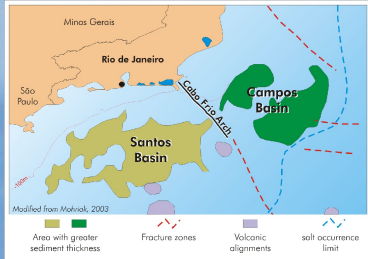


Point of Geological Interest: Limit between the Campos and Santos Basins

CABO FRIO ARCH

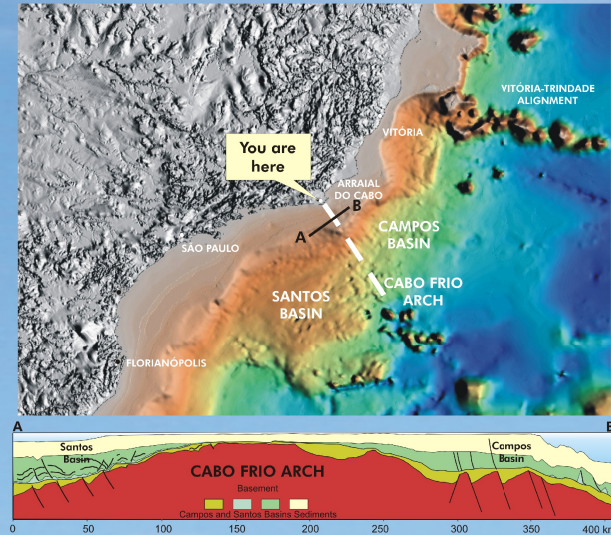


The **Cabo Frio Arch** is a geological feature that separates two big depressions of the Earth's crust (more superficial portion of our planet). This is a kind of mountain range, that separates two of the more important petroleum-producer sedimentary basins of the Brazilian coast: the **Campos and Santos basins**. This elevation runs since the continent, passing between Arraial do Cabo e Cabo Frio cities, extending itself for tens of kilometers inward sea.

HOW TO OBSERVE THE CABO FRIO ARCH?

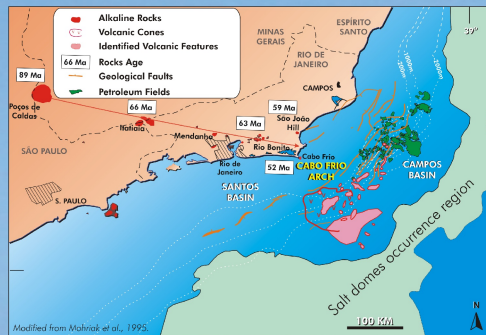
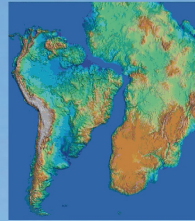
The sea bottom relief can be shown by means of a **bathymetric map**, as the one from the figure below. In this map, the Cabo Frio Arch, the submarine mountains, the sedimentary basins, and the plain regions from the sea bottom can be observed.

The map profile below corresponds to the **geological section** of Cabo Frio Arch, marked with a **A-B line** in the bathymetric map.



FORMATION OF THE CABO FRIO ARCH

Its formation is related to the **Atlantic Ocean opening** 130 million years ago, when big movements in the Earth's crust caused the separation of South America and Africa (see the right column in this panel). During this planet transformation, very old rocks (with an approximate age of 2 billion years) were uplifted to the surface, beginning the formation of this significative geological structure.



THE VOLCANISM

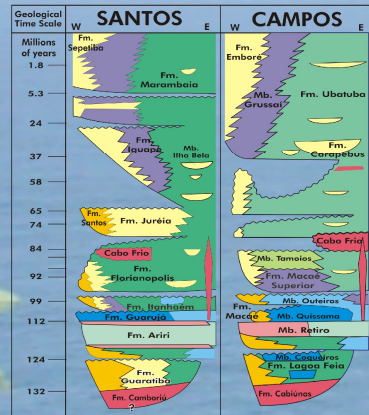
Other important geological event, that possibly influenced in the formation of the Cabo Frio Arch, occurred between 80 to 40 million years ago

Big volumes of **magma** (= molten rock) ascended to the surface, forming violent **volcanoes**, that occurred both in oceanic and continental areas. Today, they are not in activity.

As witnesses from this time, we can see São João Hill and Itatiaia, among others, in the continent and Cabo Frio (Farol Island) and Trindade Islands, in the oceanic portion. They survived to the wearing caused by time (weathering and rock erosion).

WHAT IS A SEDIMENTARY BASIN?

A sedimentary basin is a depression on the Earth's surface, where it is possible to settle sediments in successive layers that, posteriorly, will form the sedimentary rocks. The initial formation of the depression is started by forces from the Earth inside, that brought on the Atlantic Ocean opening, enabling the formation of Campos and Santos sedimentary basins.



GRAPHIC REPRESENTATION OF THE BASINS

The stratigraphic columns of the Campos and Santos Basins, presented at left, show the different types of rocks and their complex organization in the two basins. In the low portion of the drawing, the deeper and older rocks are represented. In the top, the shallower and more recent ones. In the two columns, the rocks are presented from the continent (Left - West - W) to the Ocean (Right - East - E).

STUDY METHODS OF A BASIN:

Direct Methods - Direct observation in rocky expositions in the continent or from samples removed from the subsol, that are the Core Logs.

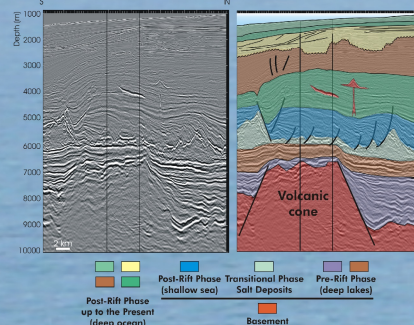
Indirect Methods - These use the physical properties of the rocks (density, magnetism, etc.) to obtain information about how the rocks are organized in depth. They are known as geophysical methods.

DIRECT METHOD

Photography of a **core log** (rock samples removed during the drilling of a petroleum well). The dark varieties are rocks rich in petroleum in the spaces among the grains (pores). The light ones do not have petroleum, because the pores were filled by other materials.



GEOPHYSICS - ULTRASONOGRAPHY OF A SEDIMENTARY BASIN



The figure at the left shows a seismic line with the image of Santos Basin, south from Cabo Frio. This is one of the **indirect methods** more used by geologists in the search for petroleum discovery.

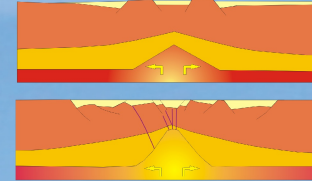
The geological section at the right was generated by the interpretation of the image summed up to data obtained by other methods. The figure shows a volcanic cone with age of 80 million years and the sediments settled over it.

THE OPENING OF ATLANTIC OCEAN

The oceans and the continents have already suffered several modifications in the evolution history of the Earth planet. The current World Map is a portrait of our geological time. Other lands and seas configurations have already occurred and other ones will still occur.

The information about the opening process of a big ocean, such as the Atlantic, is obtained from geological studies in the sedimentary basins and continents. According to the current knowledge, it can be divided in 3 phases:

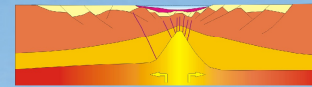
Rift Phase (continent break) - 130 to 115 million years



Stage 1 - Beginning of the continent break, by means of geological faults (fractures with movement), with frequent lava flows.

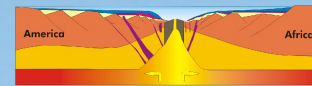
Stage 2 - Continuity of the faults action, generating depressions that form deep lakes. The environment with little oxygen preserved the organic matter in the sediments.

Transitional phase - 115 to 112 million years

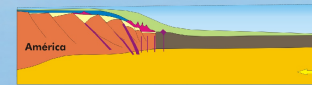


Stage 3 - Separation of the two new continents and formation of a big gulf with very salty waters. Big salt deposits, called evaporites, were formed by precipitation.

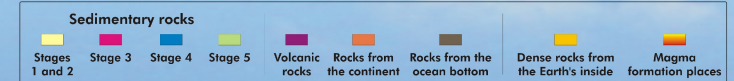
Post-rift phase - 100 million years up to the present



Stage 4 - A new ocean was generated, still shallow and hot, with great activity of organisms (algae, shells, and coral). Beginning of the generation of the rocks from the ocean bottom and the two new continents separate themselves progressively.



Stage 5 - Well developed and deep ocean harbors the sediments coming from the continent.



TO KNOW MORE, VISIT THE POINTS OF GEOLOGICAL INTEREST:

Campos Basin: Cavaleiros Beach, in Macaé
Alkaline Rocks (Volcanism): São João Hill, in Barra de São João; Cabo Frio Island, in Arraial do Cabo; and Nova Iguaçu Geopark.
Caminhos Geológicos Project - access www.drm.rj.gov.br

"The Earth led some billion years to build the rocks, the minerals, the mountains, and the oceans. Protect this masterpiece!"

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SECRETARIA DE MEIO AMBIENTE

DER-RJ
DEPARTAMENTO DE RECURSOS HÍDRICOS

TurisRio
SECRETARIA DE TURISMO

Versão em português no verso deste painel

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