

Tropical versus Temperate Zone Lacustrine Source Rocks: Examples from Takutu Basin, Guyana, and General Levalle Basin, Argentina

Introduction

ABSTRACT

Tropical versus Temperate Zone Lacustrine Source Rocks: Examples from Takutu Basin, Guyana, and General Levalle Basin, Argentina

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Rift basin lacustrine source rocks have generated 5.7 percent of the world's reserves, and some of today's most active exploration plays are driven by lacustrine-shale-based petroleum systems. However, paleolatitude and paleoclimate play major roles in determining organic richness of lake sediments, and not all restricted lacustrine basins contain commercial petroleum systems. Two continental-interior lacustrine rift basins in South America display dramatic differences.

In the Takutu basin, at a tropical paleolatitude of 2°N, deposition in an Early to Middle Jurassic rift during global "hothouse" conditions produced organic-rich shale with 1.5 to over 4% TOC, hydrogen indices of over 360, and pyrolysis yields up to 9300 ppm. Terrestrial kerogen is significant, but Type I/II non-marine algal amorphous kerogen is dominant in richer intervals. Significant oil and gas were generated but mostly lost during Miocene(?) tectonic reactivation.

In contrast, the Lower Cretaceous General Levalle rift basin formed at a temperate zone paleolatitude of 45°S during mild "icehouse" climatic conditions. Dark lacustrine shale is organic-lean, with maximum TOC just over 1%. Kerogen is Type III/IV, with little generative capacity, and derived mostly from pollen from nearby upland forests. Here the annual seasonal cycle probably caused lake turnover and prevented long-term establishment of an anoxic bottom layer to preserve organic matter, which is common in more tropical settings such as the Takutu.

Global Considerations



Purpose of this Poster Session

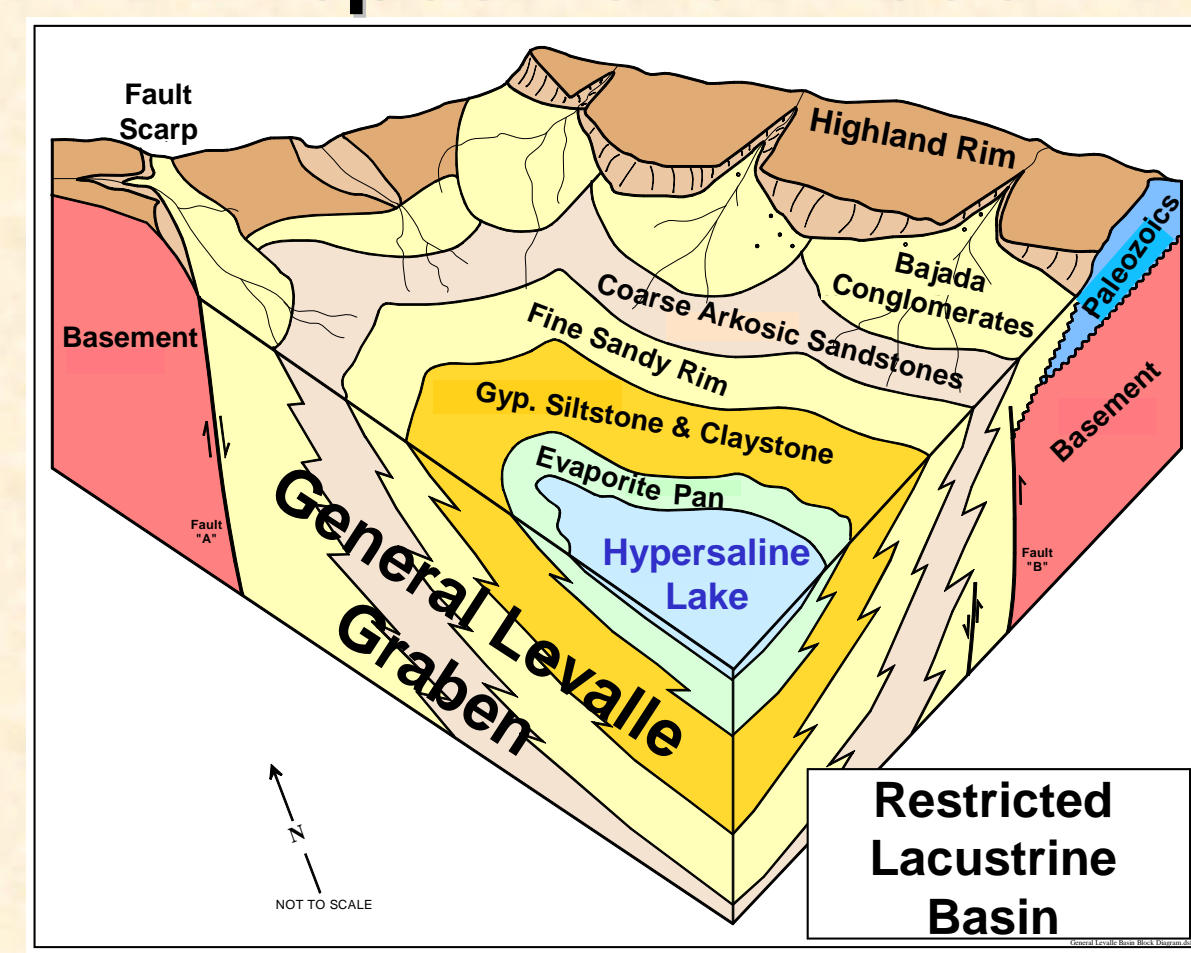
- Review depositional environments and source rock characteristics of two geologically-similar South American Mesozoic rift basins that formed at different paleolatitudes under different climates.
 - ✓ Compare tropical vs temperate settings.
- Goal: Increase awareness of source risk associated with exploration for lacustrine-sourced basins.



Global Considerations: Lacustrine Source Rocks

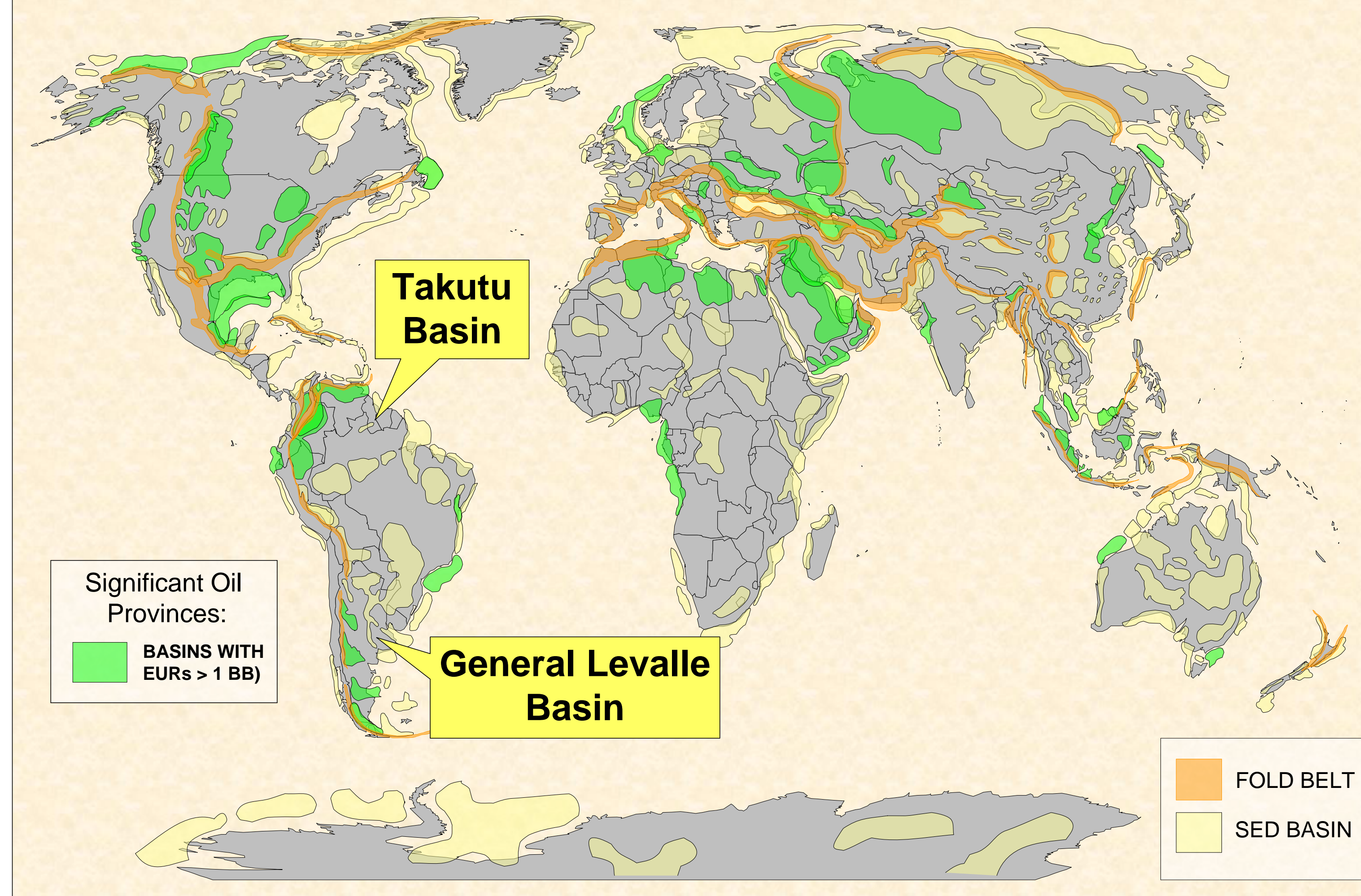
- Most South American and African Atlantic margin petroleum plays are sourced by L. Cretaceous lacustrine source rock.
- Most organic-rich lacustrine source rocks were deposited in tropical to sub-tropical settings.
- Annual lake turnover associated with the freeze/thaw cycle tends to limit preservation of organic material in lake bottom sediment.

Depositional Model



Basin Locations

Guyana/Brazil and Argentina Lacustrine Basin Locations



TAKUTU BASIN

- Type- Intracratonic rift basin
- Age- E. Jurassic to E. Cretaceous
- Paleolatitude- 2°North
- Size- 280 km long, 40 km wide, and over 7 km deep
- Area- >11,200 sq. km.
- Sedimentary Fill- Early basaltic phase followed by lacustrine and basin margin clastics, an evaporite phase, and final siliciclastic fill.
- Structural reactivation: Miocene.



GENERAL LEVALLE BASIN

- Type- Intracratonic rift basin
- Age- Early Cretaceous
- Paleolatitude- 45°South
- Size- 150 km long, 5-50 km wide, and over 6.5 km deep
- Area- >5,000 sq.km.
- Sedimentary Fill- Early coarse siliciclastic fill fines upward to an evaporite phase, then coarsens upward again into siltstones and sandstone, capped by basalt flows.
- Structural reactivation- none.