

# Universidad de Chile

Departamento de Geofísica

## Sismología

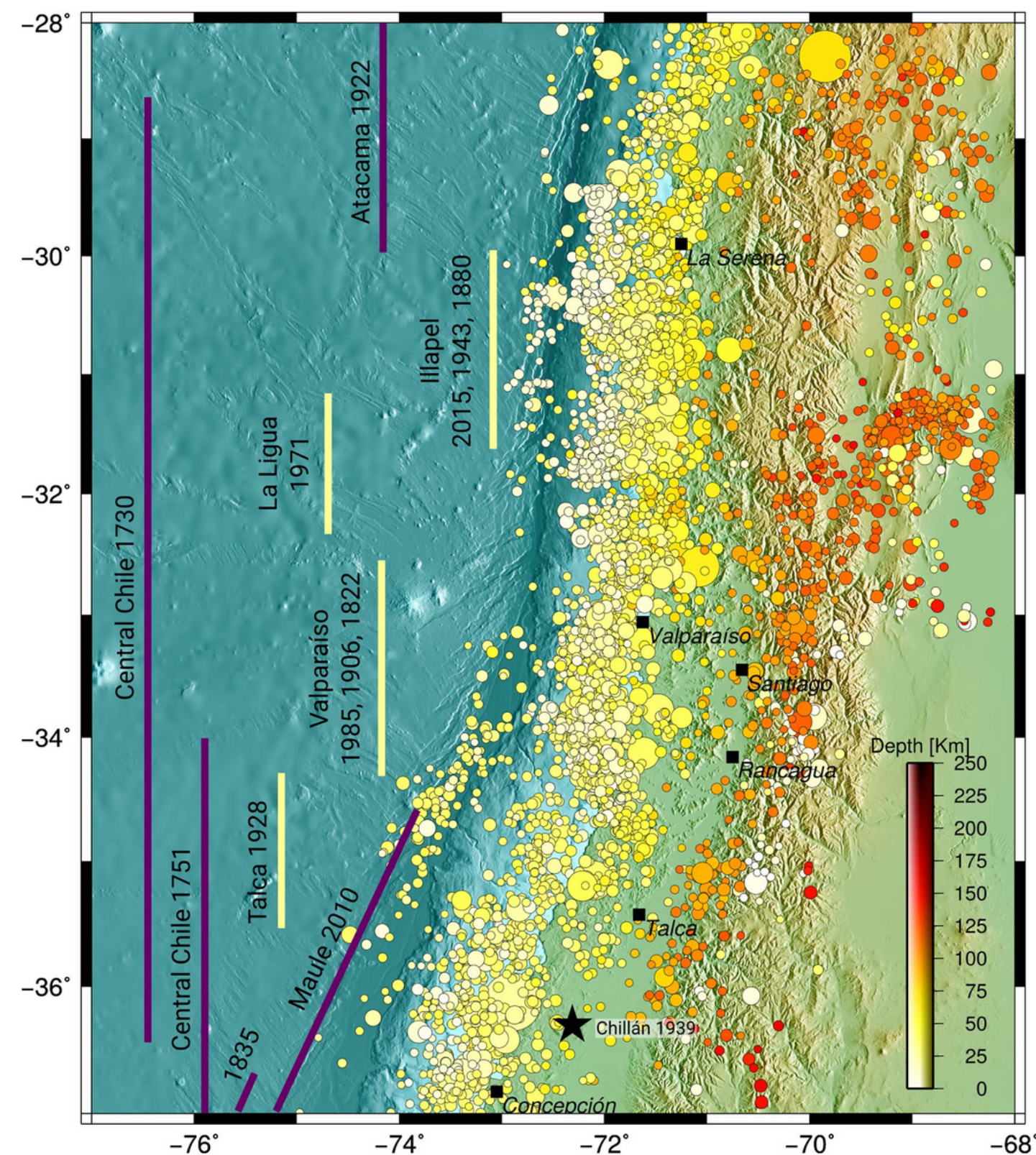
GF 4001-2

Auxiliar 1  
Introducción

Auxiliar: Hermann Schwarze  
Profesor: Sergio Ruíz



Marzo 2022





# ¿QUIÉNES SOMOS?

EQUIPO

**Sergio Ruíz**

Responsable  
académico

**sruiz@uchile.cl**



**Rogelio Torres**

Estudiante de  
doctorado

**dp.rogelio.tc@gmail.com**



**Hermann Schwarze**

Estudiante de doctorado

**hschwarze@dgf.uchile.cl**



**M. de los Ángeles  
Méndez**

Estudiante de  
magister

**mdla.mendezsilva@gmail.com**



**Kellen Uzúa**

Estudiante de  
doctorado

**kellen.azua@gmail.com**

# Contenido del curso

**CONTEXTO SISMOTECTÓNICO**

**LEYES EMPIÍRICAS**

**ECUACIÓN DE MOVIMIENTO**

**LOCALIZACIÓN**

**MECANISMO FOCAL**

**MAGNITUD**

**CINEMÁTICA DE LA FUENTE**

**TERREMOTOS LENTOS**



# Contenido del curso

**CONTEXTO SISMOTECTÓNICO**

**LEYES EMPIÍRICAS**

**ECUACIÓN DE MOVIMIENTO**

**LOCALIZACIÓN**

**MECANISMO FOCAL**

**MAGNITUD**

**CINEMÁTICA DE LA FUENTE**

**TERREMOTOS LENTOS**



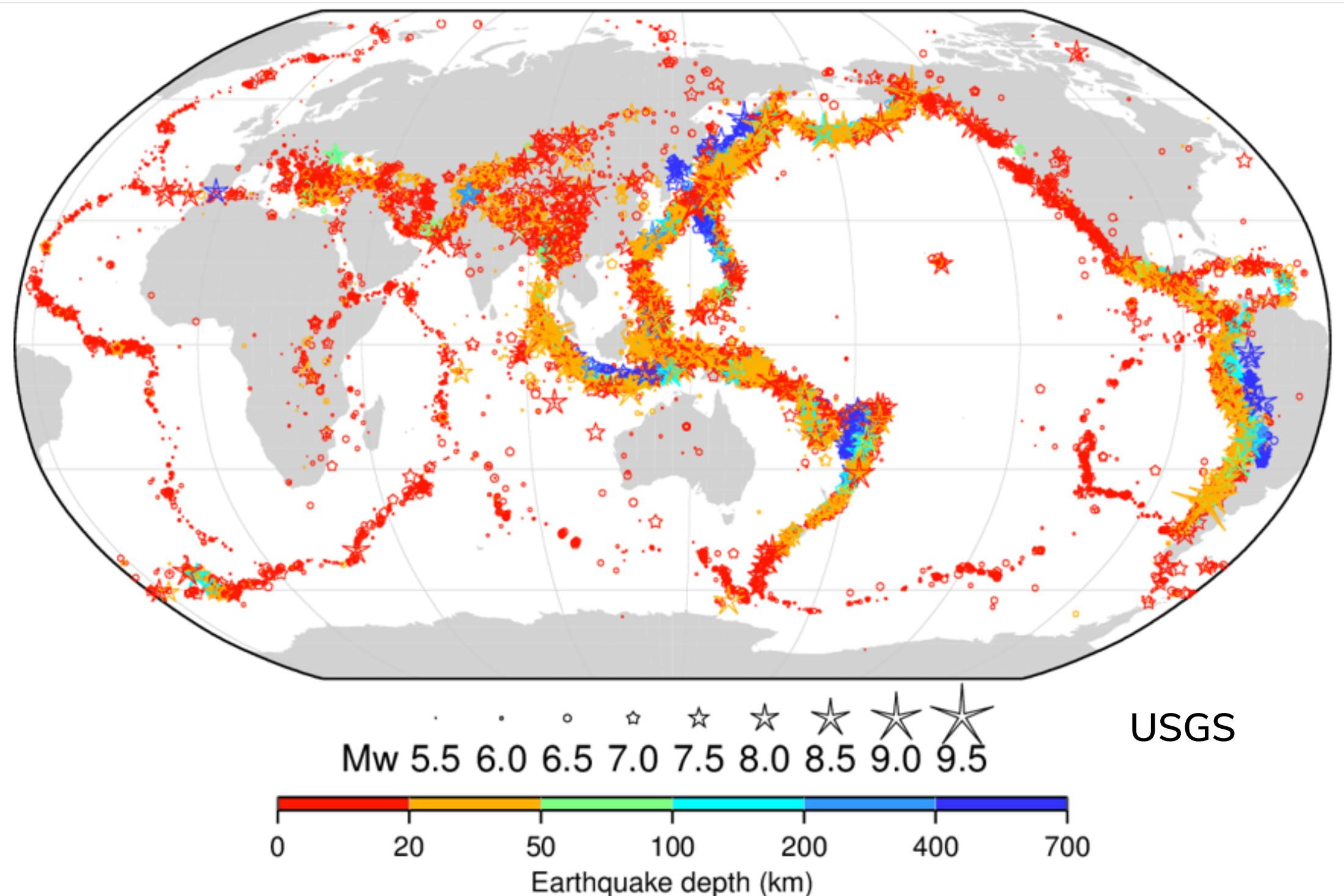
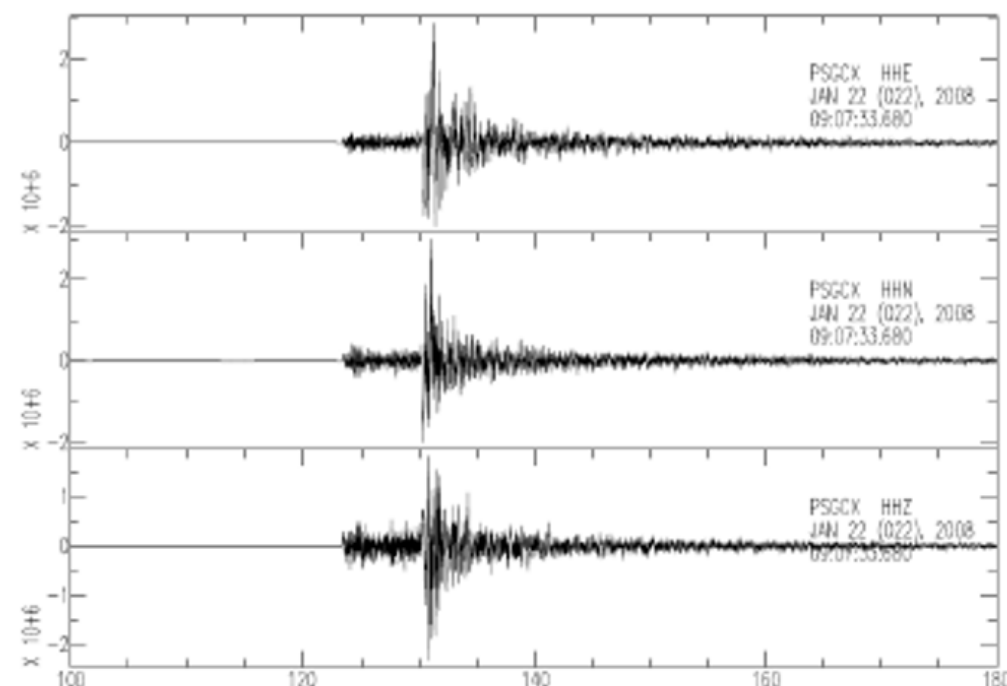


# Sismicidad Mundial

**¿Alguna vez  
has visto un  
sismo?**

# Sismicidad Mundial

¿Alguna vez  
has visto un  
sismo?



# Sismicidad Mundial

¿Que es un terremoto?



Terremoto del Maule  
del 27 de Febrero del  
2010, Mw 8.8



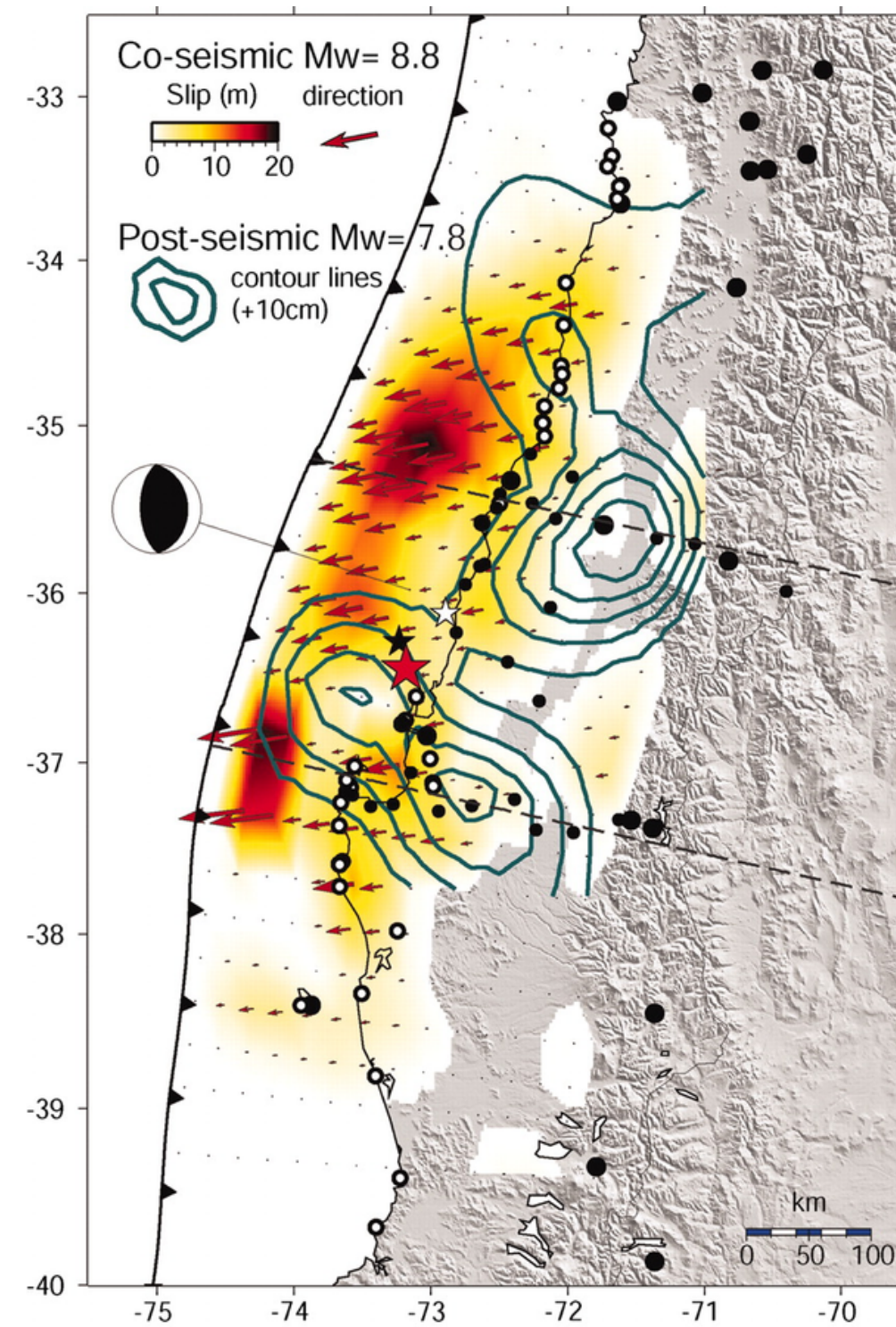
# Sismicidad Mundial

## ¿Que es un terremoto?

Es la perturbación repentina de la corteza terrestre producto de la liberación de energía acumulada en forma de ondas sísmicas.

Existen distintos tipos de fuentes:

- Fallas geológicas
- Erupciones volcánicas
- Impacto de asteroides
- fuentes generadas por el hombre

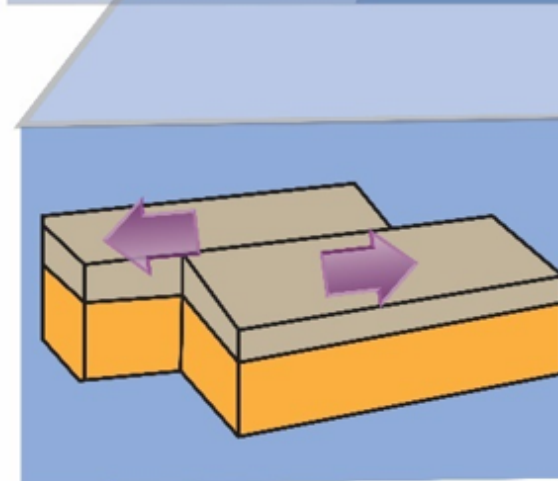
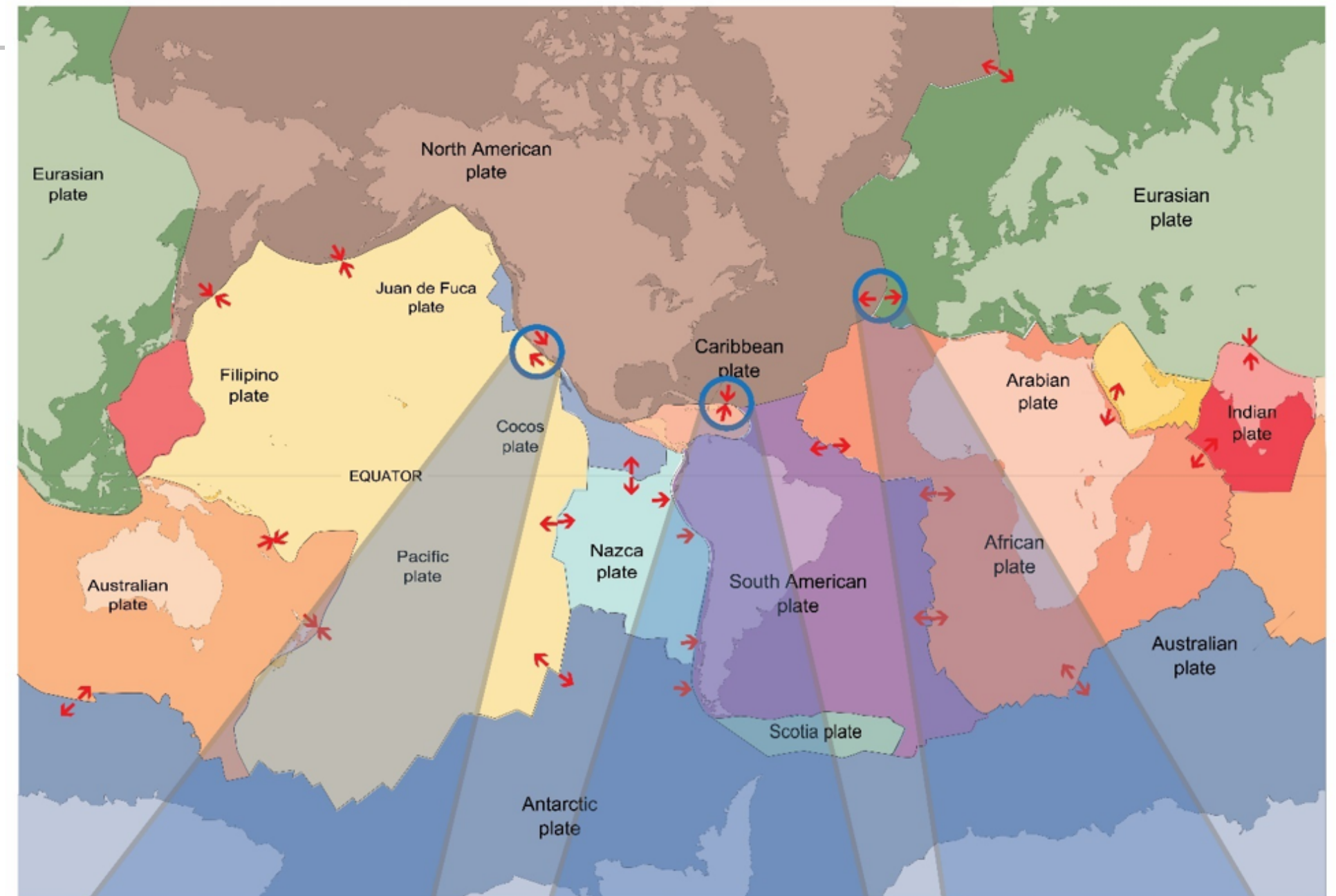
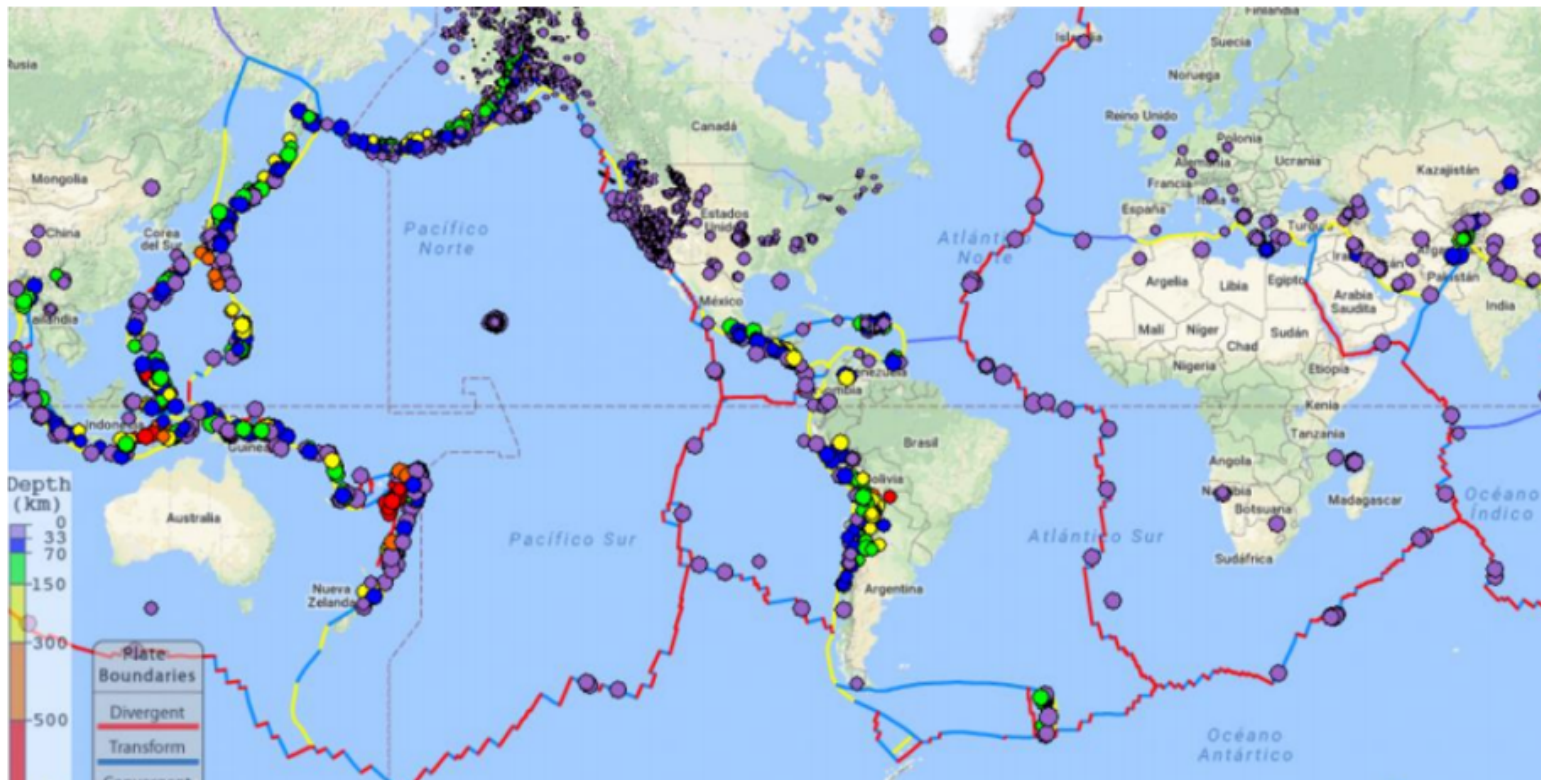


Terremoto del Maule  
del 27 de Febrero del  
2010, Mw 8.8

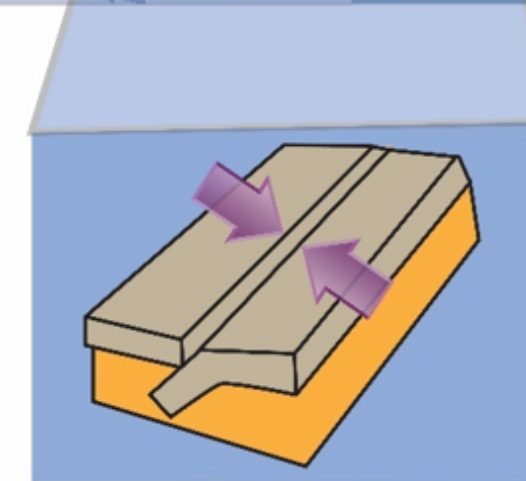
Vigny et al., (2011)



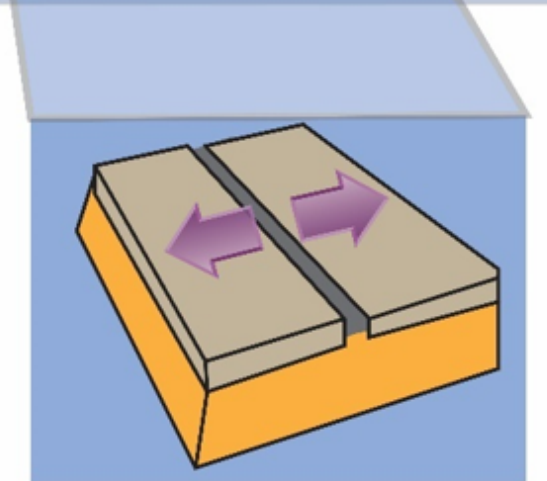
# Tipos de bordes



Bordes  
transformantes



Bordes  
convergentes



Bordes  
divergentes

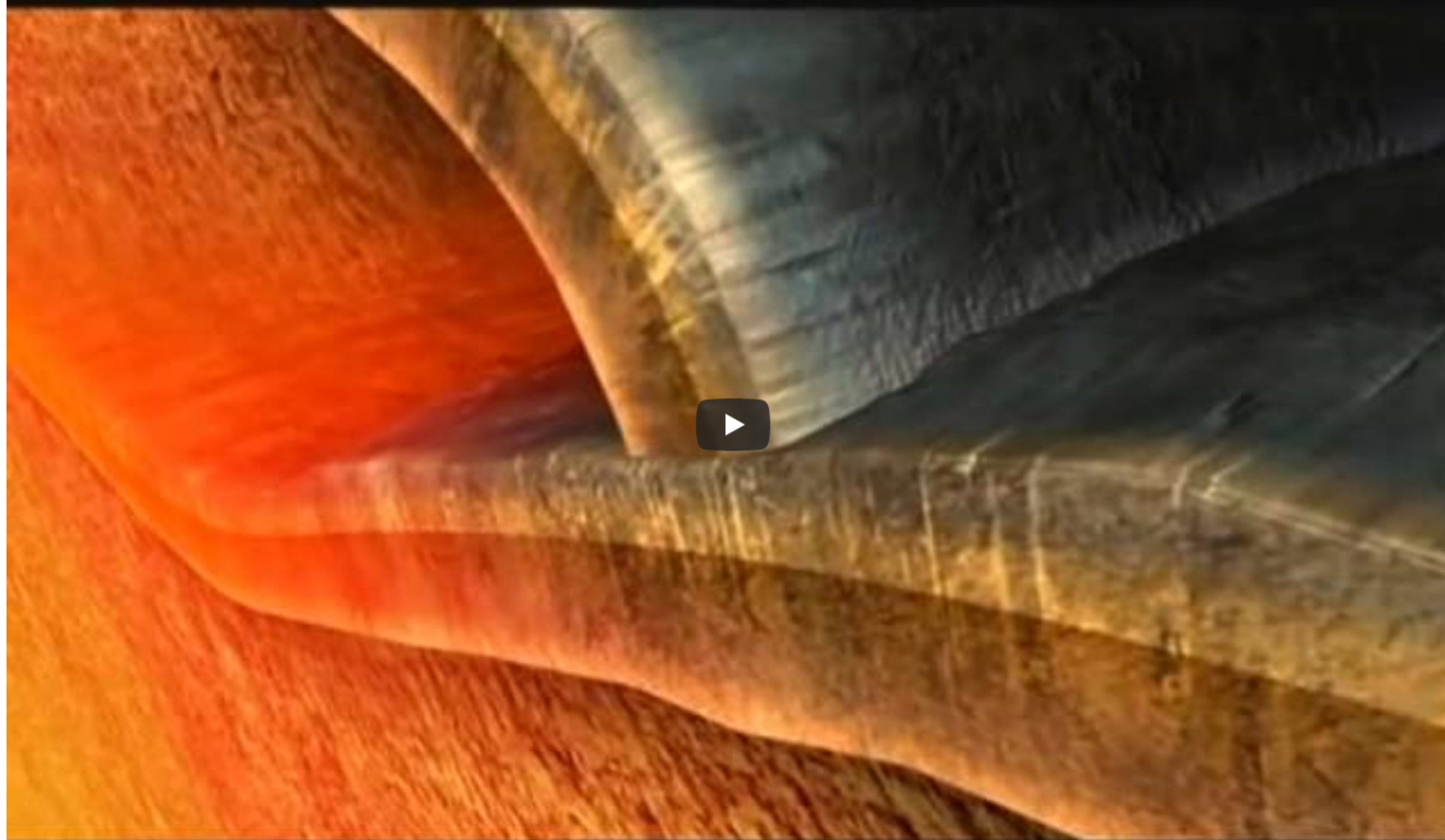




Convección del manto



Share



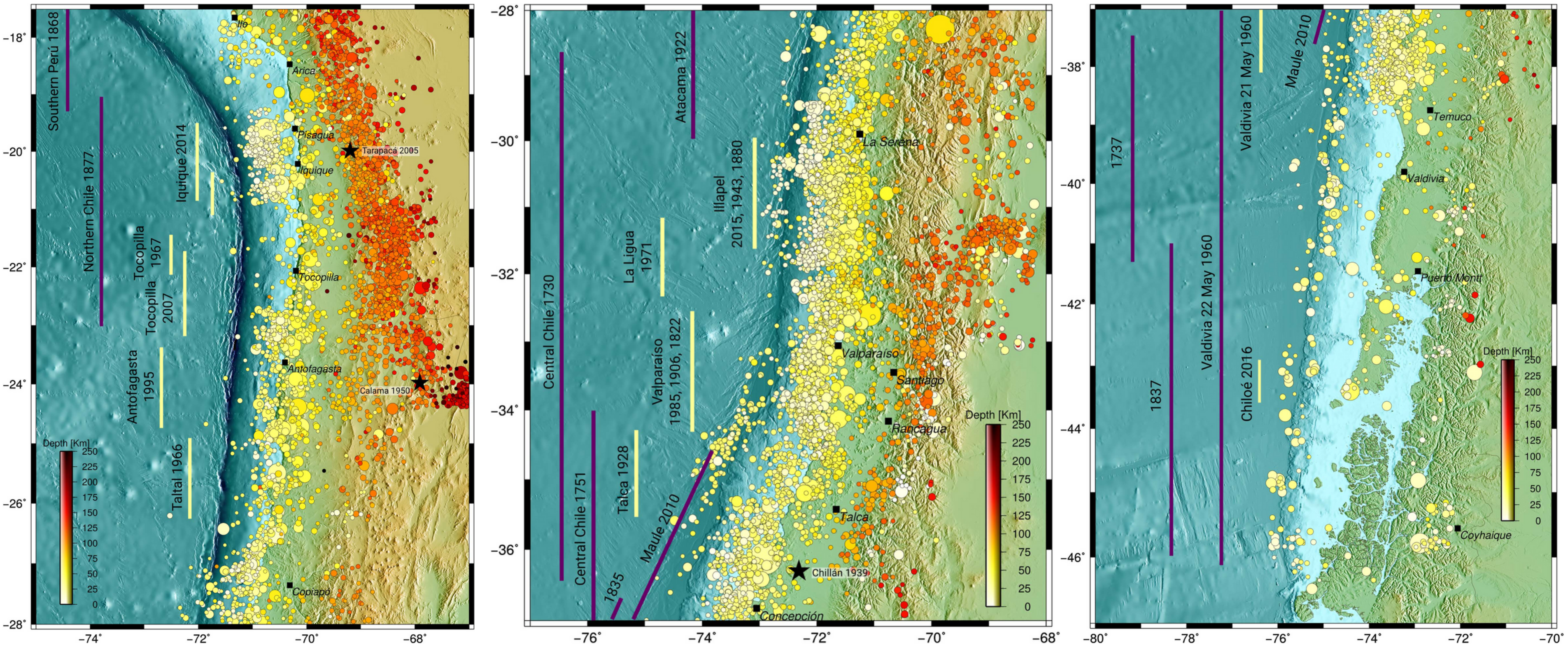
Watch on  YouTube

[https://www.youtube.com/watch?v=UR\\_IE7bVI90](https://www.youtube.com/watch?v=UR_IE7bVI90)



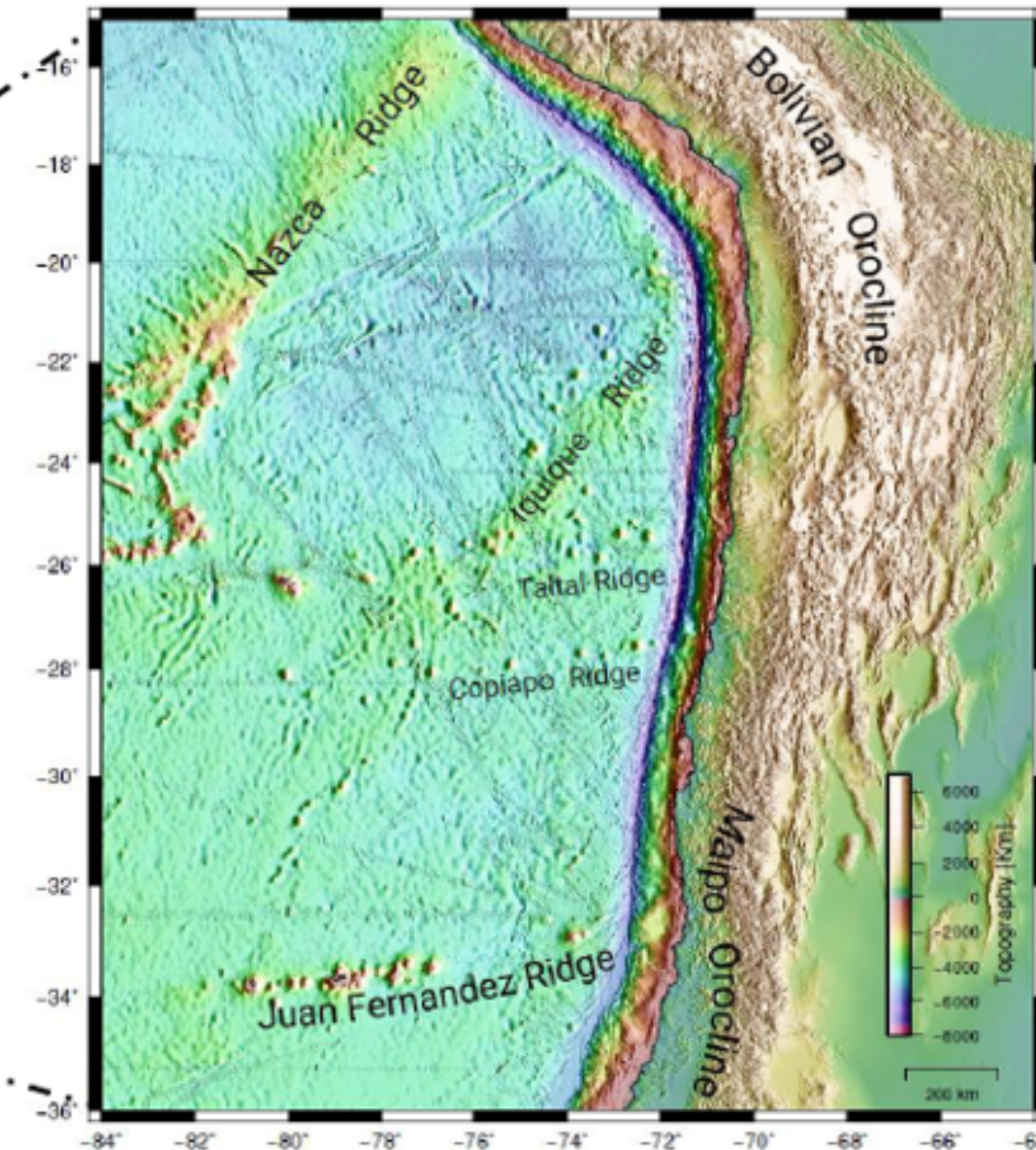
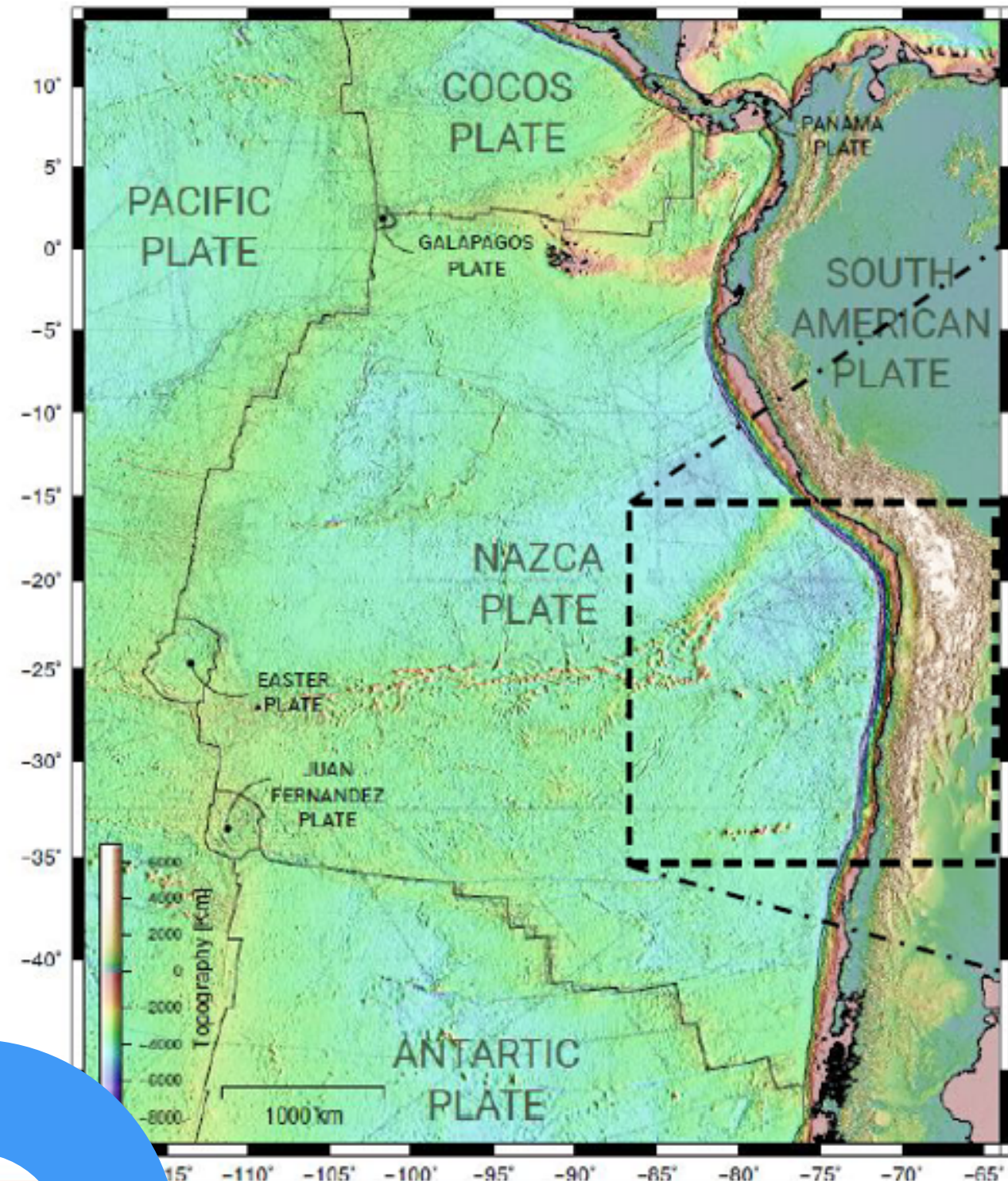
# Sismos históricos

Ruiz S & Madariaga R (2018)

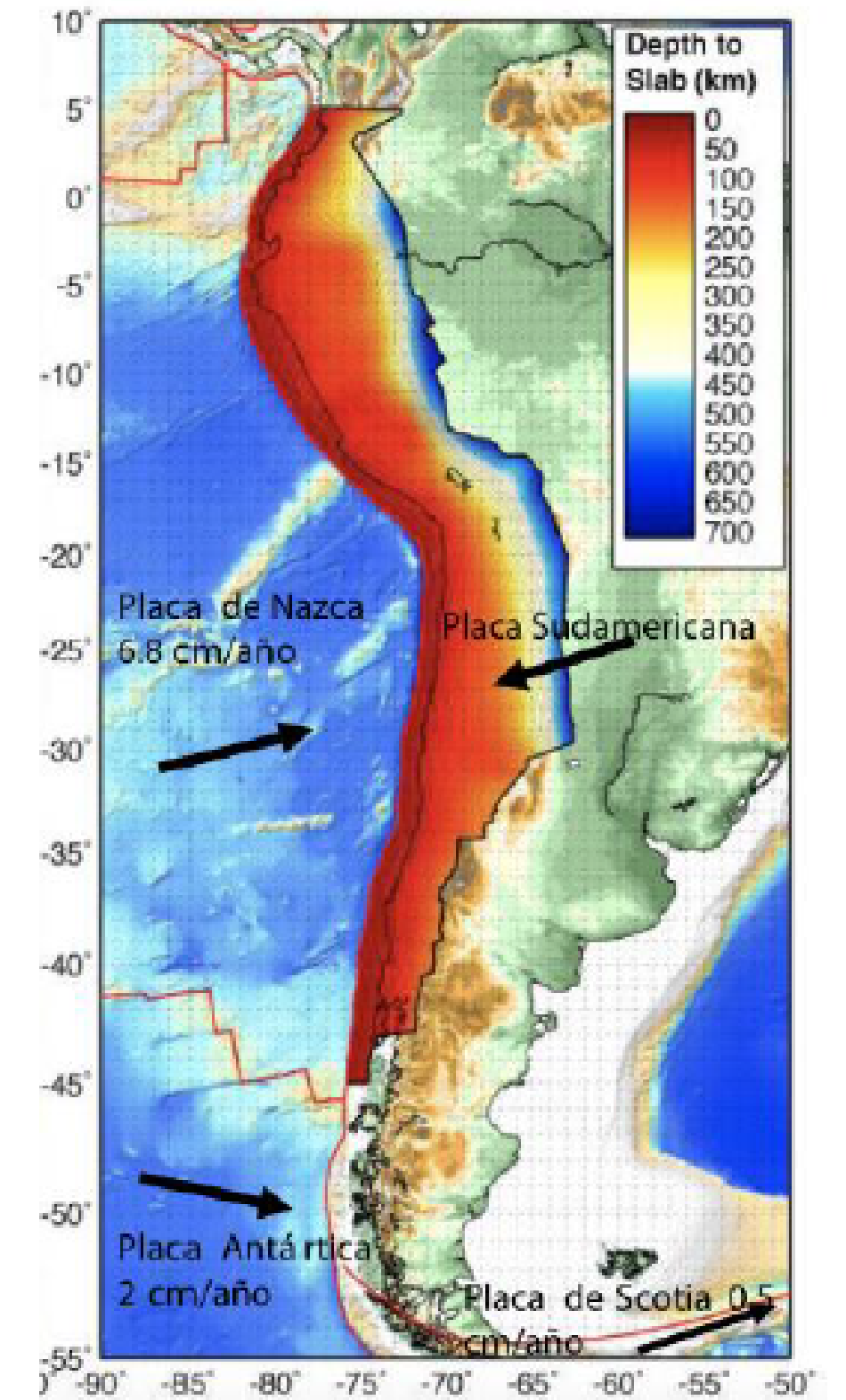




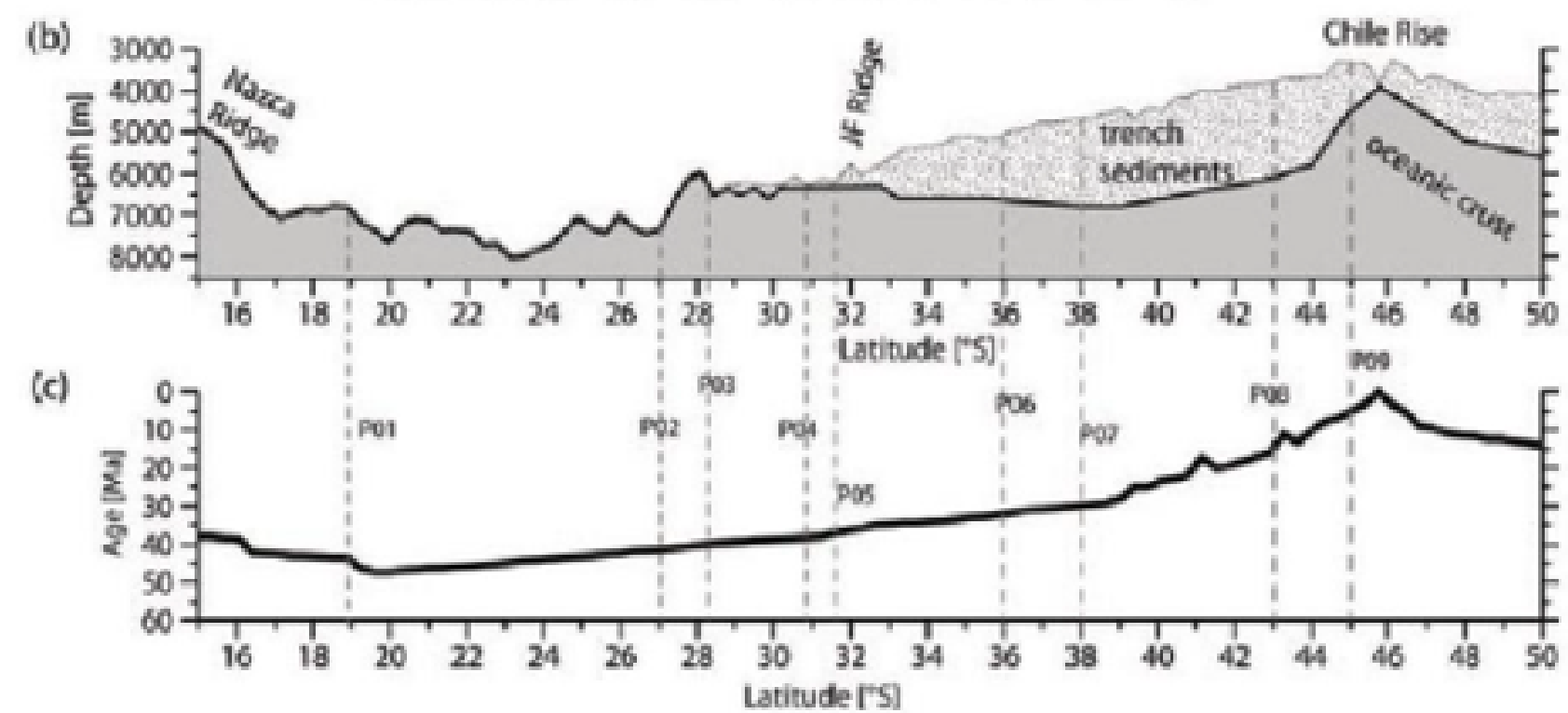
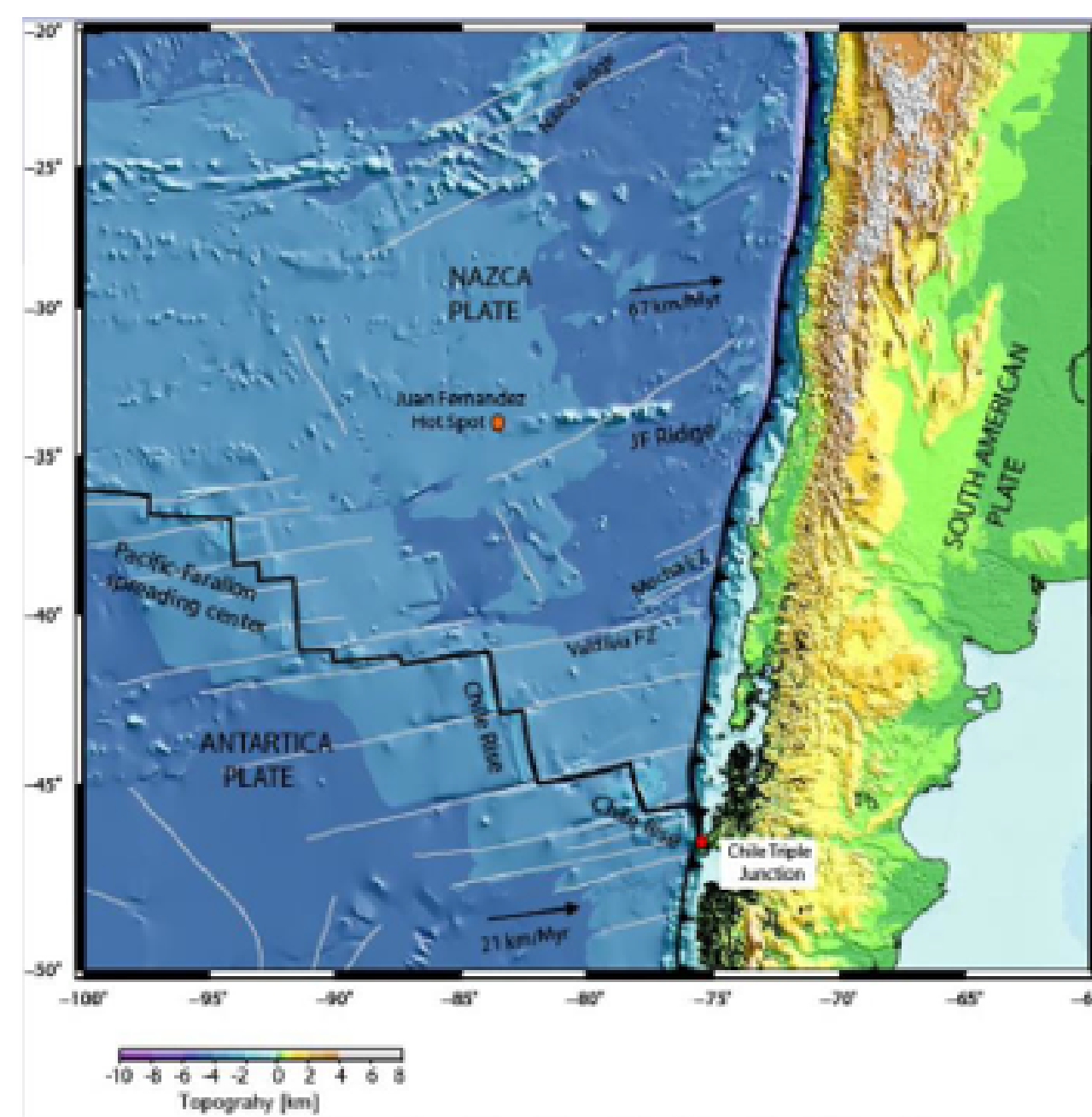
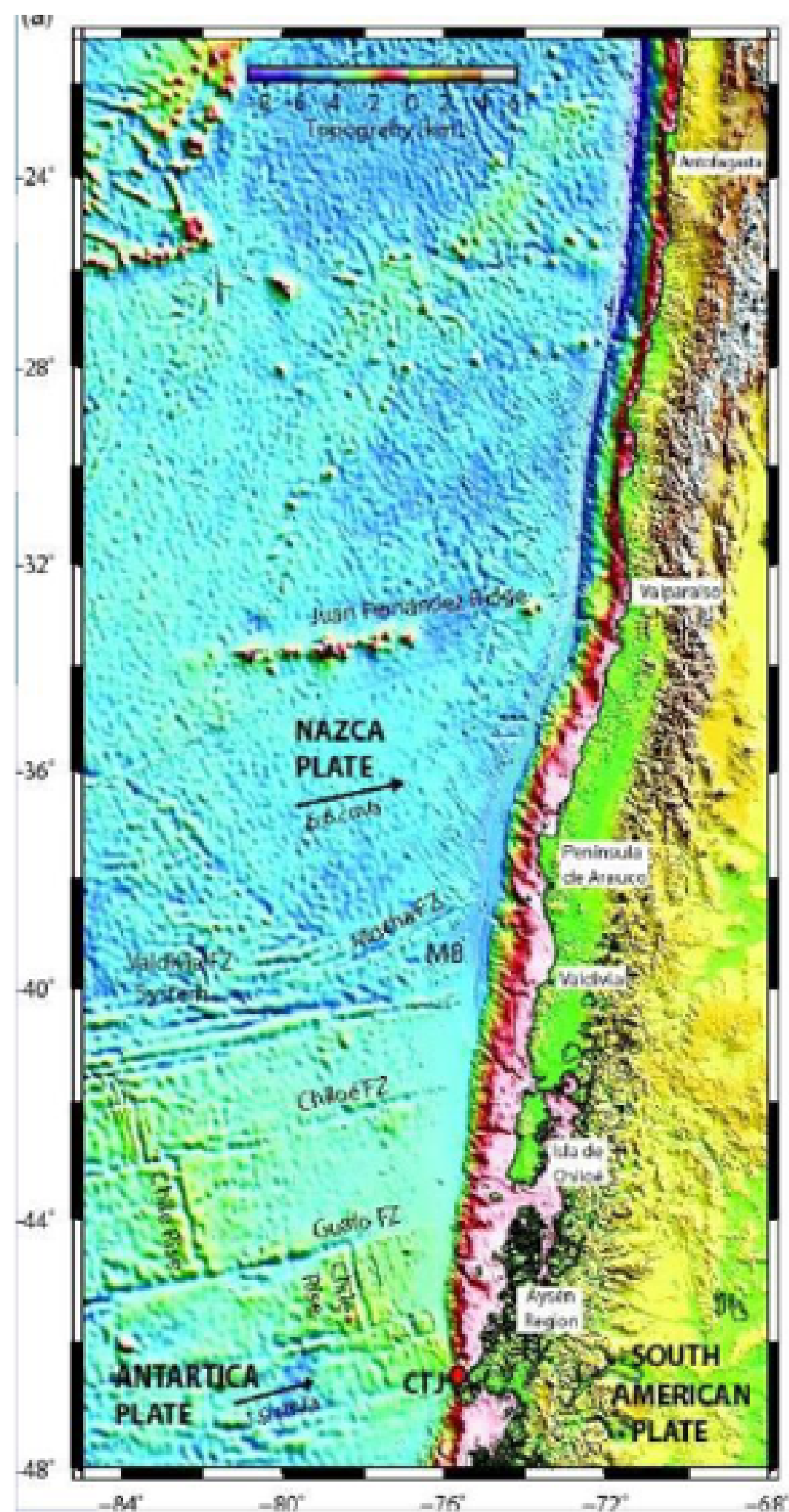
# Contexto sismotectónico



CSN

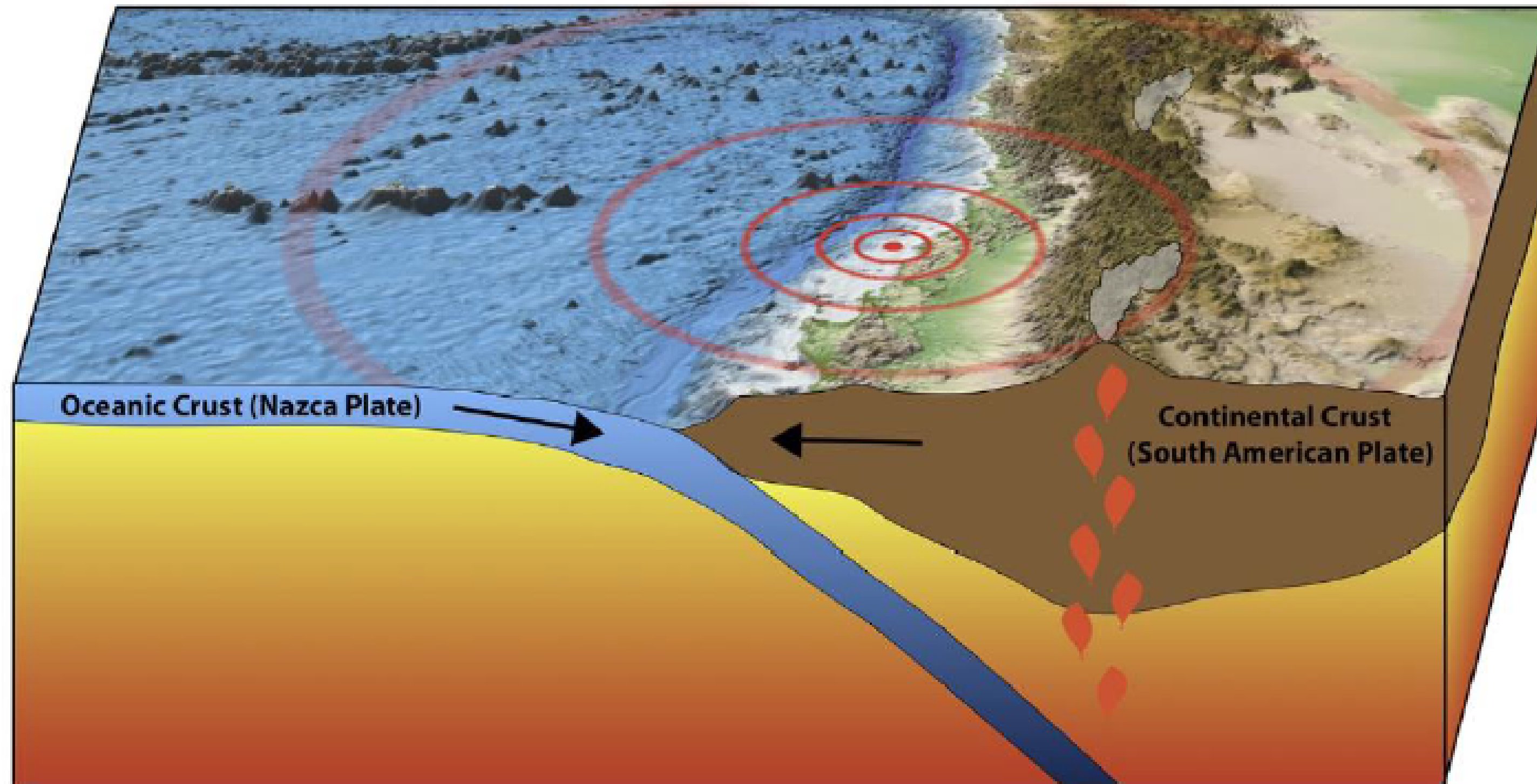






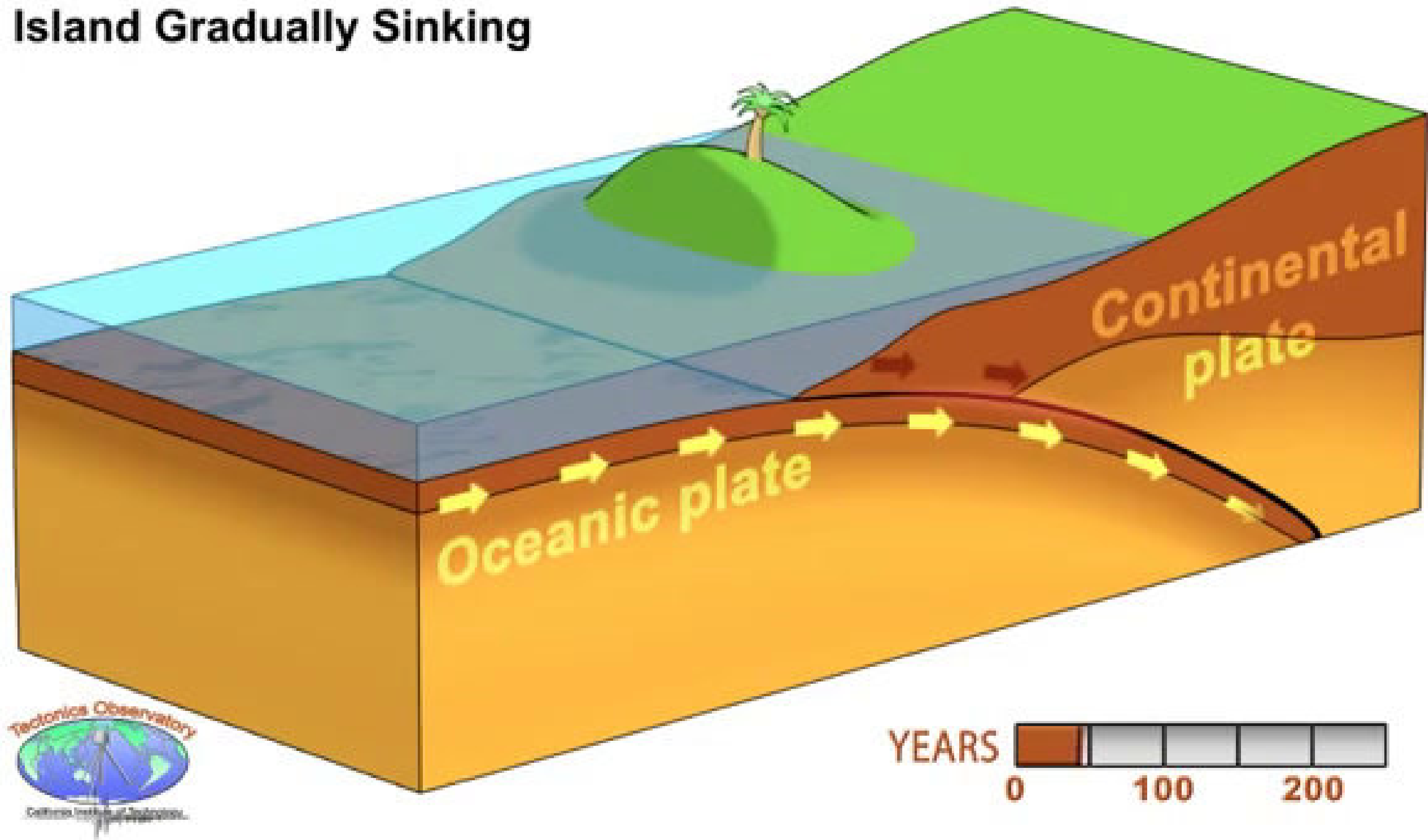


# Subducción (Nazca-Sudamericana)

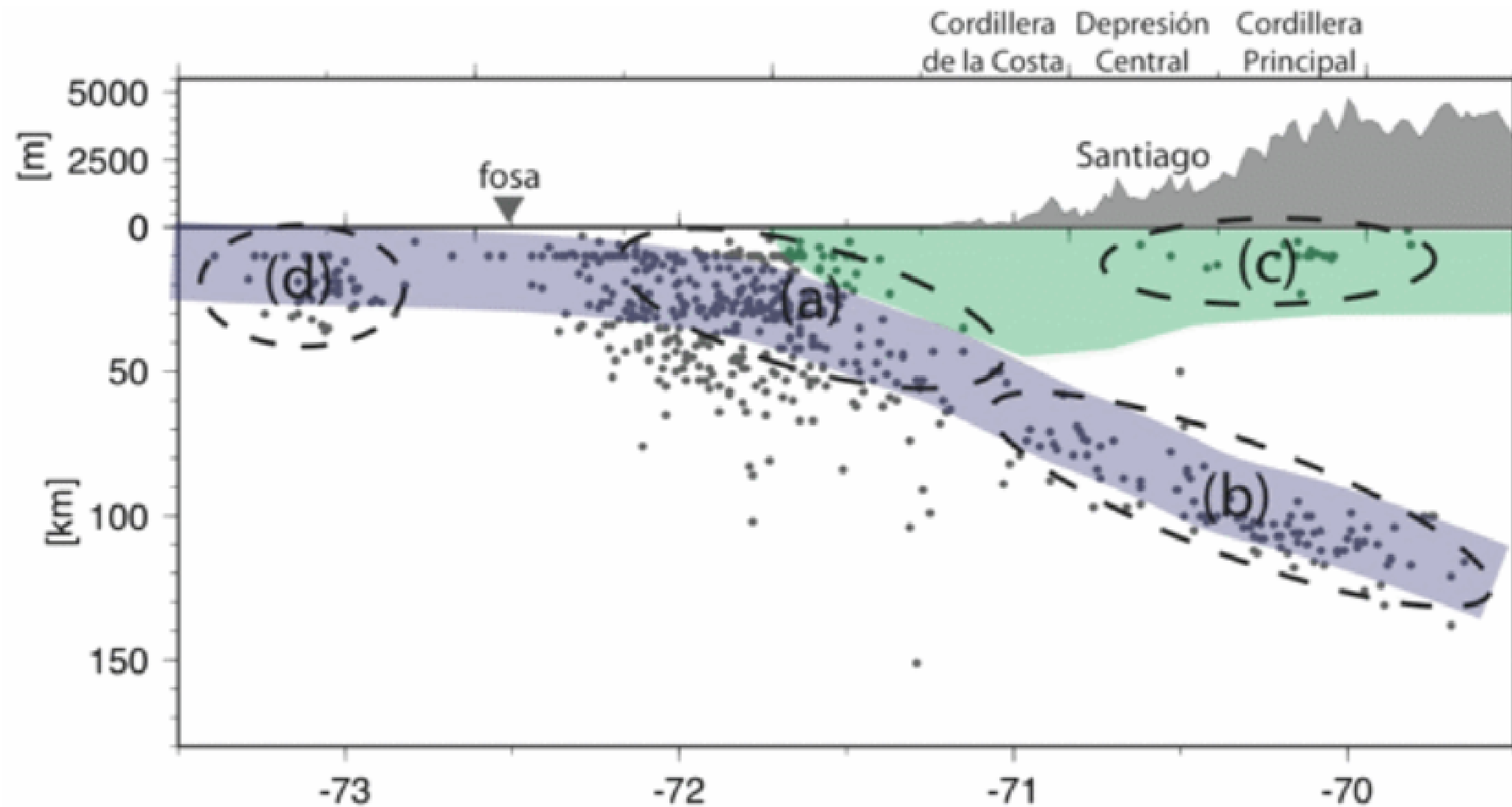




## Island Gradually Sinking



# Sismicidad en Chile



(a) Sismos Interplaca

(b) Sismos Intraplaca

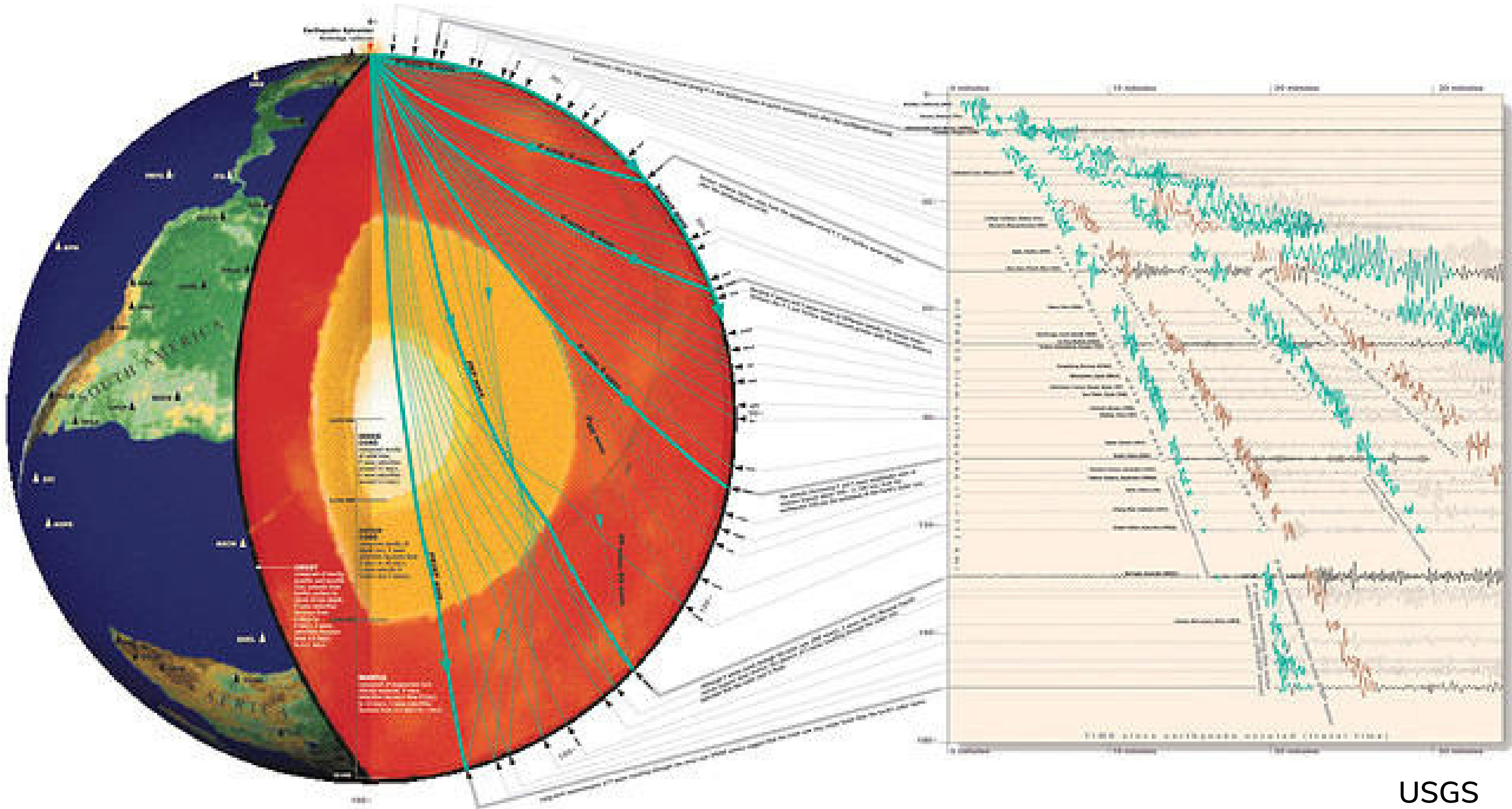
(c) Sismos Corticales

(d) Sismos Outer-Rise





January 17, 1994, magnitude 6.7 east of Los Angeles

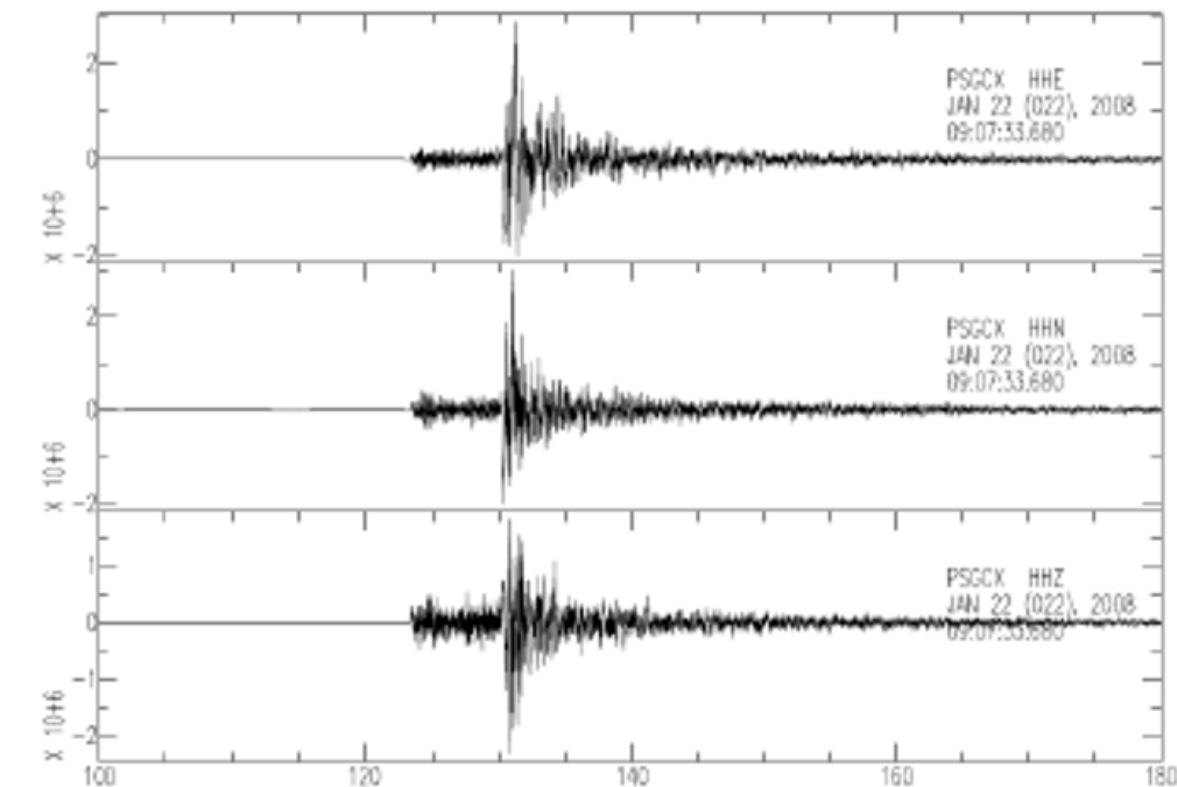
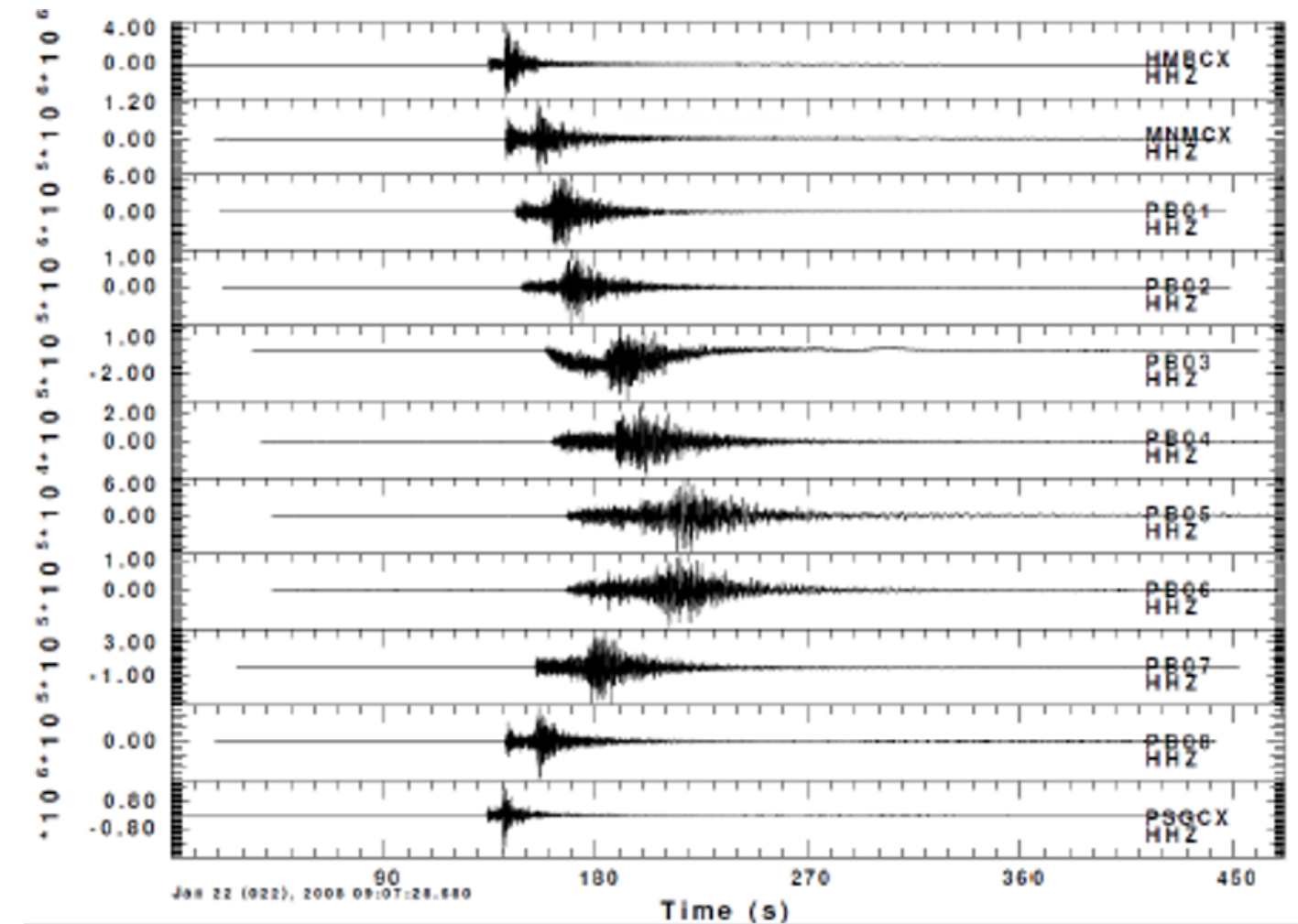
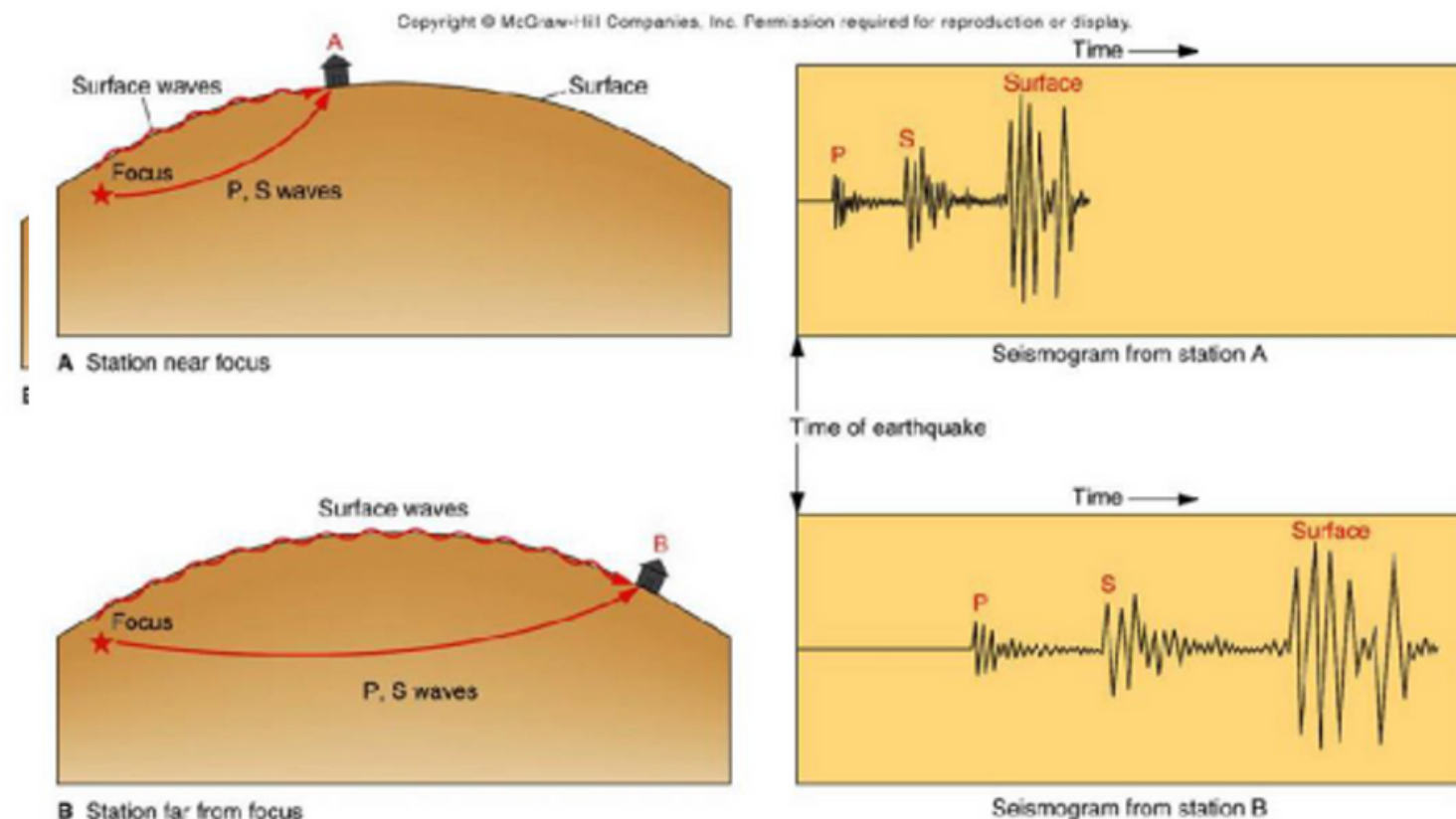


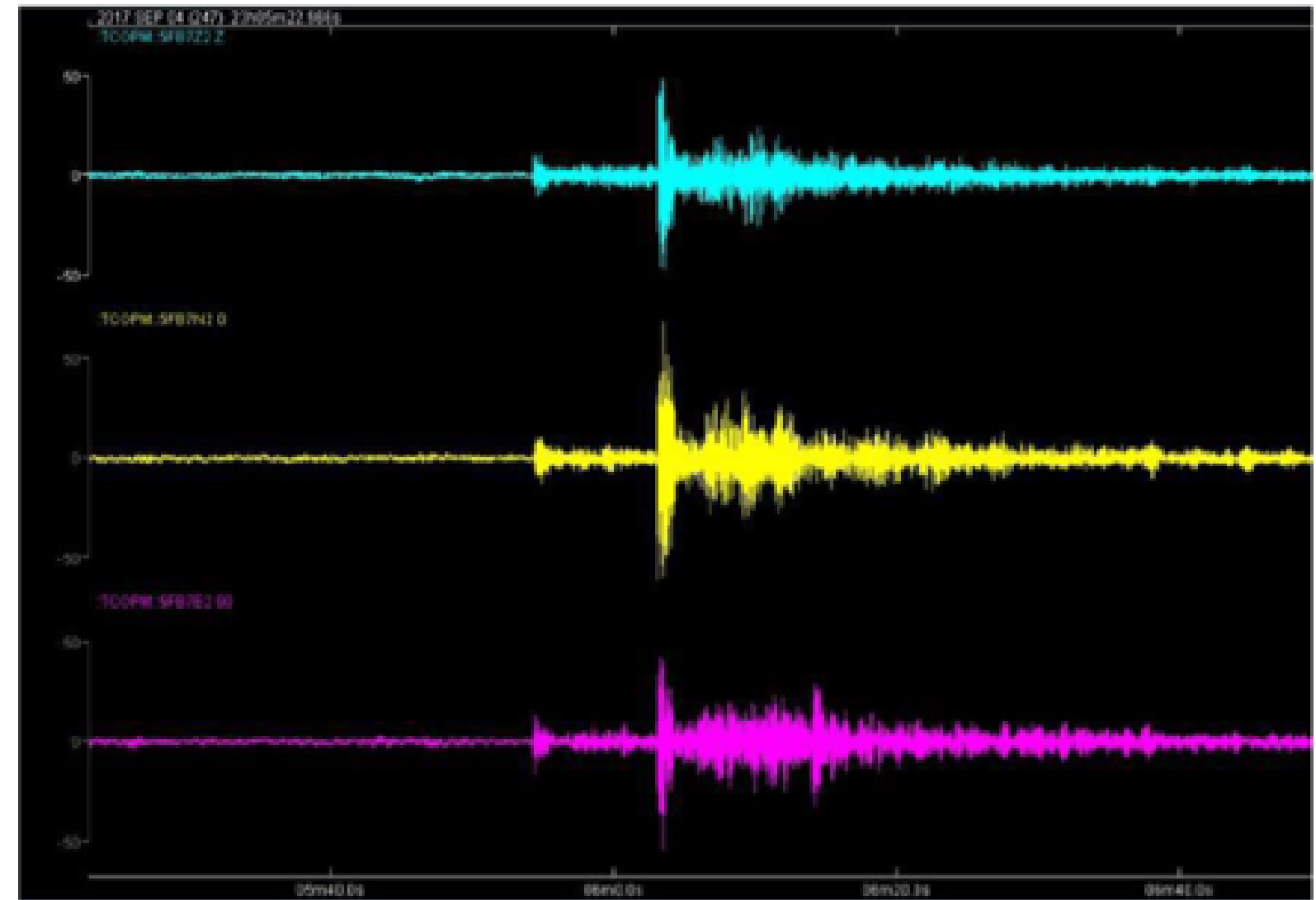
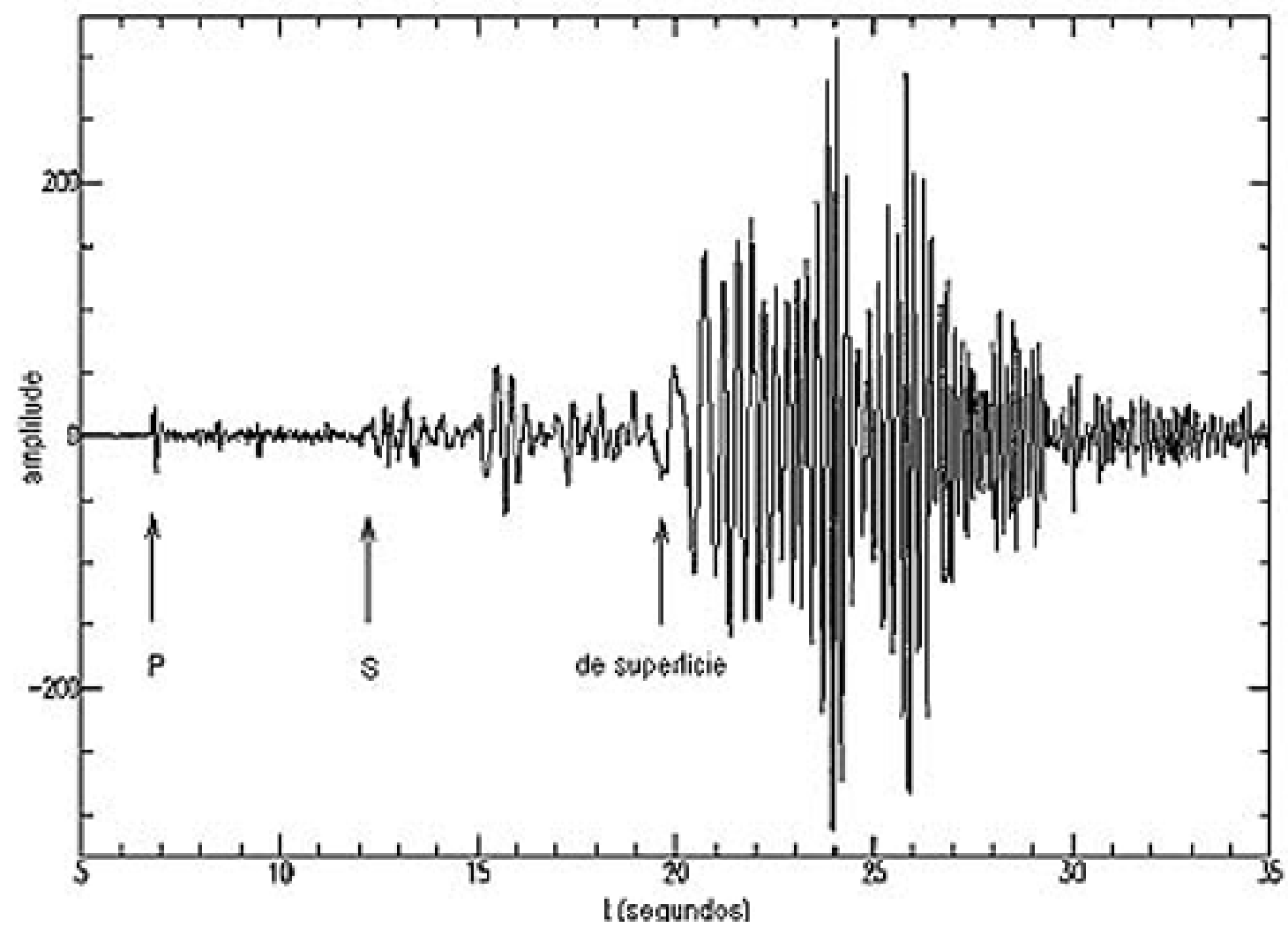
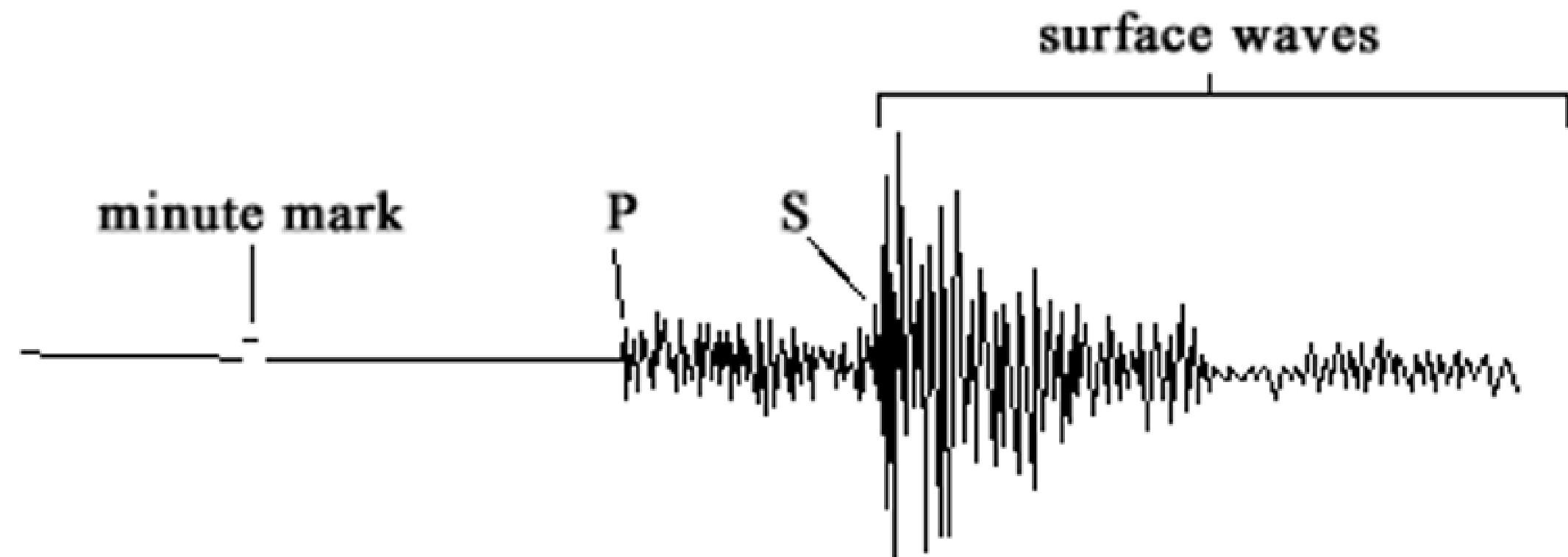


# Sismo y ondas

Ondas de cuerpo  
Primarias (P) y Secundarias (S)

Ondas superficiales  
Rayleigh (R)  
Love (L)

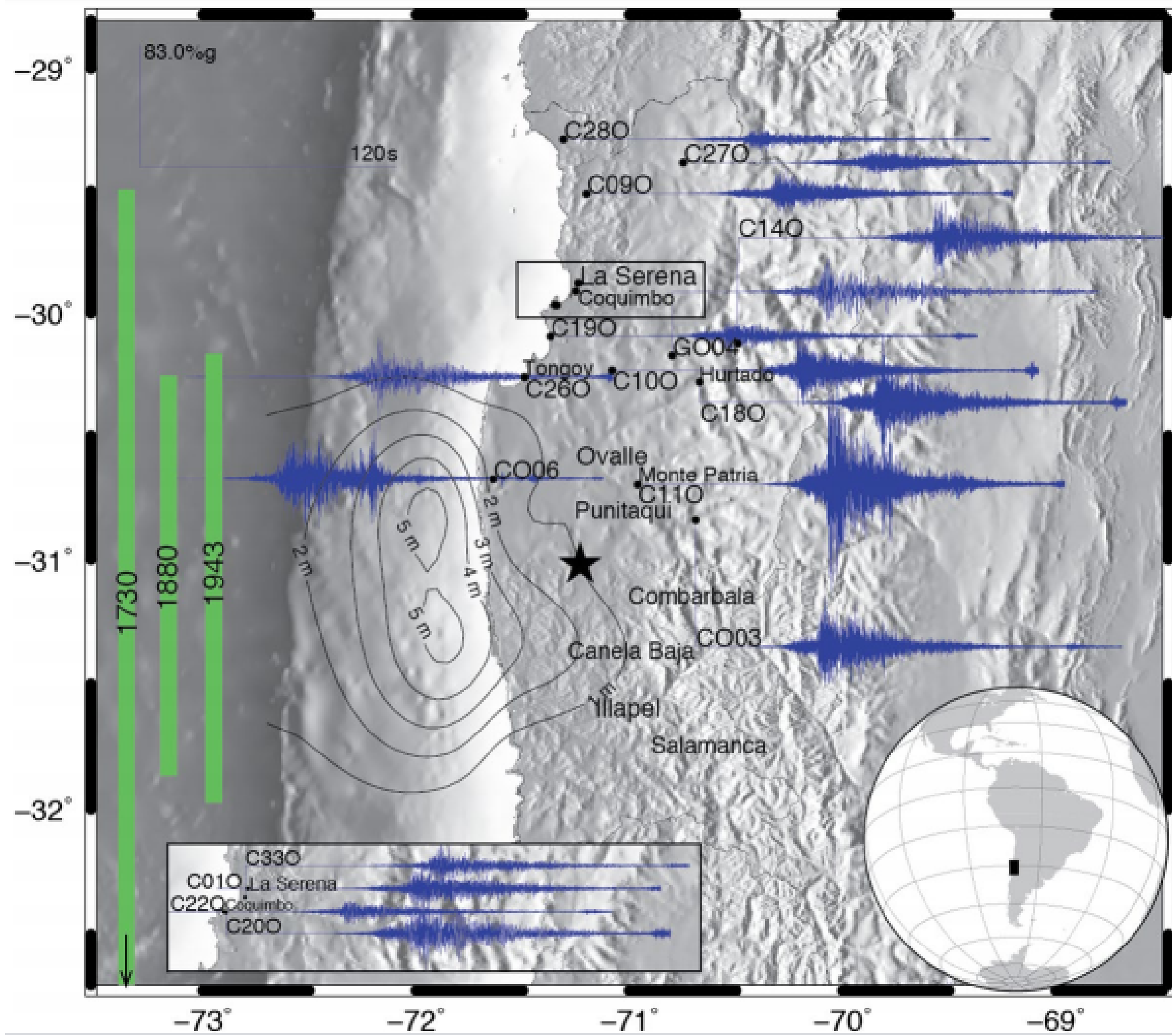






# Ejemplos sísmicos

- Illapel 2015
- Iquique 2014
- Maule 2010

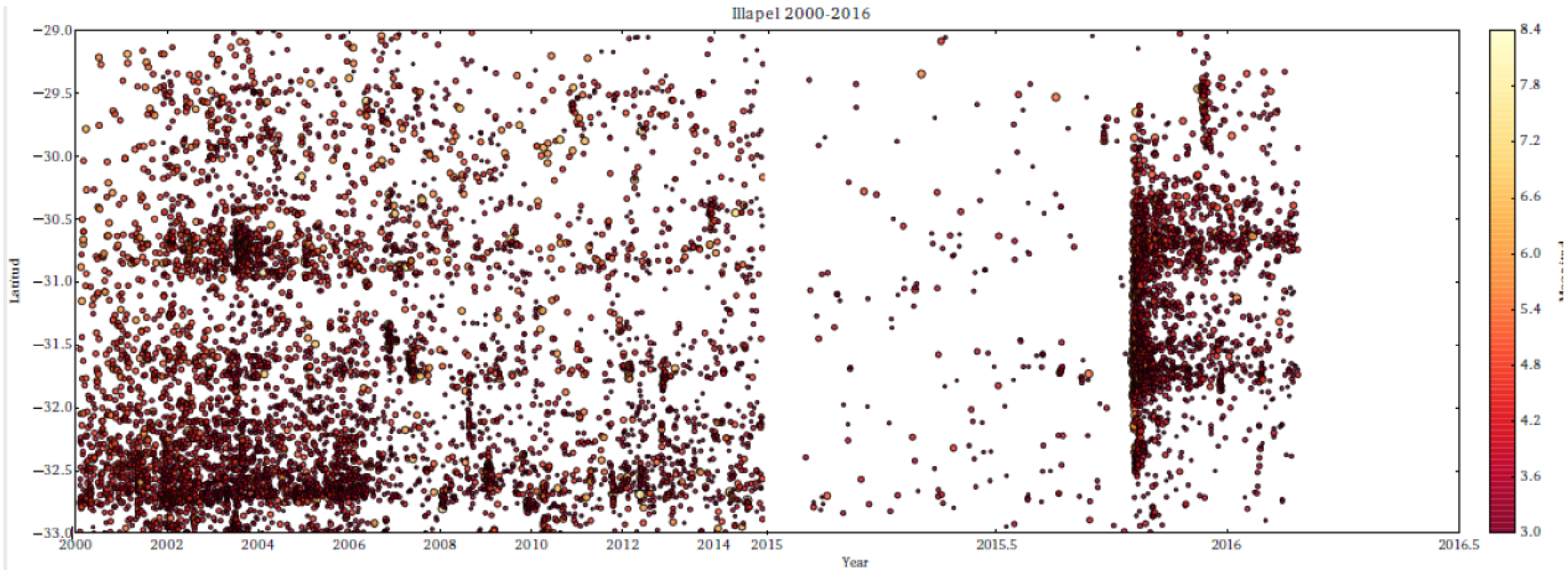


# Illapel 2015

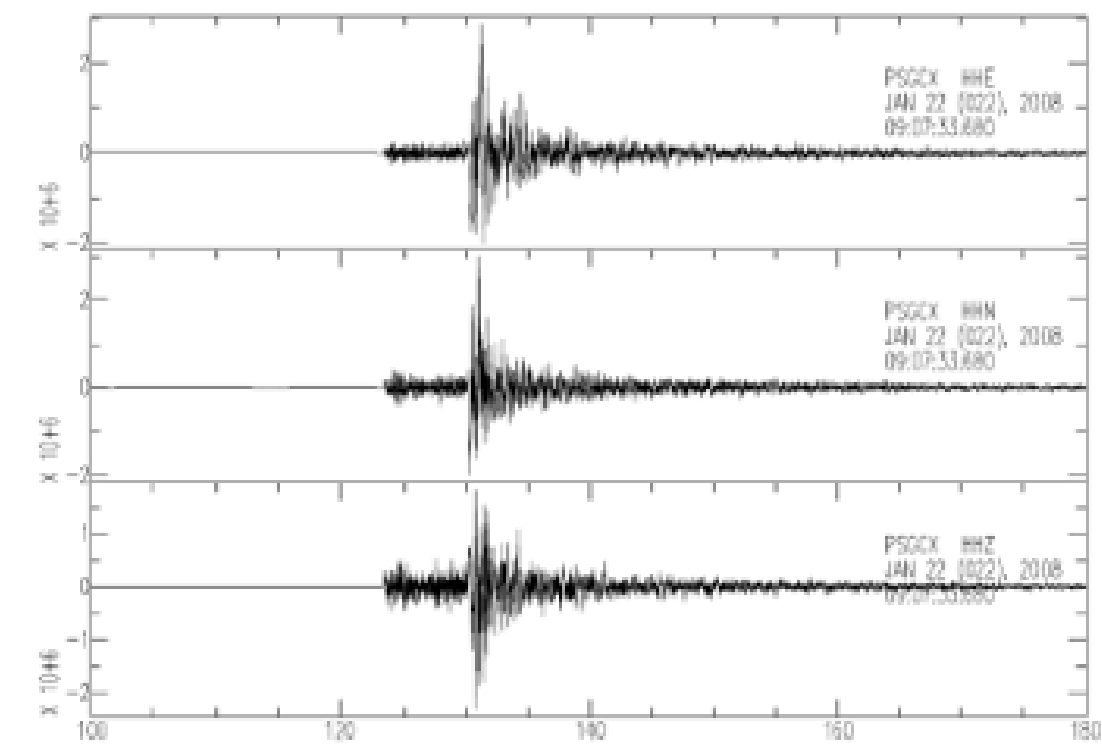
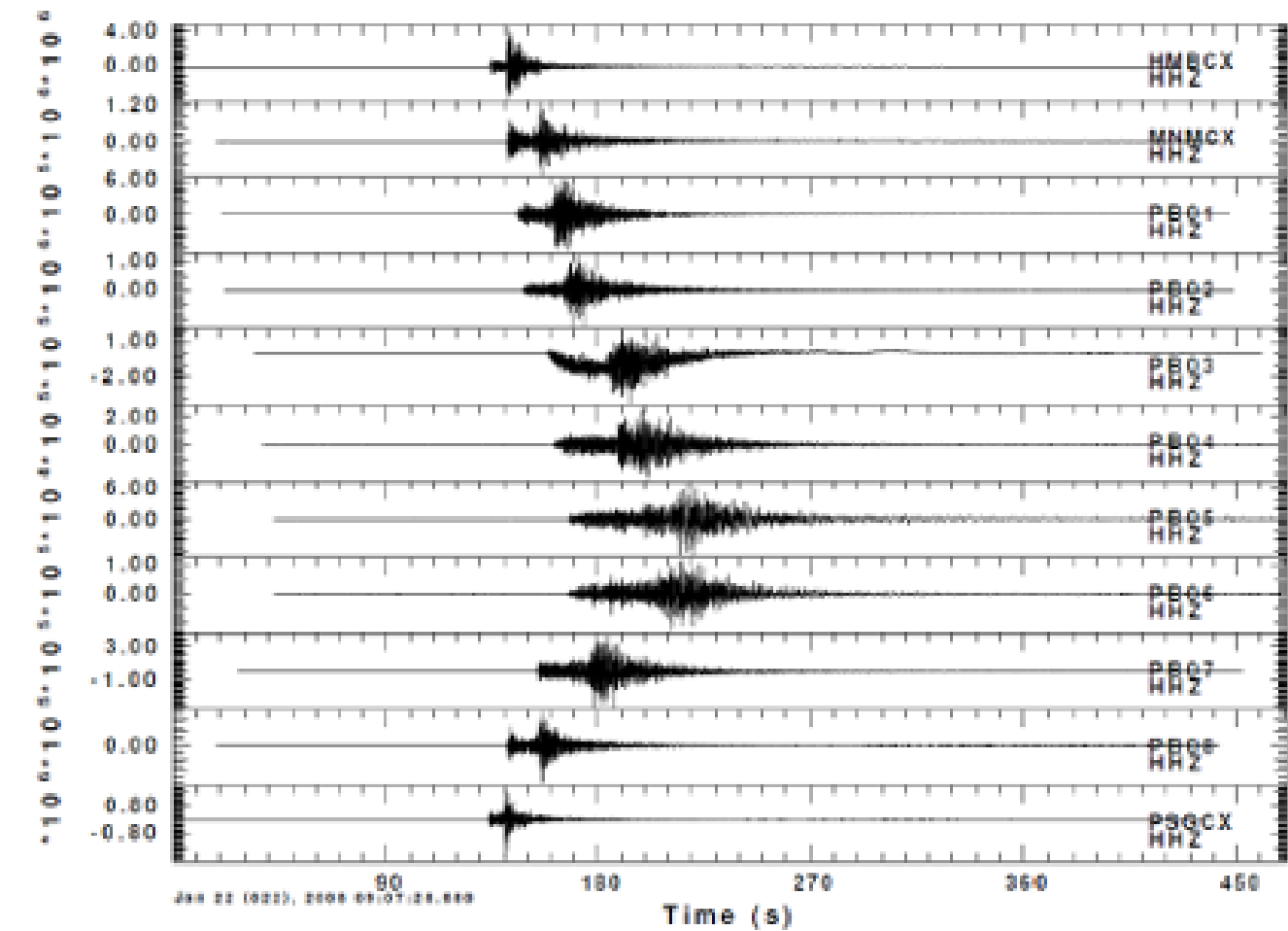
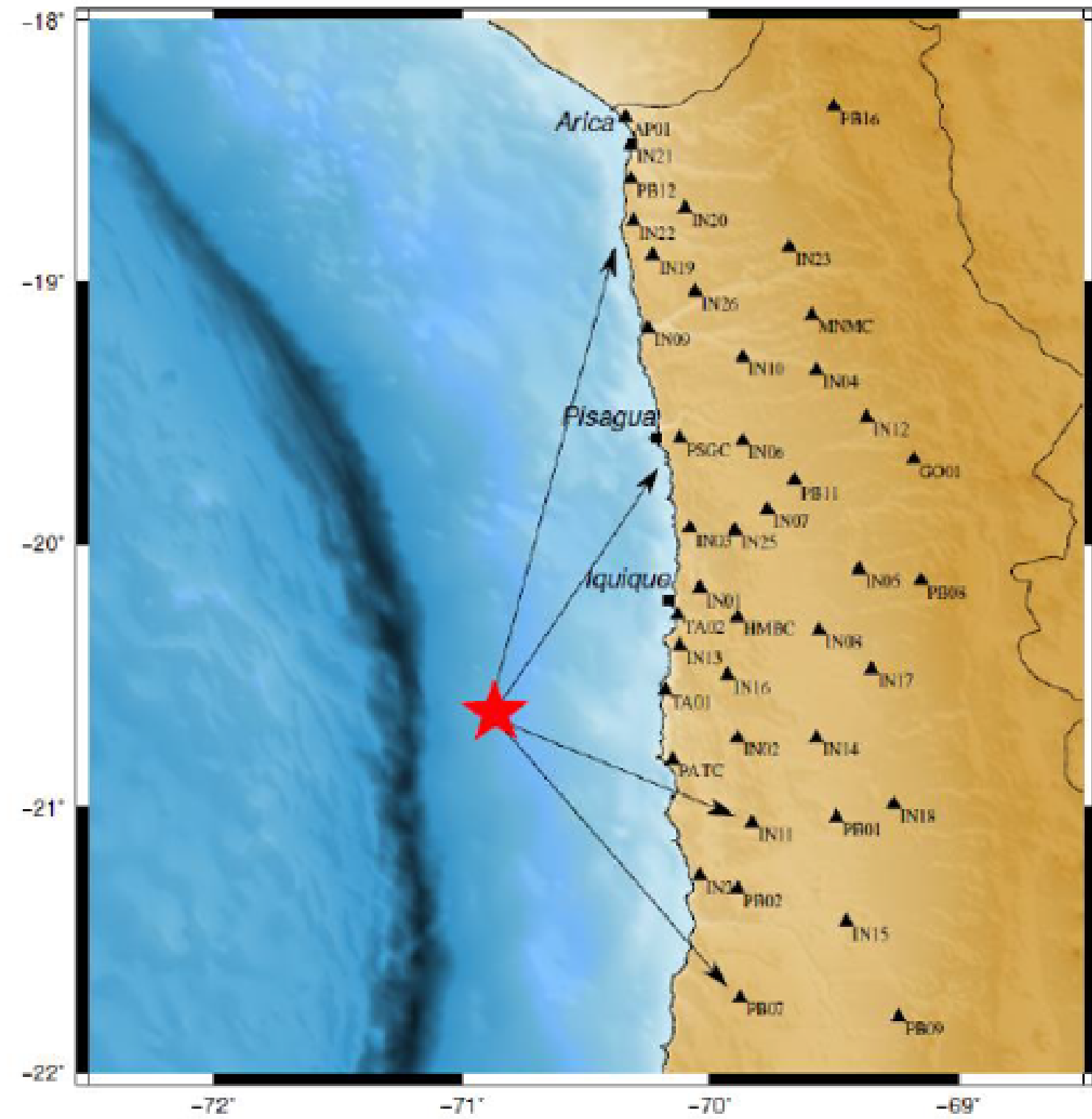
Fernández, J et al., (2019)



# Latitud vs Tiempo

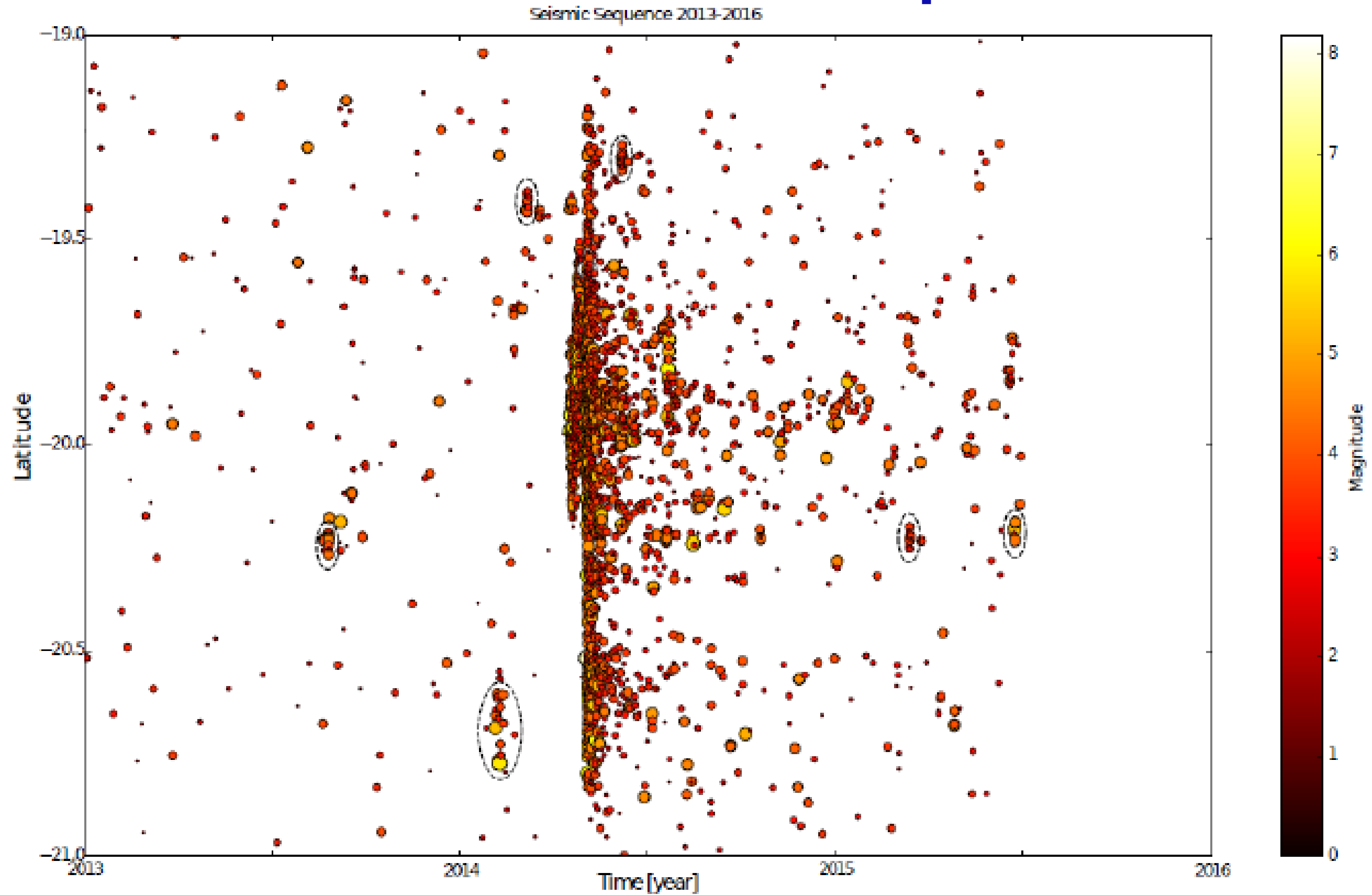


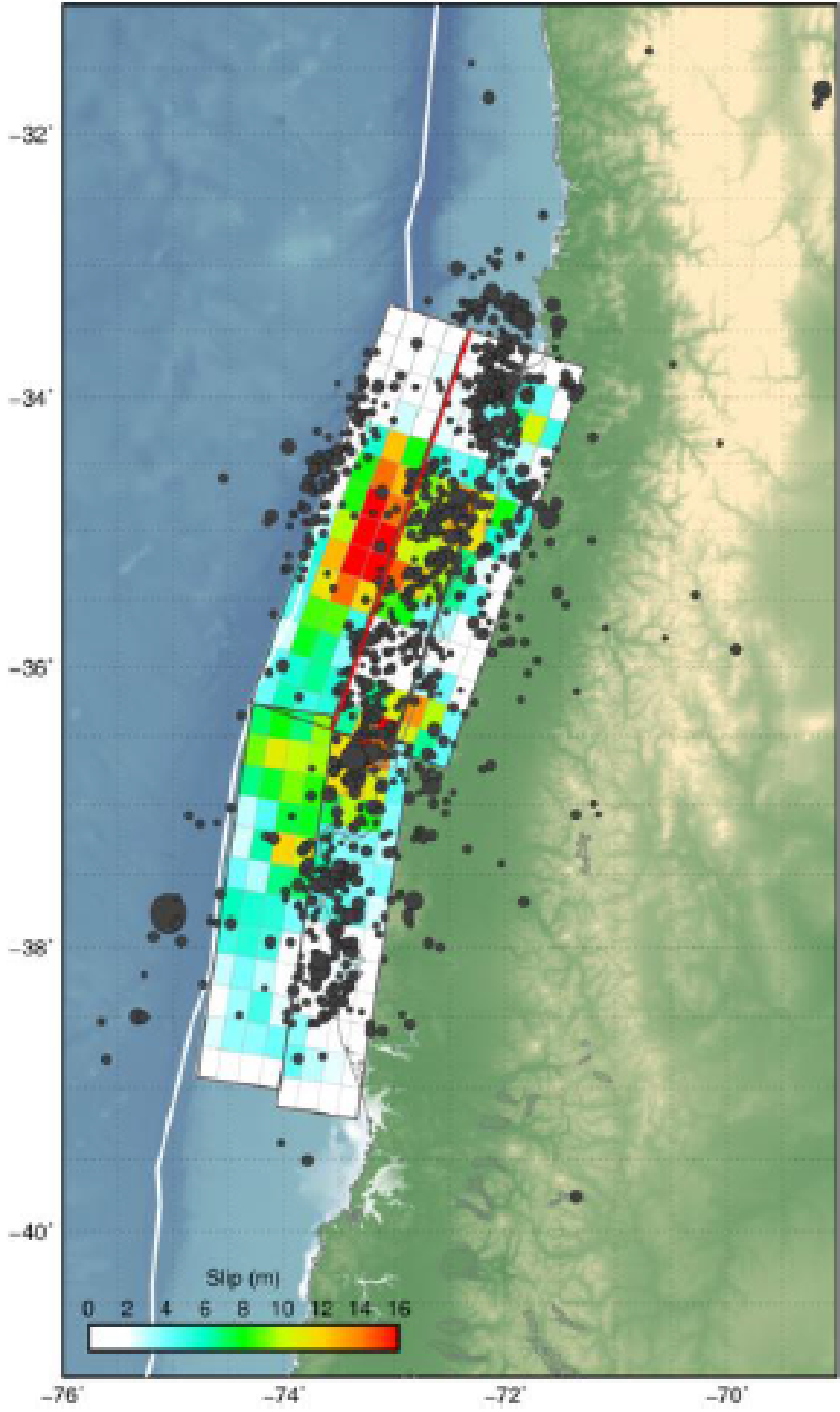
# Iquique 2014



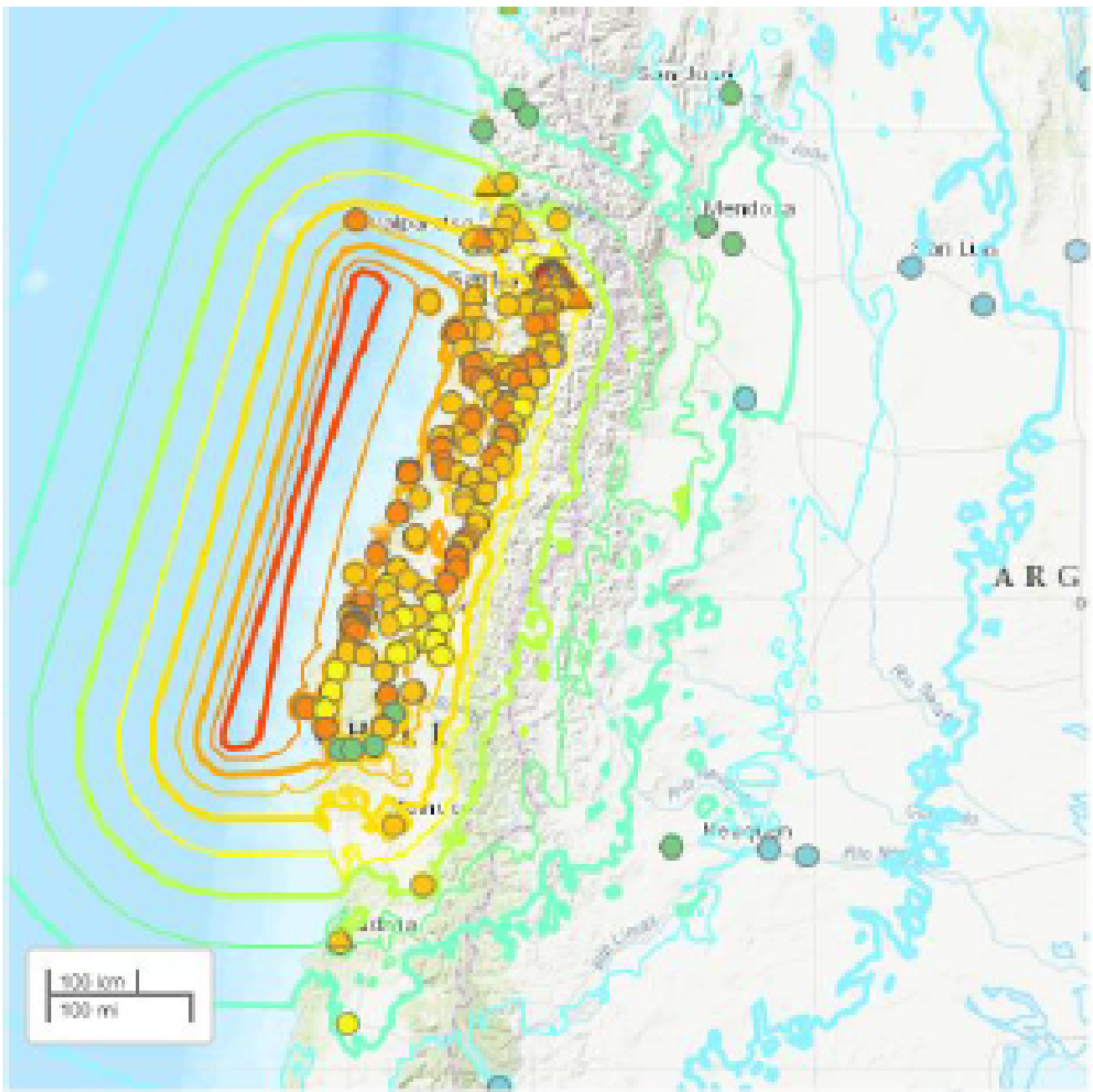


# Latitud vs Tiempo





# Intensidad



| PERCEIVED SHAKING      | Not felt | Weak   | Light | Moderate   | Strong | Very strong | Severe     | Violent | Extreme    |
|------------------------|----------|--------|-------|------------|--------|-------------|------------|---------|------------|
| POTENTIAL DAMAGE       | none     | none   | none  | Very light | Light  | Moderate    | Mod./Heavy | Heavy   | Very Heavy |
| PEAK ACC (%g)          | <0.05    | 0.3    | 2.8   | 6.2        | 12     | 22          | 40         | 75      | >139       |
| PEAK VEL (cm/s)        | <0.02    | 0.1    | 1.4   | 4.7        | 9.8    | 20          | 41         | 86      | >178       |
| INSTRUMENTAL INTENSITY | I        | II-III | IV    | V          | VI     | VII         | VIII       | IX      | X+         |

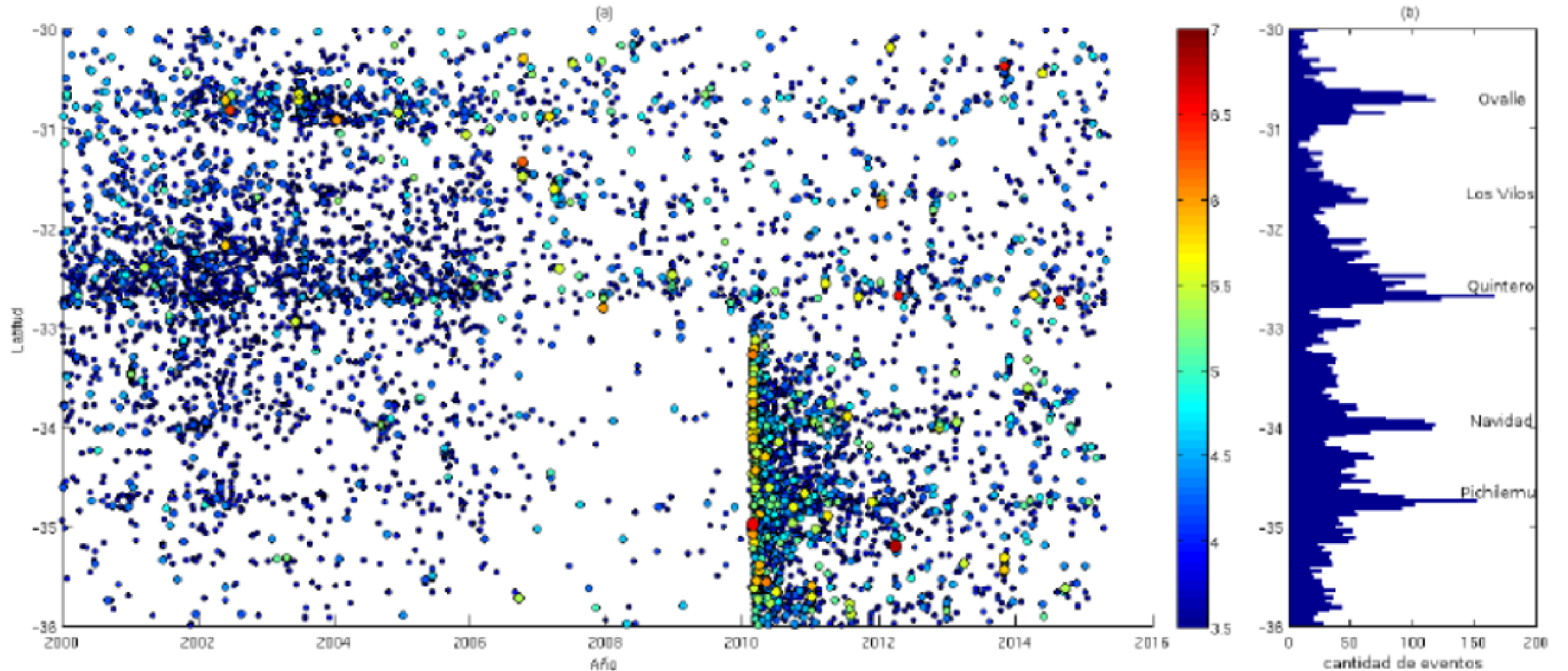
Scale based upon: Winkler et al. (2012)

USGS

Maulle  
2010



# Latitud vs Tiempo



## ¿15 mil sismos por año? Es decir ¿40 sismos diarios?

**Sismos a partir del 2010  
mayores a Mw=7.5:**

• **Maule 2010 M 8.8**

• **Iquique 2014 M 8.2**

• **Illapel 2015 M 8.1**

• **Chiloé 2016 M 7.6**

• **2017 = NO**

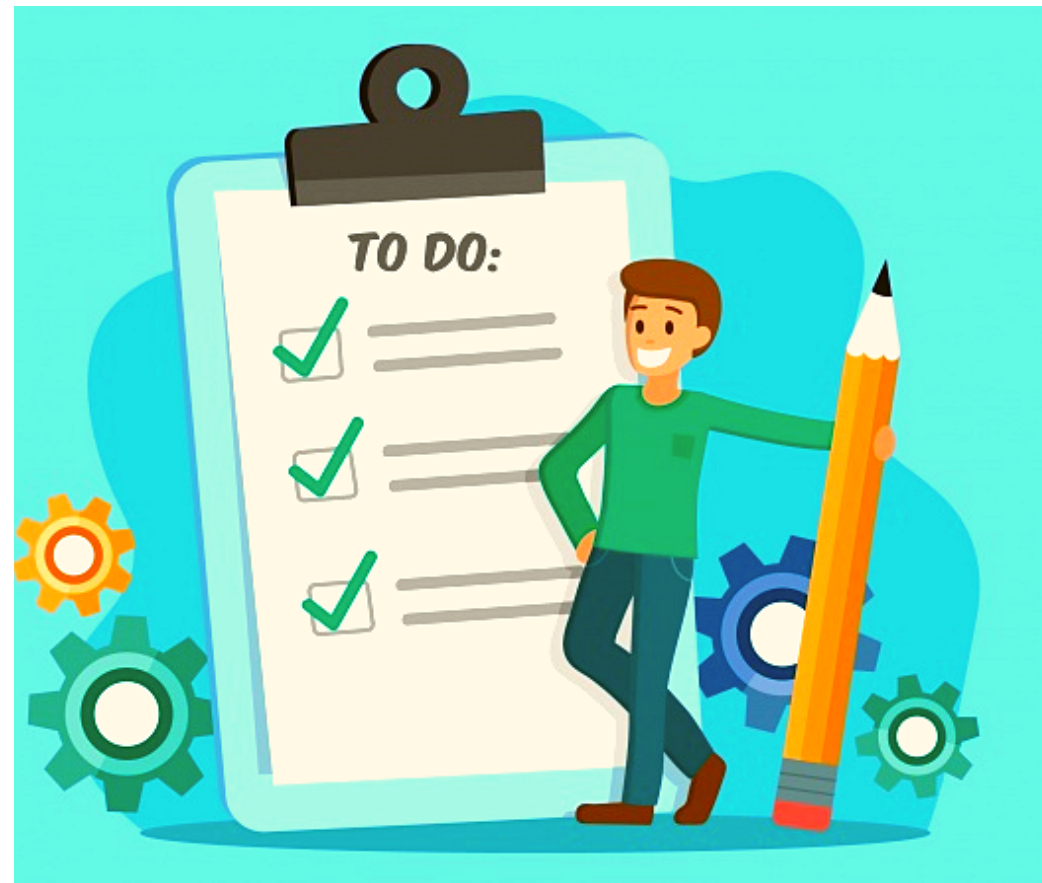
• **2018 = NO**

• **2019 = ?**

| Fecha Local                         | Latitud | Longitud | Profundidad [Km] | Magnitud    |
|-------------------------------------|---------|----------|------------------|-------------|
| <a href="#">03/11/2019 20:29:34</a> | -31.591 | -69.563  | 141.5            | 4.2 MI GUC  |
| <a href="#">03/11/2019 17:19:11</a> | -21.577 | -68.458  | 124.5            | 3.8 MI GUC  |
| <a href="#">03/11/2019 15:29:20</a> | -17.831 | -69.815  | 117.9            | 4.2 MI GUC  |
| <a href="#">03/11/2019 15:16:42</a> | -24.088 | -67.538  | 228.0            | 3.2 MI GUC  |
| <a href="#">03/11/2019 13:25:47</a> | -30.721 | -72.025  | 17.7             | 2.8 MI GUC  |
| <a href="#">03/11/2019 12:14:32</a> | -34.062 | -70.093  | 17.1             | 2.5 MI GUC  |
| <a href="#">03/11/2019 11:59:37</a> | -32.124 | -71.239  | 83.7             | 2.8 MI GUC  |
| <a href="#">03/11/2019 10:23:16</a> | -29.197 | -67.853  | 138.4            | 5.7 Mww GUC |
| <a href="#">03/11/2019 09:57:37</a> | -30.918 | -71.748  | 24.2             | 2.5 MI GUC  |
| <a href="#">03/11/2019 09:49:01</a> | -33.843 | -69.370  | 200.4            | 2.5 MI GUC  |
| <a href="#">03/11/2019 08:36:59</a> | -23.017 | -66.918  | 265.5            | 3.8 MI GUC  |
| <a href="#">03/11/2019 08:14:40</a> | -30.233 | -70.900  | 82.6             | 3.2 MI GUC  |
| <a href="#">03/11/2019 08:01:58</a> | -36.047 | -73.362  | 40.7             | 2.5 MI GUC  |
| <a href="#">03/11/2019 07:33:38</a> | -17.466 | -70.123  | 154.3            | 3.5 MI GUC  |
| <a href="#">03/11/2019 05:41:54</a> | -25.840 | -69.304  | 121.2            | 3.1 MI GUC  |
| <a href="#">03/11/2019 05:06:09</a> | -30.722 | -72.114  | 10.3             | 5.2 Mww GUC |
| <a href="#">03/11/2019 00:28:21</a> | -24.212 | -67.452  | 227.7            | 2.8 MI GUC  |
| <a href="#">02/11/2019 22:39:22</a> | -22.101 | -68.835  | 109.9            | 3.1 MI GUC  |

CSN, 3/11/2019

# ¿Qué sigue?



- **Ciclo sísmico**
- **Leyes empíricas**
- **Enjambre sísmico**
- **Laguna sísmica**



# ¿Dudas, preguntas, sugerencias?

Profesor: Sergio Ruiz  
Auxiliar: Rogelio Torres  
y Hermann Schwarze

