

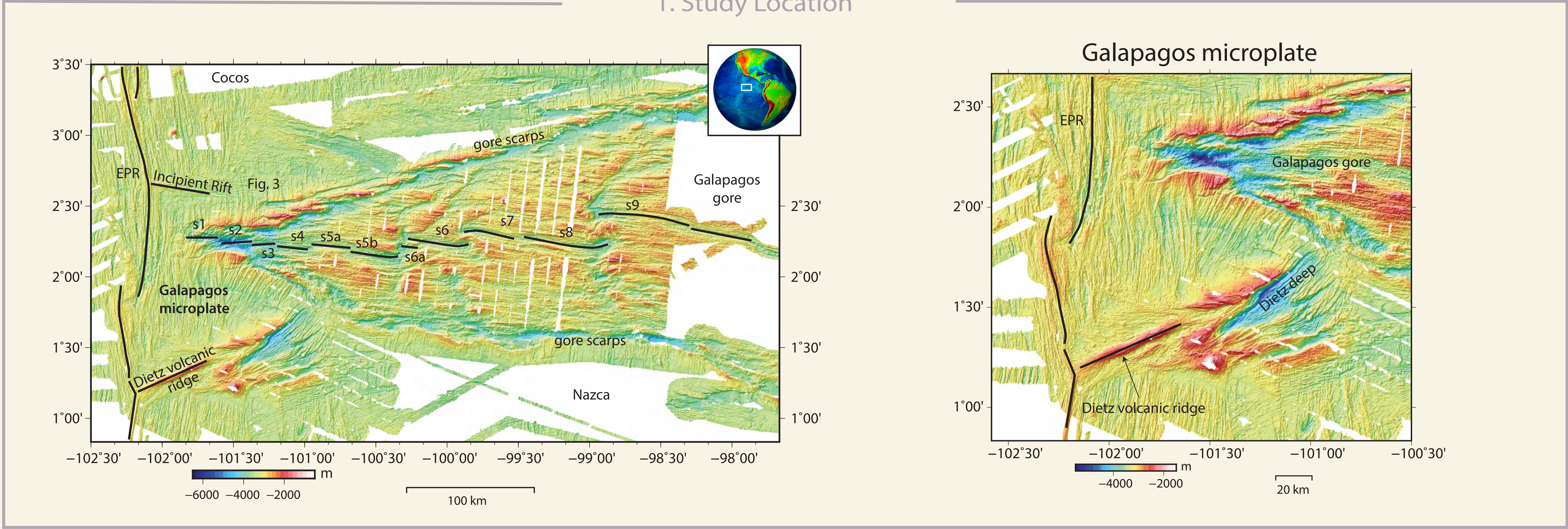
# Formation of the Galapagos Microplate and its Effect on Rifting at the Galapagos Triple Junction

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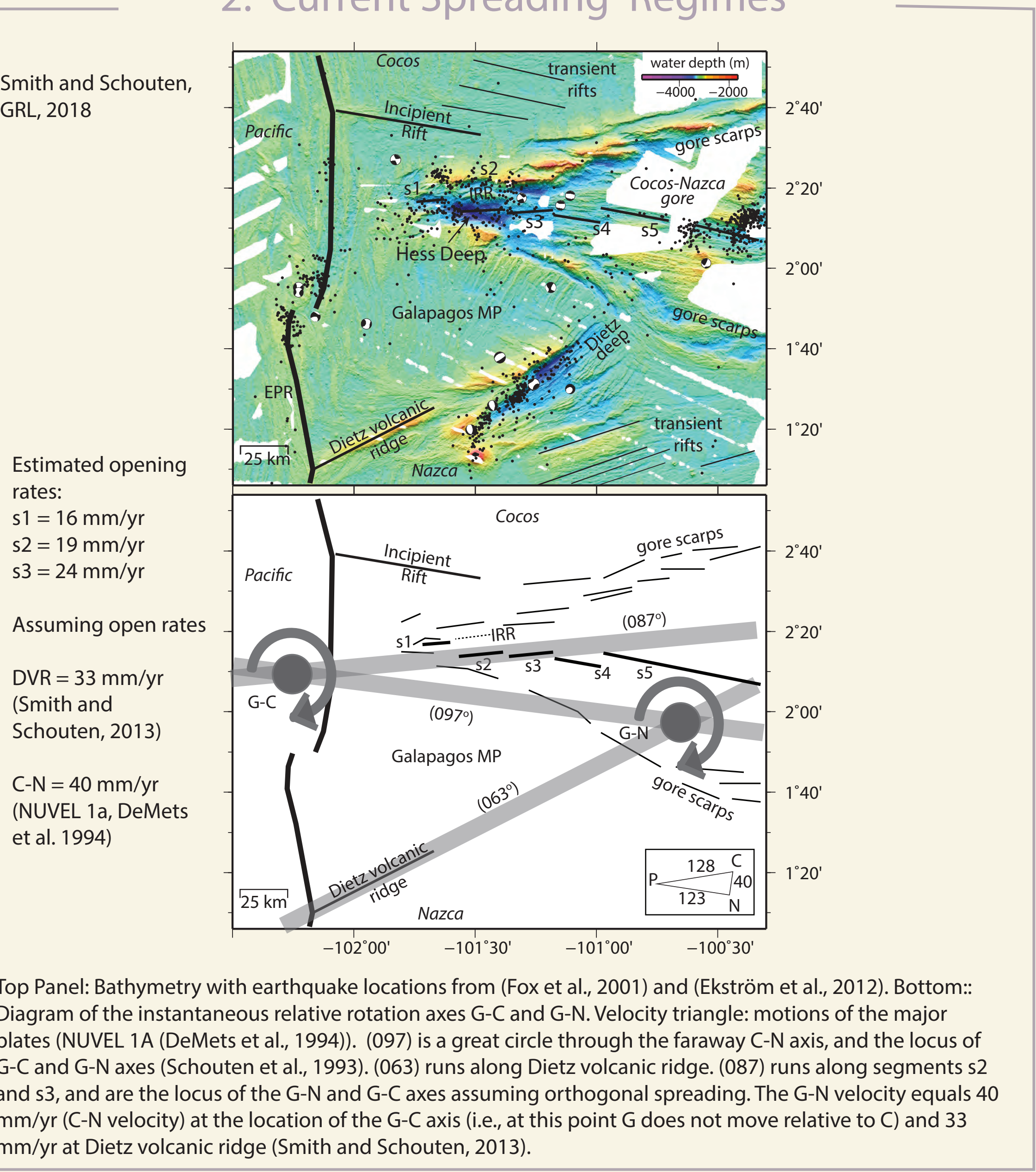
**Introduction.**  
The Galapagos microplate formed at ~1.4 Ma, initiating Nazca–Galapagos magmatic spreading along its southern and eastern borders. We examine in detail the formation and evolution of the microplate and its effect on the major rift boundaries of the Galapagos triple junction region. We show that the microplate originated by breaks along three pre-existing zones of structural weakness in the Nazca lithosphere: 1) to the south, an active ‘secondary rift’ located ~50 km south of the Pacific-Cocos-Nazca triple junction; 2) to the east, faults associated with the off-axis East Pacific Rise (EPR) abyssal hill fabric, and 3) to the north, the deep normal faults of the southern scarp of the Galapagos gore (the faulted boundary between the Pacific-Nazca and the Cocos-Nazca regimes). The breaks were likely forced by the appearance of a significant magmatic anomaly that crossed the EPR, flooded the ‘secondary rift’ in the south with lavas, and shortly thereafter created two large seamounts (~1500 m and ~1000 m in relief) on the southern boundary. This magmatic anomaly may also be associated with the unusually high elevation of Dietz Volcanic Ridge west of the seamounts, which resembles the rift zones of Axial Seamount on the Juan de Fuca Ridge.

Dietz Volcanic Ridge is the present southern boundary of the Galapagos microplate and opens at ~33 mm/yr. It is ~900 m in relief and 7.5-8 km wide at its shallowest section. Rock samples dredged from the shallow section of the ridge in 2018 on the R/V Sally Ride support the idea of a magmatic anomaly in this area. The rocks are transitional MORB that are more enriched than any Cocos-Nazca lavas or the adjacent EPR that we sampled. The residual mantle Bouguer anomaly indicates thicker crust associated with the two seamounts and the eastern section of Dietz Volcanic Ridge. We also examine the response of the Cocos-Nazca rift and the EPR to the arrival of the magmatic anomaly and microplate formation. The Galapagos triple junction region is complex, but this complexity provides an opportunity to obtain a better understanding of how plates deform internally near their boundaries, and the relationship between this deformation and upwelling mantle material.

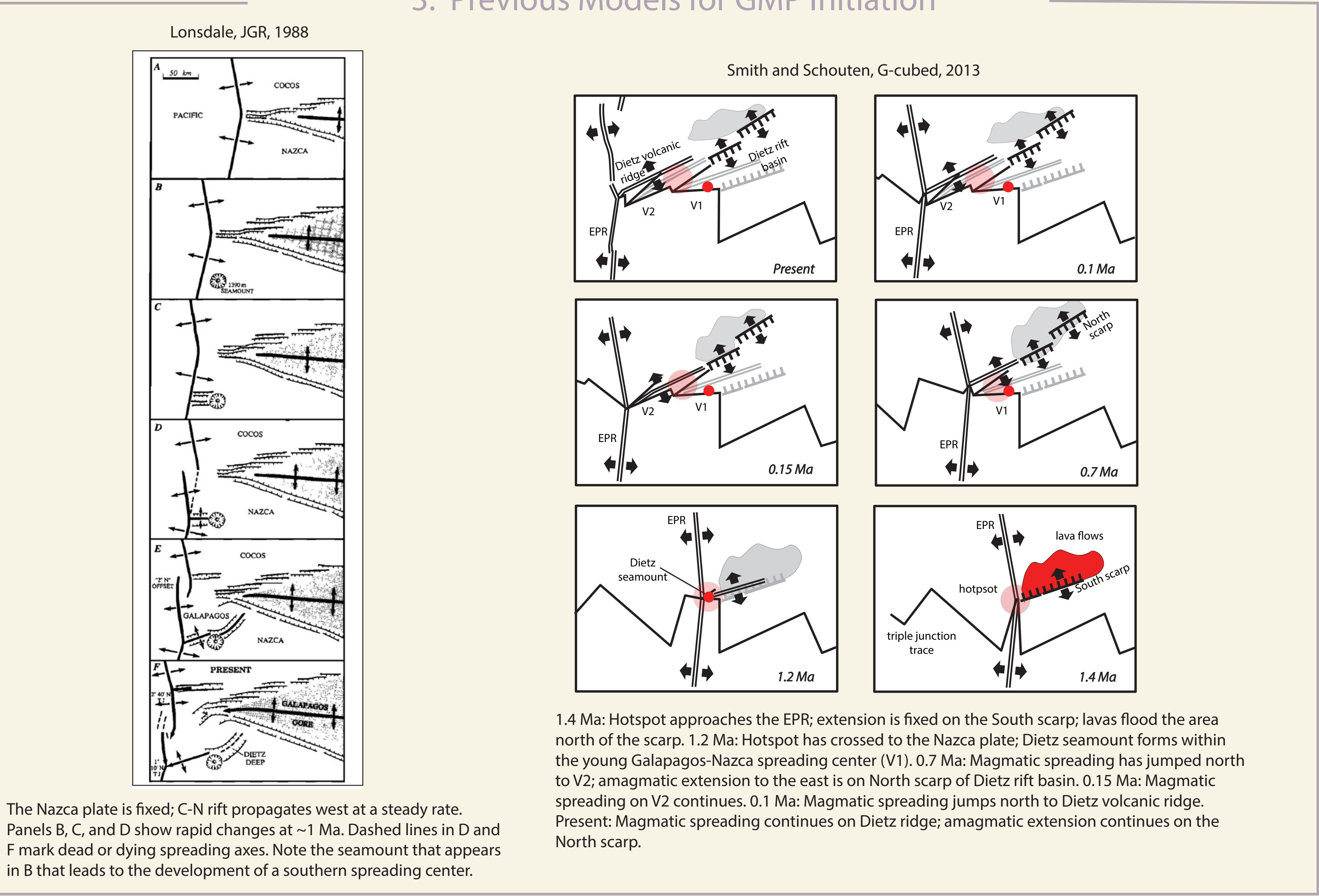
## 1. Study Location



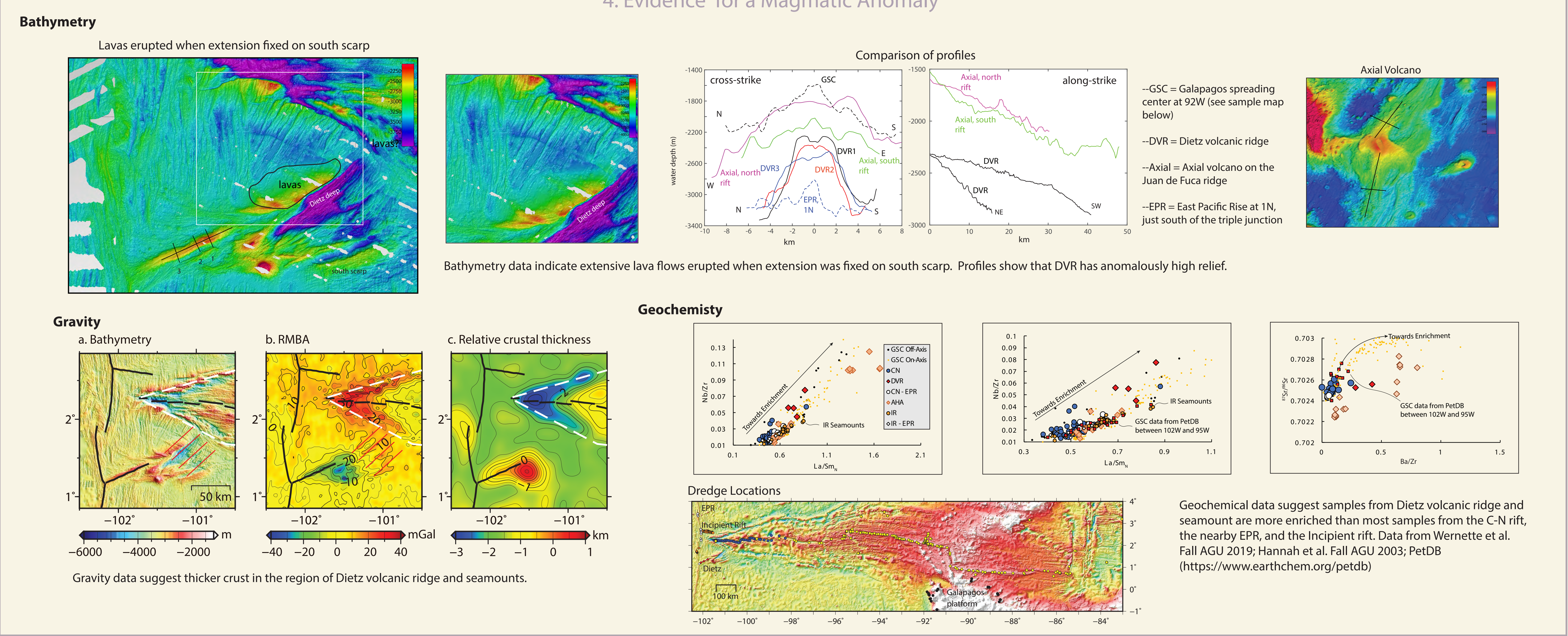
## 2. Current Spreading Regimes



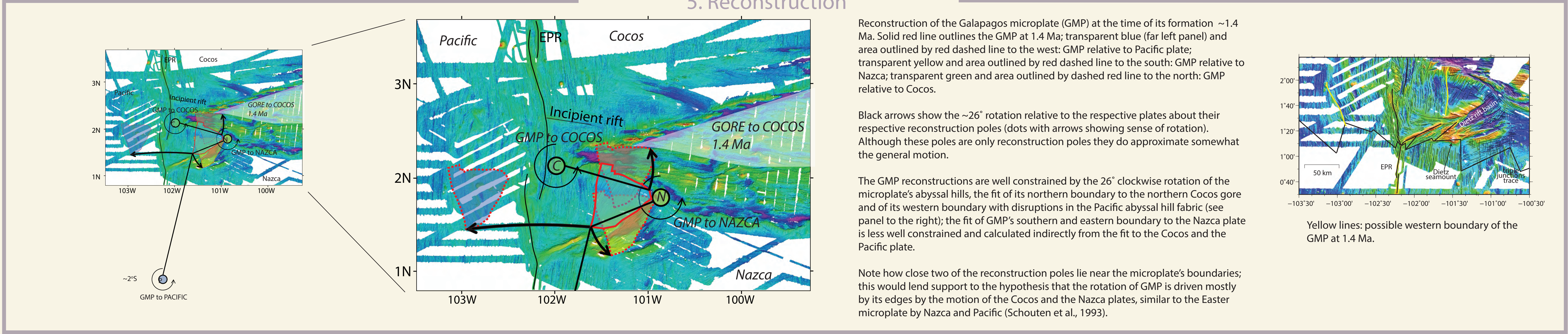
## 3. Previous Models for GMP Initiation



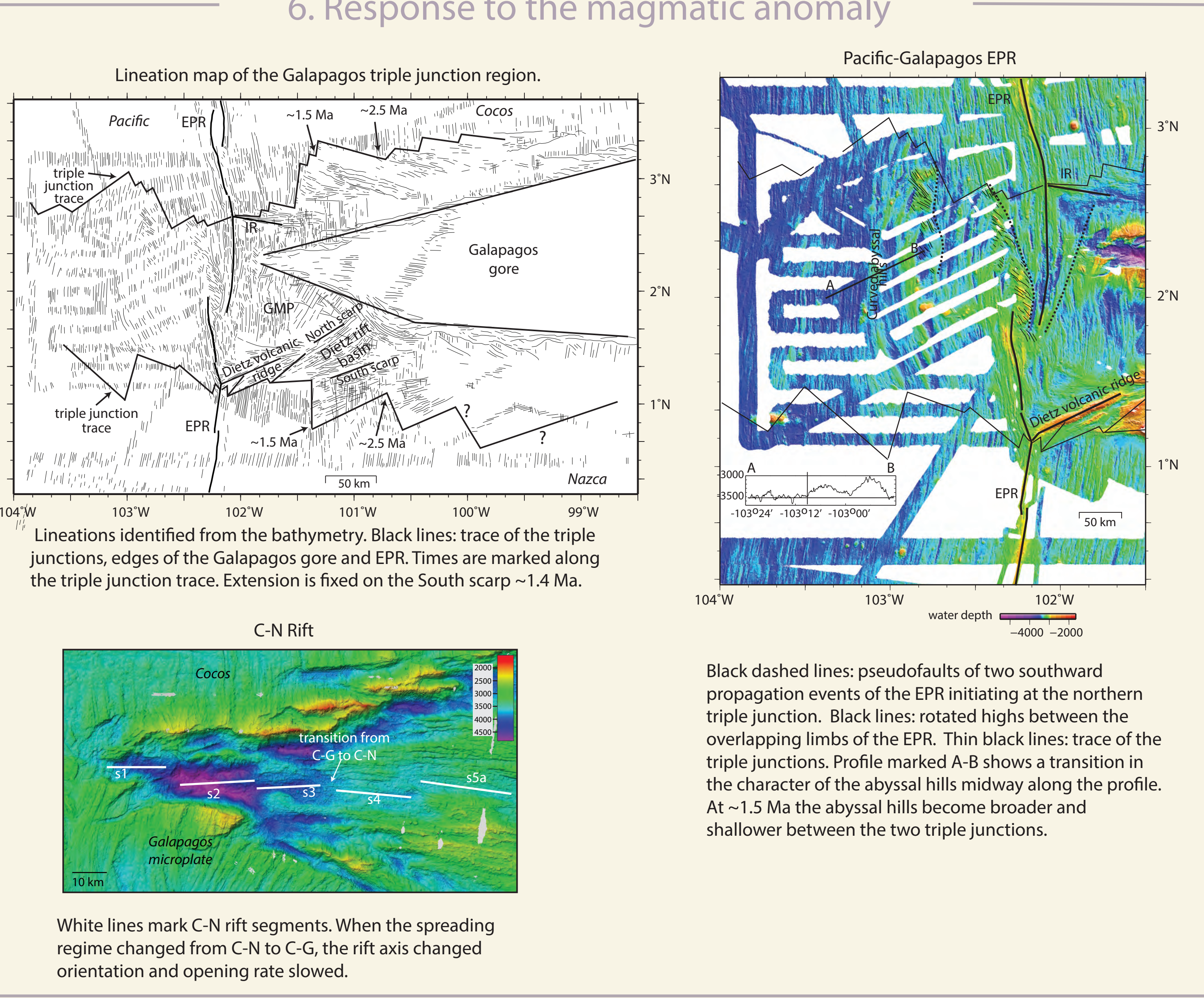
## 4. Evidence for a Magmatic Anomaly



## 5. Reconstruction



## 6. Response to the magmatic anomaly



## 7. Conclusions

- 1) The Galapagos microplate originated by breaks along three pre-existing zones of structural weakness in the Nazca lithosphere.
  - The southern boundary formed along a transient rift induced by CN propagation. Extensive eruptions support the idea that a magmatic anomaly initiated the break.
  - The eastern boundary formed along the pre-existing abyssal hill fabric on the Nazca plate.
  - The northern boundary formed along the deep faults of the Galapagos gore.
- 2) The magmatic anomaly was responsible for Dietz Seamount, a series of northwestward jumps of the southern boundary and, presently, for Dietz Volcanic Ridge, which is anomalously high. Gravity data indicate thicker crust in this region.
- 3) The chemistry of the very fresh volcanic glasses dredged from Dietz Seamount indicate that the lavas are enriched.
- 4) The arrival of the magmatic anomaly coincided with a change in the character of the abyssal hills flanking the EPR.
- 5) The rifted basins at the western tip of the Galapagos gore changed orientation and their opening rates decreased.

**Acknowledgments:**  
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