Abstracts

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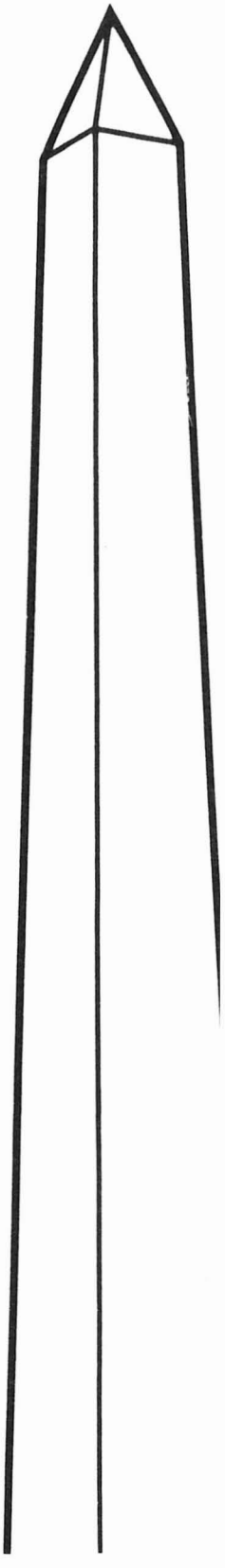

During late Cretaceous time oceanic circulation continued between the Atlantic and Indian oceans, and true oceanic conditions developed between the southern and northern Atlantic ocean. Thus, marine transgressions occurred not only on the Pacific side of South America, but also in different areas along its eastern and northeastern margin. The Antarctic Peninsula was still adjacent to South America, preventing open circulation between the South Atlantic and Pacific oceans.

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Convergent Strike-Slip Faulting in Passive Continental Margin, Southeastern Brazil

The Serra do Mar Continental Rift, southeastern Brazil, exhibits a two-fold tectonic evolution, marked by a horizontal northwest-southeast sedimentary distensive stage of Paleogene age and a younger post sedimentary strike-slip stage (Riccomini, 1987). Both stages follow Upper Precambrian east-northeast to east-west basement shear-zones.

The Itatiaia Alkaline Massif, located at the boundaries between São Paulo, Rio de Janeiro, and Minas Gerais States, is a slightly northwest-elongated body emplaced in Precambrian domains at Late Cretaceous (66 Ma) and provides an excellent situation for the observation of the second tectonic stage.

Exposures in the alkaline massif yielded 150 orientations of faults and their respective slickenside lineations, and for about one-third the probable sense of displacement was determined. There is a clean west–west-northwest to east–east-southeast main trending, and two other groups striking north–north-northeast and north–north-northwest. All these populations have both right- and left-lateral strike-slip displacements.

Megascope features of the massif such as the right-lateral displacement of ring-dykes, indicate at least 500 m offset. On the other hand, a small number of fault planes present superposition of striae and suggest a young age for the left-lateral movement.

Graphical determination of the main principal stress axes using the method proposed by Angelier and Mechler (1977) yielded the definition of a horizontal northwest-southeast compressive axis, a vertical intermediate axis, and a horizontal northeast-southwest extension axis for the right-lateral faulting. The axes for the left-lateral faulting are exactly coaxial with the first ones, with permutation of the compressive axis by the extension axis. As indicated by the rakes of fault population of this phase it probably represents a relaxation of the main horizontal stresses near the surface.

The data obtained in the studied area showed strong agreement with a major right-lateral east-west convergent transcurrence, probably caused by transpression, observable in other areas of the Serro do Mar Rift. This stress is responsible for the development of structural features affecting the Tertiary as well as the recent sediments (Riccomini et al, in preparation), and also for The present-day stress-field in the region as showed by the fault-plane solutions of swarms of reservoir-induced events (Assumpção et al, 1985).

A mechanism similar to those suggested by Lima (1987) for basins of northeastern Brazil is here proposed for the synsedimentary distensive stage, establishing the relationship of faulting with subsidence of continental margin at its thermal stage. Clockwise rotation of the South American Plate during the Cenozoic opening of Atlantic Ocean (Sadowski, 1987) was probably responsible for the convergent stage.

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Geochemistry of Coal Derived Hydrocarbons and Source Rock Potential of Coal Beds, San Juan Basin, New Mexico and Colorado

Coal beds are considered to be a major source of nonassociated gas in the Rocky Mountain basins of the United States. In the San Juan basin of northwestern New Mexico and southwestern Colorado, significant quantities of mainly nonassociated gas are being produced from coal beds of the Upper Cretaceous Fruitland Formation and from adjacent sandstone reservoirs. The in-place gas resources of the coal beds are estimated to be about 1.5×10^{12} m^3. Analysis of gas, condensate, and coal samples from the various gas producing intervals provided a means of determining the origin of the hydrocarbons and of evaluating the source-rock potential of the coal beds.

The coal rank in the Fruitland Formation in the central part of the San Juan basin, where major gas production occurs, increases to the northeast and ranges from high volatile B bituminous to medium volatile bituminous (R_m values range from 0.70 to 1.45%). On the basis of chemical, isotopic, and coal rank data, the gases are interpreted to be thermogenic. Gases from the coal beds show little isotopic variation ($\delta^{13}C_1$ values range from -43.6 to -40.5 ppt), are chemically dry (C_1/C_1-5 values are >0.99), and contain significant amounts of CO_2 (as much as 6%). These gases are interpreted to have resulted from devolatilization of the humic-type bituminous coal which is composed mainly of vitrinite with only minor amounts of liptinite. The primary products of this process are CH_4, CO_2, and H_2O.

Minor gas production is established in beds of high volatile C bituminous coal (R_m values of about 0.5%). These gases are isotopically light ($\delta^{13}C_1$ values range from -46.6 to -46.5 ppt), chemically dry (C_1/C_1-5 values of 0.99), and contain minute amounts of CO_2 (0.1%). These gases are interpreted to have been generated in the coal beds by either early thermogenic or microbial processes. If the gases are microbial, the heavy $\delta^{13}C_1$ values resulted from generation by acetate dissimilation, instead of CO_2 reduction.

In contrast to the coal bed gases, gases produced from overlying sandstones in the Fruitland Formation and underlying Pictured Cliffs Sandstone show a wider range of isotopic values ($\delta^{13}C_1$ values range from -43.5 to -38.5 ppt), are chemically wetter (C_1/C_1-5 values range from 0.85 to 0.95), and generally contain less CO_2 (<2%). These gases are interpreted to have been derived from type III kerogen dispersed in marine shales of the underlying Lewis Shale and nonmarine shales of the Fruitland Formation.

In the underlying Upper Cretaceous Dakota Sandstone and Tocito Sandstone Lentil of the Mancos Shale, another type of gas is produced. This gas, which is associated with oil, is isotopically lighter and chemically wetter at the intermediate stage of thermal maturity (R_m values range from 0.6 to 1.0%) than gases derived from dispersed type III kerogen and coal. This type of gas is interpreted to have been generated from type II kerogen in the Mancos Shale.

The coal generated methane-rich gas is usually contained in the coal beds of the Fruitland Formation; this gas has not been expelled from the coal beds and has not migrated into the adjacent sandstone reservoirs. The coal bed reservoirs also produce a distinctive bicarbonate-type connate water and have higher reservoir pressures than adjacent sandstone reservoirs. The combination of these factors indicates that coal beds are a closed reservoir system consisting of gases, water, and associated pressures that are trapped in the micropore structure.

Locally, gases produced from the Fruitland coal beds or sandstone reservoirs in the Pictured Cliffs or Fruitland are identical to those produced from adjacent reservoirs. These gases probably either migrated from or were produced from adjacent reservoirs as a result of recent well drilling and completion practices.

For organic matter contained in coal beds and carbonaceous shales of the Fruitland Formation, hydrogen indexes from Rock-Eval pyrolysis are between 100 and 350, and atomic H/C ratios are between 0.8 and 1.2. Oxygen indexes and atomic O/C values are less than 24 and 0.3, respectively. Extractable hydrocarbon yields are as high as 7000 ppm. These values indicate that the coal beds and carbonaceous shales have good potential for the generation of not only gas but also liquid hydrocarbons from both the vitrinite and liptinite macerals. Voids in the coal filled with a fluorescent material that is probably bitumen are evidence that liquid hydrocarbon generation has taken place. However, much of the generated bitumen has apparently not undergone significant migration. Preliminary correlations of oils and source rocks, on the basis of gas chromatography and stable carbon isotope ratios of C_{15}^+ hydrocarbons, indicate that the coals and (or) carbonaceous shales in the Fruitland Formation may be the source of minor amounts of condensate produced from the coal beds at relatively low levels of thermal maturity (R_m = 0.7%).

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"3.65 Å A Phase" in System MgO-SiO_2-H_2O at Pressures Greater Than 90 Kbars: Crystallochemical Implications for Mantle Phases

Sclar and Morzenti (1971) reported that the "10 Å phase," a pressure-dependent phyllosilicate in the system MgO-SiO_2-H_2O (Bauer and Sclar, 1981, 1985), is stable between 30 and 90 Kbars but that at pressures greater than 90 Kbars and temperatures below 500 °C a new phase occurs which they termed the "3.65 Å phase" after its strongest powder diffraction