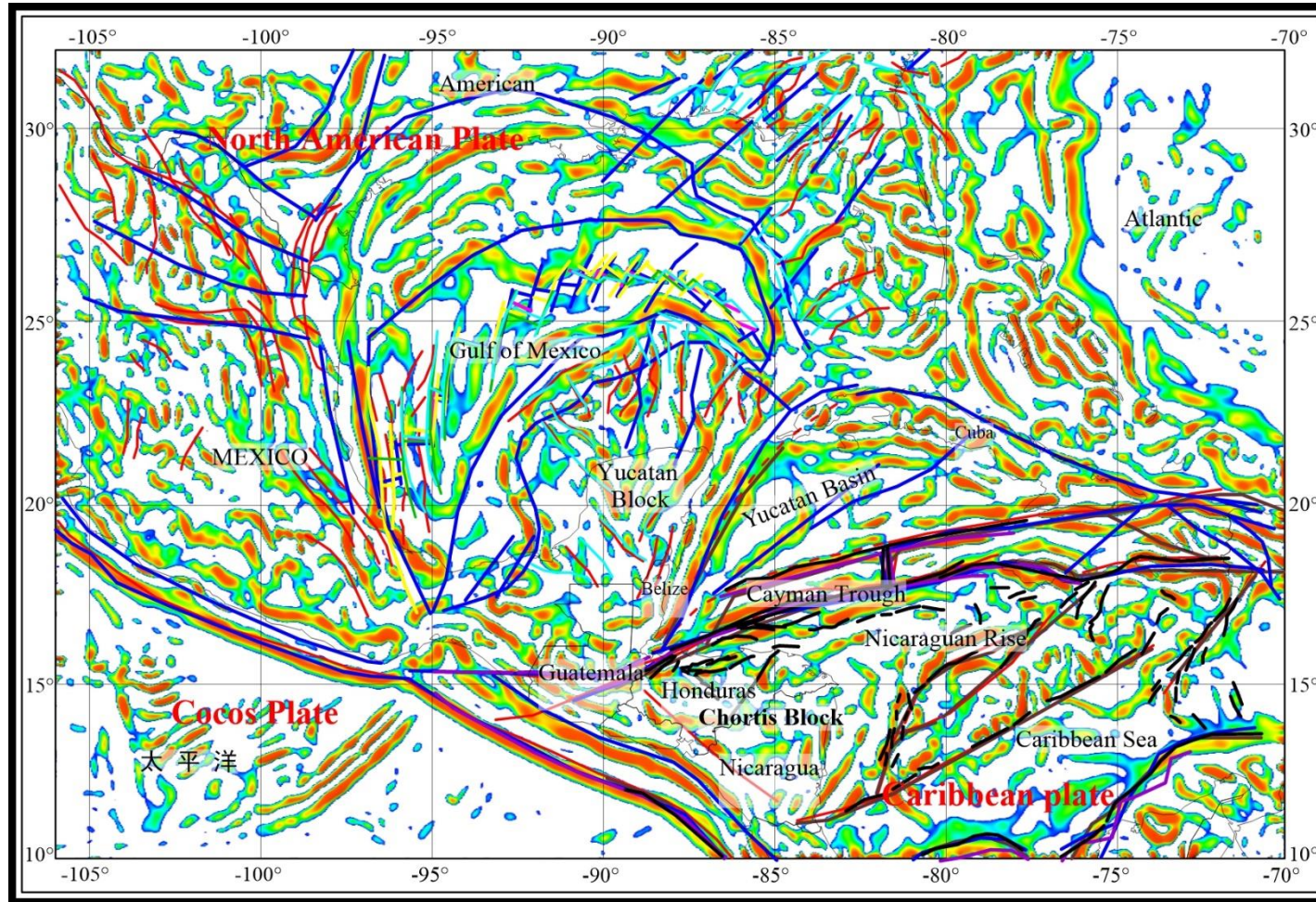
At the edge of the plate, the Bouguer gravity anomaly has a large step belt of gravity anomalies.

Bouguer Gravity Anomaly NVDR-THDR is characterized as stable, continuous and large-scale.

Bouguer Gravity Anomaly NVDR-THDR is NE-NEE shaped arc in Gulf of Mexico, is NEE in Cayman Trough, is NNE or SN in Yucatan Block.



### ■ 3 Distribution Features of Faults

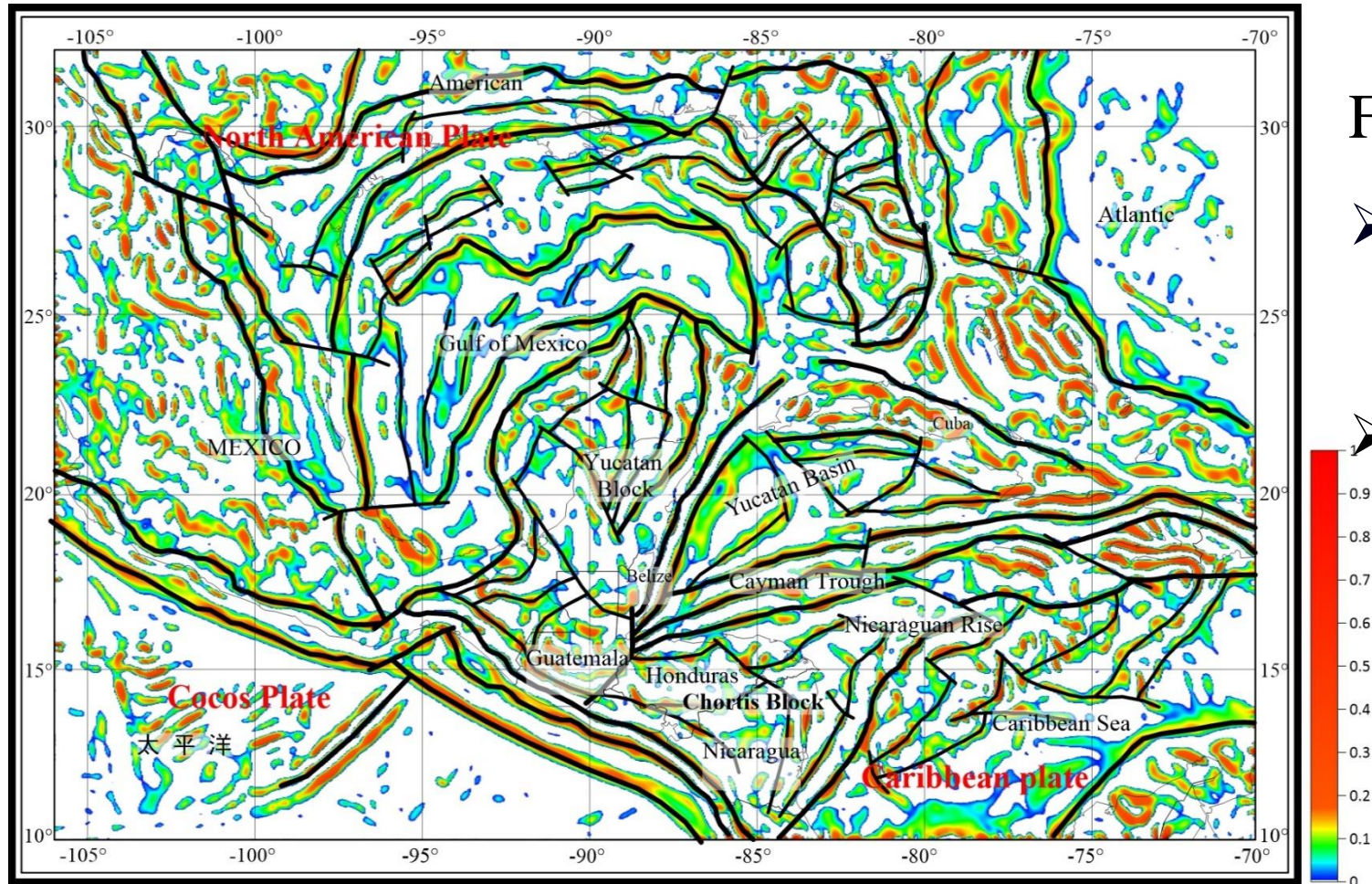


Bouguer Gravity Anomaly NVDR-THDR and Previous research results

- The fault of the plate edge is consistent with the position of the maximum value of NVDR-THDR.
- Inside the plate, The direction of some of the fault is consistent with the direction of the maximum value of NVDR-THDR



### ■ 3 Distribution Features of Faults



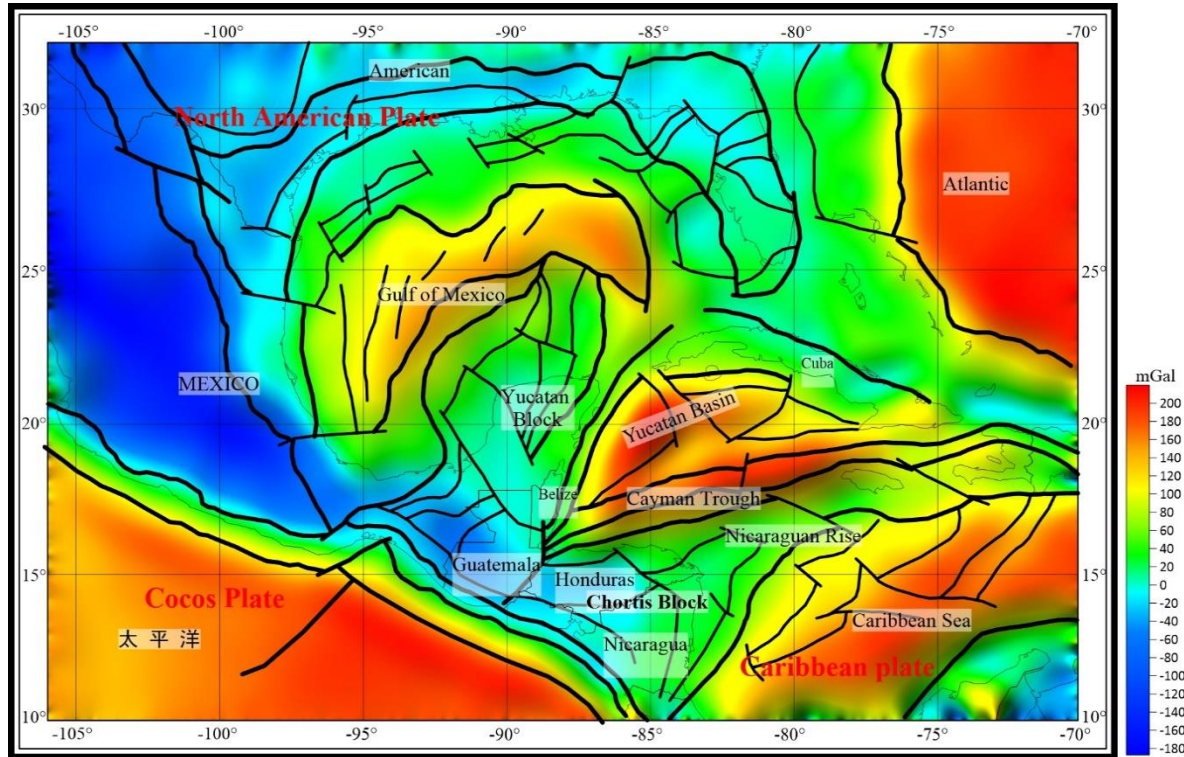
Bouguer Gravity Anomaly NVDR-THDR and the fault

Fault identification:

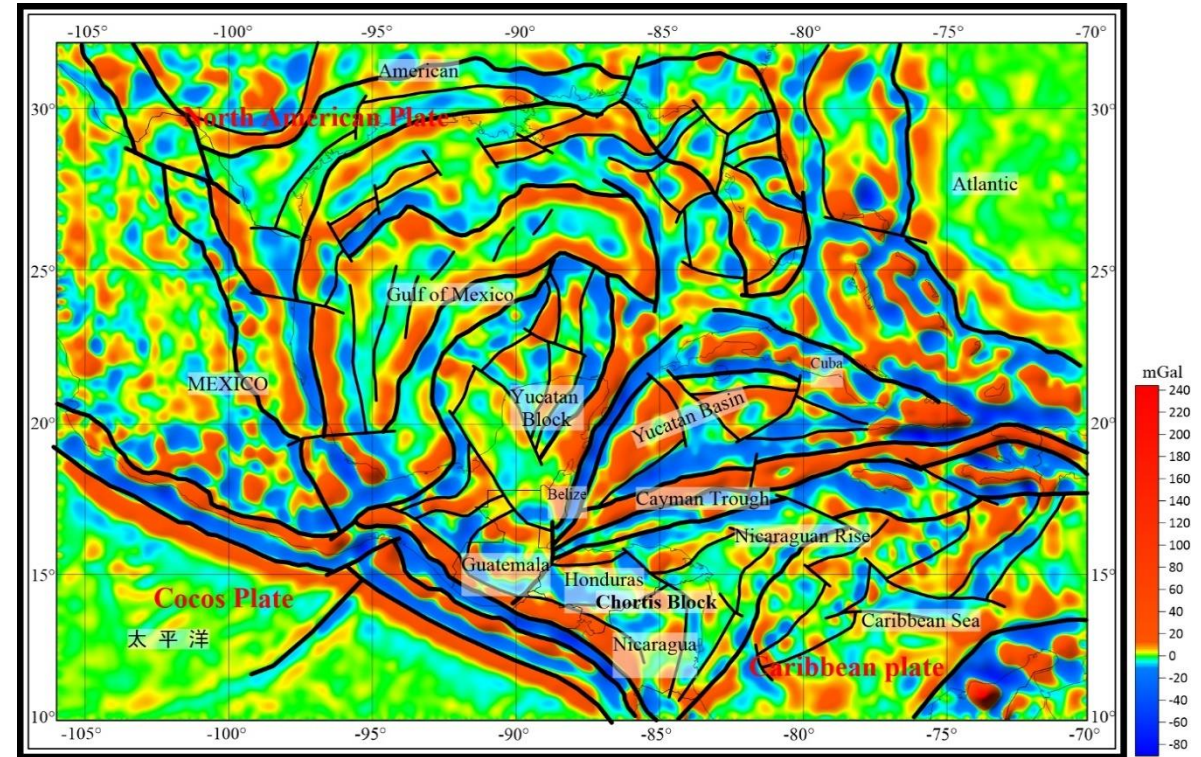
- The maximum value of the connection.
- If the maximum continuity is poor, then we use regional or residual Bouguer gravity anomaly to identify the fault.



### ■ 3 Distribution Features of Faults



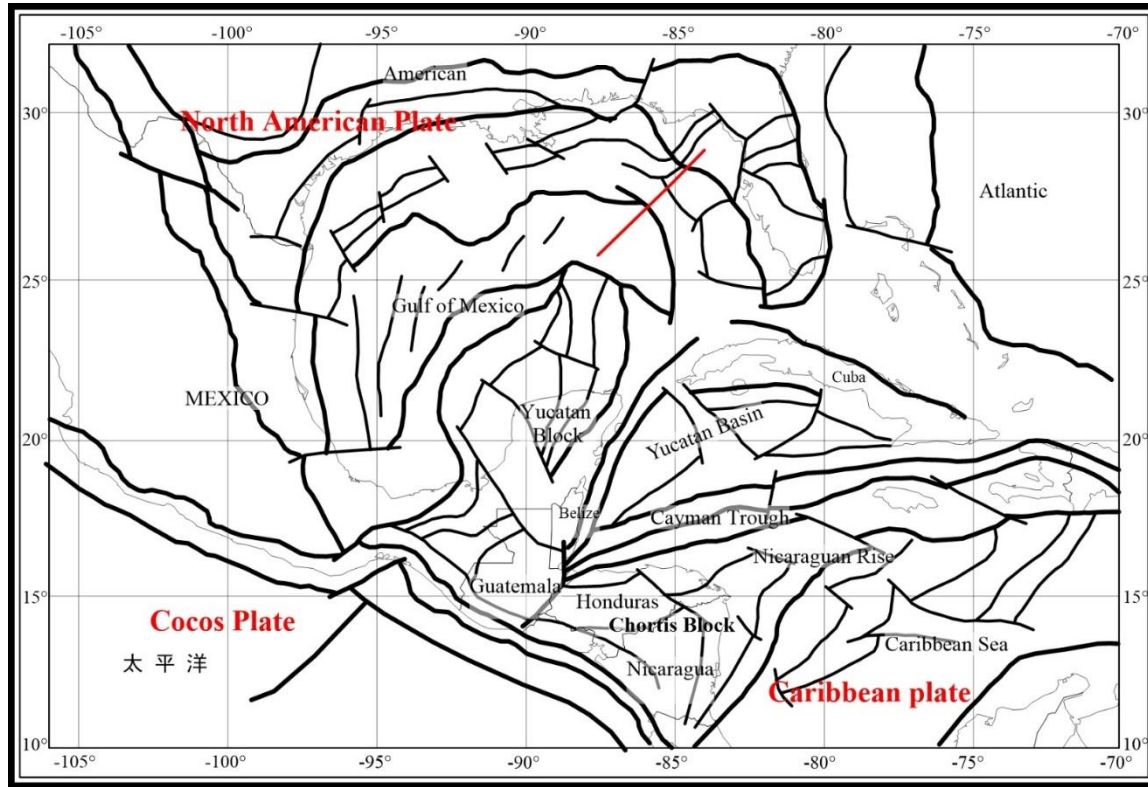
Regional Bouguer Gravity Anomaly and the fault



Residual Bouguer Gravity Anomaly and fault

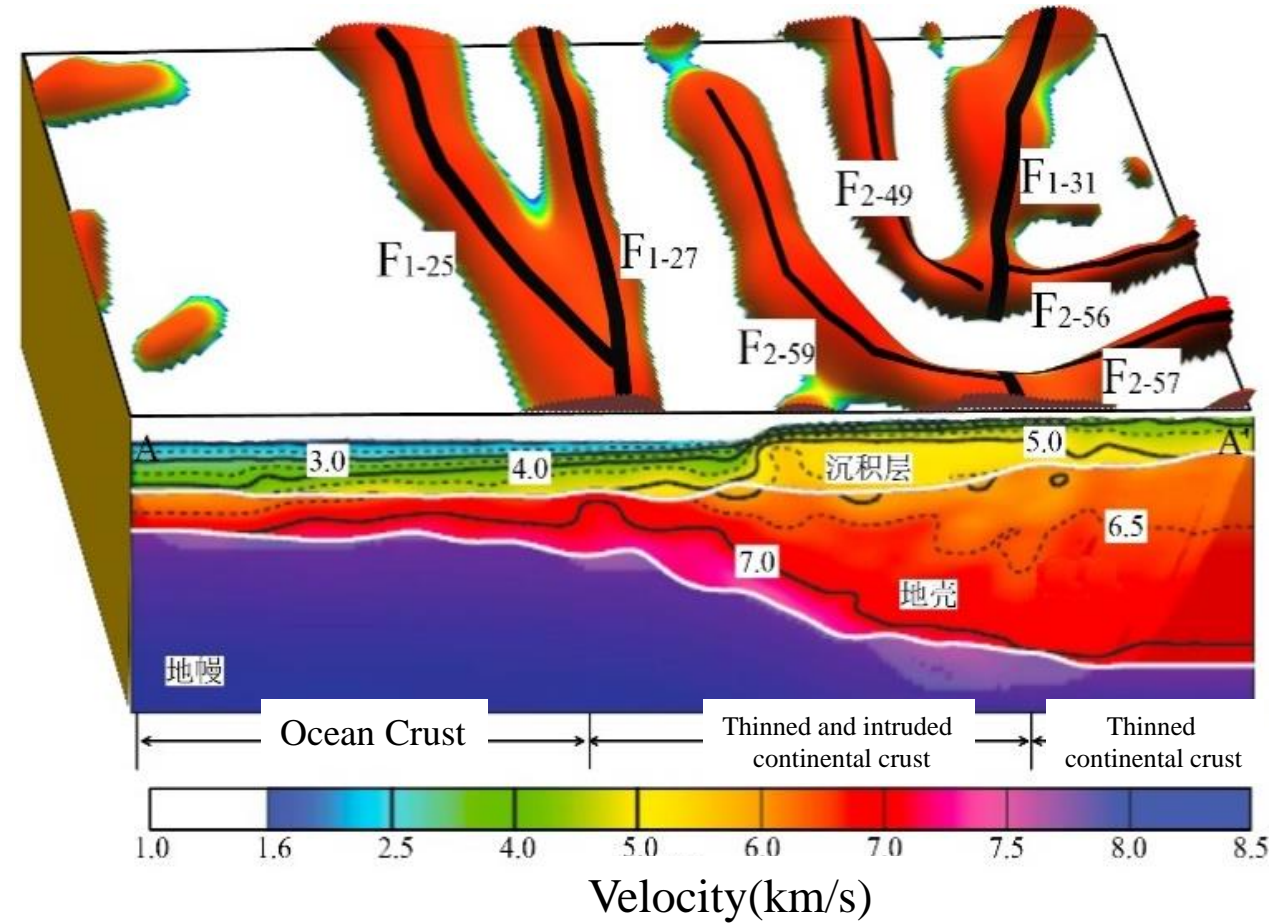


### ■ 3 Distribution Features of Faults



Distribution Features of the Fault

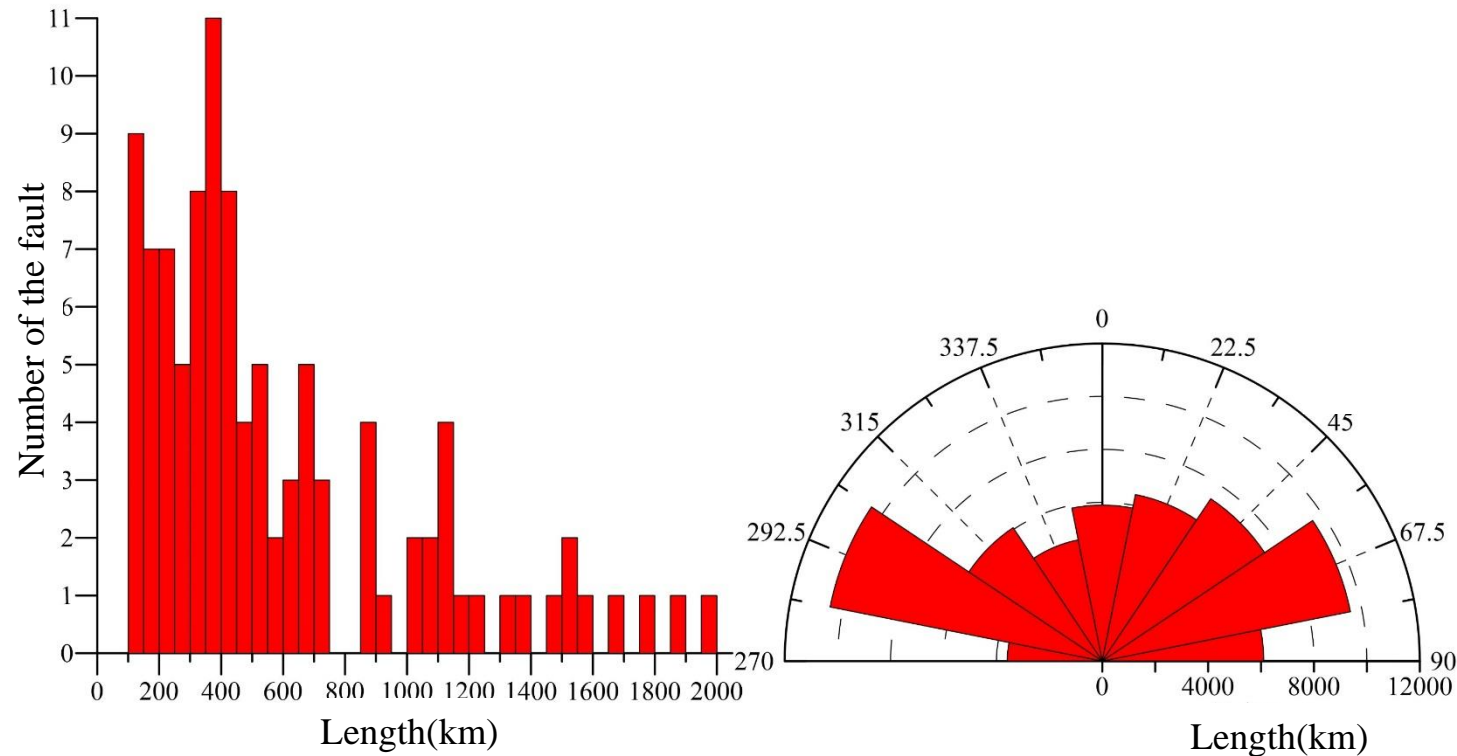
Result of the fault reflect different crustal boundaries.



Seismic refraction profile GUMBO4  
(modified from Christeson et al., 2014)

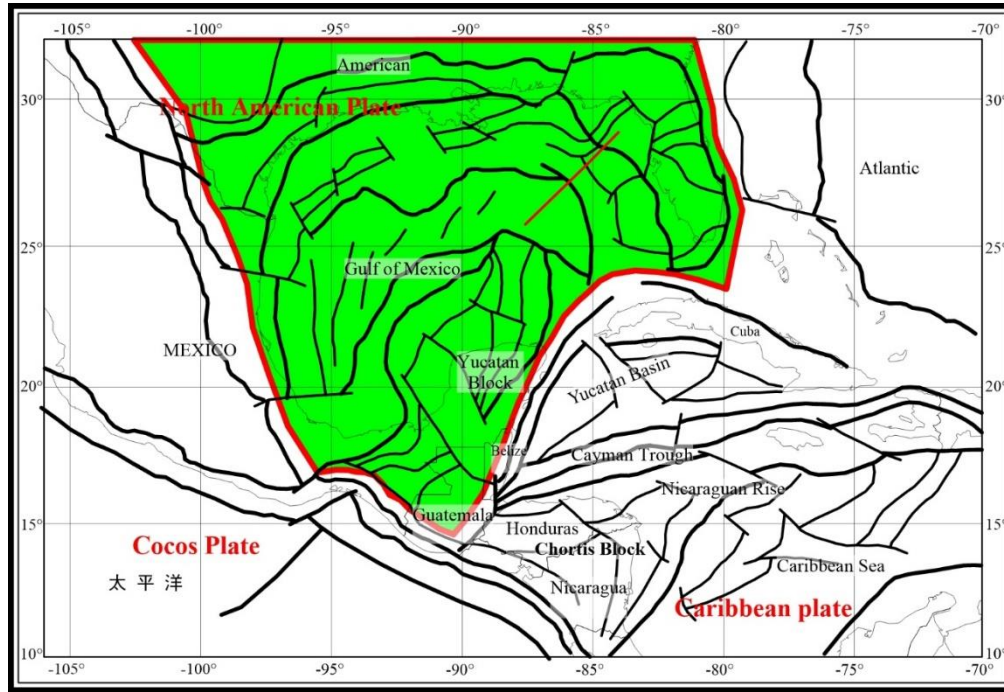


### ■ 3 Distribution Features of Faults



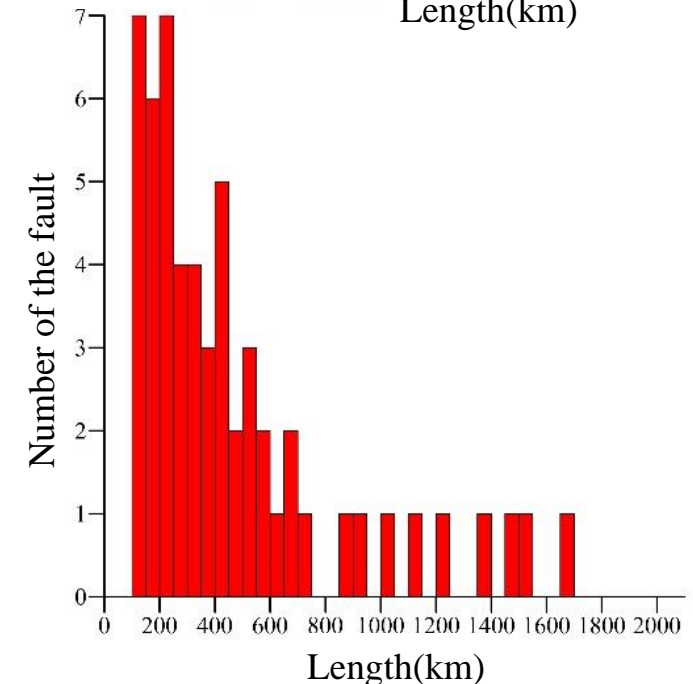
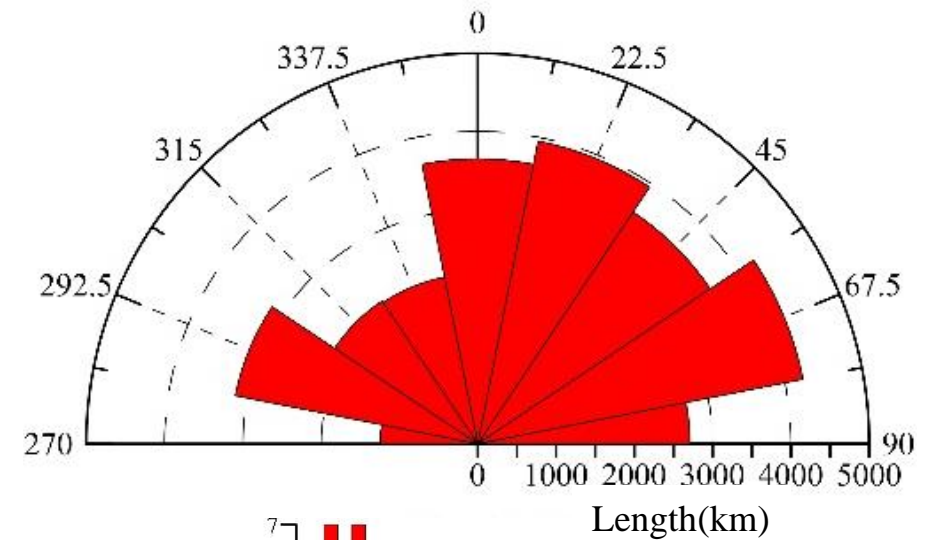
The faults in NWW and EW-NEE directions are mostly related to plate movement. In NE-NEE directions, arc faults are related to oceanic crust expansion. The faults in NE and NW are related to late Jurassic rift activities, or simply showing the boundaries of Yucatan and Chortis old landmass. The faults in nearly SN direction are less than that of we have talked above.

### ■ 3 Distribution Features of Faults



Distribution Features of the Fault(Green area)

In the Gulf of Mexico, there are four kinds of faults: the transition faults and mid-ocean ridge faults in the middle of central deep-sea area, the ocean-crust boundary faults in the north and south side of the central deep-sea area, the faults of thinning continental crust in the north and south of the Gulf of Mexico and the strike slip faults in the west of the Gulf of Mexico.



# Contents



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- The gravity anomaly NVDR-THDR has the characteristics of simplicity, clarity and high recognizability for identifying fault structures, especially the plate boundaries are manifested as obvious NVDR-THDR maximum value features
- We inferred the characteristics of the fault distribution and analyzed the fault properties.

*Thanks for your attention*

