16th New World Luminescence Dating Workshop (NWLDW)
São Paulo, July 21-23, 2025

Day trip to Serra do Mar State Park

1. Guidelines

Departure location and time

We will meet on Wednesday (July23) at the parking lot of the Institute of Geosciences of USP.

Address: Rua do Lago, 562 - Cidade Universitária - São Paulo - SP

Meeting time: 8h30

If, for any reason, you miss the bus/shuttle but have your alternatives of transportation, please let us know by telephone/WhatsApp (+55 11 98645-4735) so we can meet you at the parking lot of the Caminhos do Mar Park (located within the Serra do Mar State Park). The address park is road SP-148 km 42 - São Bernardo do Campo – SP (https://maps.app.goo.gl/Rzk2dJrYFL4AGwDbA).

Food

Lunch will be provided (sandwich, water/soft drink, fruit and snacks).

Park visit and walking

After arrival at the Serra do Mar park, we will walk around 4 km along the old road (paved) to Santos, until the "Rancho da Maioridade" spot. On the way back, there will be the option through the "Calçada do Lorena" trail. If anybody feels tired or unwell, a van will take you back to the parking lot. The "Calçada do Lorena" is an uphill unpaved trail crossing the Atlantic Forest and with some steep slope stretches. It takes around 2 hours to reach the parking lot of the Serra do Mar park walking uphill through the "Calçada do Lorena" trail.

The expected weather is sunshine with temperature from 16ºC to 22ºC, but it can be cloudy and windy in the afternoon. We recommend wearing comfortable tennis shoes for walking and bringing sun protection (hat and sunscreen) and a thin jacket or coat.

Arrival time in São Paulo

We will leave the park at 4:30 pm (departure from the parking lot), with the expectation to arrive at the Institute of Geosciences around 6 pm depending on the traffic.

2. Background information

The Serra do Mar Stake Park and its geological setting

The Serra do Mar State Park covers an area of over 315,000 hectares. It is the largest conservation unit in the Atlantic Forest of Brazil and spans 25 municipalities in São Paulo State, extending from the border with Rio de Janeiro to the southern coast of São Paulo. The Atlantic Forest Biome used to cover most of the Brazilian coast before the arrival of the Portuguese. Sadly, what is left today is roughly 13% of the original area. This percentage

corresponds to areas of mature and well-preserved forest. This forest was the most devastated biome in Brazil, and the remaining area is fragmented and unevenly distributed. We will visit a small section of the state park located 45 km from the city of São Paulo.

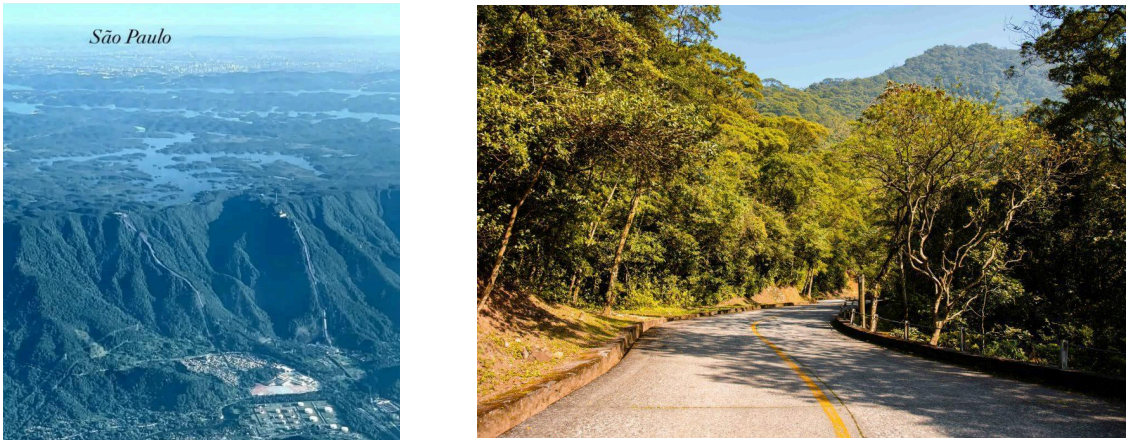

Figure 1. The left picture shows the Atlantic Plateau (~800 m above sea level) and its border corresponding to the Serra do Mar bounding the coastal plain. The right picture shows the old road to Santos crossing the Atlantic Forest.

The Serra do Mar represents the eastern border of the Atlantic Plateau, which is separated from the Atlantic Ocean by a narrow coastal plain in the central coast of São Paulo. The Atlantic Plateau is mostly supported by Pre-Cambrian igneous (granites) and low to high grade metamorphic rocks (schists, gneiss, quartzites and migmatites) of the Ribeira Fold Belt, which represent the basement of a Phanerozoic sedimentary cover (Figure 2). The Atlantic Plateau resulted from basement uplift associated with the break up of Gondwana and opening of the South Atlantic Ocean during the Cretaceous and Cenozoic. The basement rocks exposed in the Serra do Mar are heavily weathered, giving origin to thick red soils, with frequent gravity flows during the rainy season.

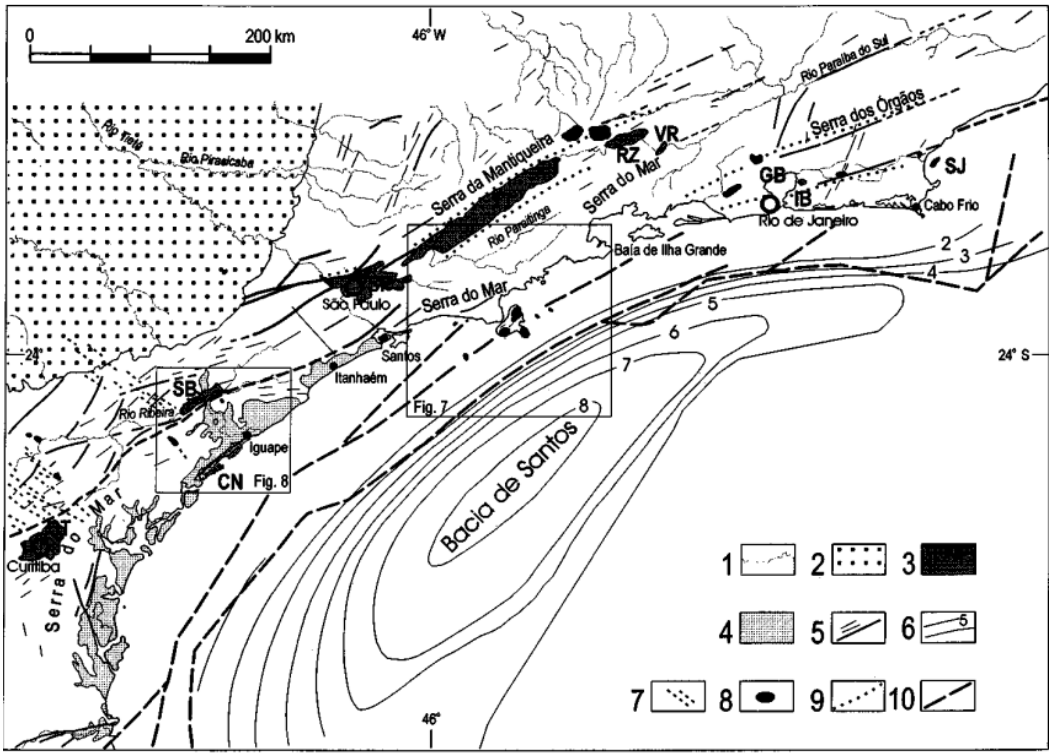

Figure 2. Main geological features of Southeastern Brazil (from Almeida and Carneiro, 1998). The field trip area corresponds to the sector between São Paulo and Santos municipalities. Legend: 1. Basement drainages; 2. Paraná cratonic basin; 3. Continental rift basins: Curitiba (CT), Sete Barras (SB), Cananéia (CN), São Paulo (SP), Taubaté (TT), Resende (RZ), Volta Redonda (VR), Guanabara (GB), São José de Itaboraí (IB), Barra de São João (SJ); 4. Quaternary coastal/estuarine sediments; 5. Structural lineaments and faults; 6. Basement contour lines (km); 7. Igneous dykes; 8. Alkaline intrusions; 9. Rift boundaries; 10. Offshore fault traces.

Botanical Aspects of the Atlantic Rainforest of São Paulo

The Brazilian Atlantic Rainforest (Mata Atlântica) is one of the richest and most diverse ecosystems on Earth in terms of plant biodiversity. It is recognized as one of the world's major Biodiversity Hotspots—regions that are both extraordinarily rich in species and highly threatened—alongside areas such as Madagascar, the Philippines, Sri Lanka, the Himalayas, California, and the Cape region of South Africa.

Before European colonization began in the 1500s, the Atlantic Forest covered approximately 1.2 million square kilometers (463,000 square miles), stretching along Brazil's eastern coast. One of the most abundant and historically significant species was the brazilwood tree (*Paubrasilia echinata*), particularly prevalent in the coastal regions of the former captaincies of Pernambuco, Bahia, and Rio de Janeiro. This species played a central role in early Portuguese exploitation and gave Brazil its name.

Originally, the Atlantic Forest extended across a vast latitudinal range—about 29 degrees—from roughly 3°S to 32°S, encompassing both tropical and subtropical zones, contributing to its incredible ecological complexity and biodiversity. Despite centuries of deforestation, agricultural expansion, and urbanization, the remaining fragments of the forest still harbor remarkable botanical richness, including over 20,000 plant species, with approximately 8,000 found nowhere else on Earth.

The forest is vertically structured into distinct layers: the emergent layer, the canopy, the understory, and the forest floor. In the emergent and canopy layers, species such as *Cariniana legalis* (jequitibá-rosa), one of Brazil's tallest native trees, can grow up to 50 meters high. Other prominent species include *Ficus* spp. (fig trees), *Euterpe edulis* (juçara palm, Figure 3), and *Araucaria angustifolia*, a subtropical conifer found in higher elevations. The juçara palm, once widely exploited for its heart, remains ecologically vital by producing fruit that sustains birds, mammals, and other wildlife.

Figure 3. Examples of iconic plants of the Atlantic Rainforest: Jussara palm (upper left), bromeliad (upper right), Manacá da Serra (lower left), samambaiaçu (lower right).

The understory is rich in shade-adapted vegetation, including shrubs, small trees, ferns, and tree ferns like *Alsophila setosa*. Epiphytic orchids and bromeliads thrive on tree trunks and branches, absorbing nutrients

directly from rain and air. Genera such as *Vriesea*, *Neoregelia*, and *Aechmea* form miniature water-holding ecosystems that support insects, amphibians, and even small vertebrates.

The forest floor, although dimly lit, supports herbaceous plants, fungi, and a dense layer of seedlings, particularly in canopy gaps where sunlight reaches the ground. Mycorrhizal fungi form symbiotic relationships with plant roots, enhancing nutrient uptake in the generally poor tropical soils—a key factor in the survival of native flora.

The trail we will explore is a secondary growth, having been heavily logged over the past four centuries, and contains relatively few large trees. Nonetheless, visitors can still observe impressive biodiversity, particularly in the variety of orchids, bromeliads, and ferns.

Sedimentation and quartz luminescence

The uplifted rocks of the eastern border of the Atlantic Plateau are under the action of wet tropical weathering, giving origin to thick muddy soils. The Serra do Mar comprises the headwaters of coastal eastward small rivers and westward large rivers of the Paraná-Prata watershed, with outflow in the South Atlantic at the border of Uruguay and Argentina. Quartz grains produced by weathering of the Serra do Mar source rocks are eroded and can reach coastal systems through a short (10^1 km) eastward fluvial pathway or through a long-distance (10^3 km) fluvial pathway. After reaching the coast, quartz grains are transported northward by a regional-scale littoral drift system connecting wave-dominated, estuarine and coastal eolian systems. Quartz from Brazilian coastal sediments have high optically stimulated luminescence (OSL) sensitivity and it is strongly dominated by the fast OSL component (samples SGT05 and SGT06 in Figure 4), allowing the estimation of equivalent doses of tens of milligrays. In the Serra do Mar, quartz sand grains from hillslope soils and streams have low OSL sensitivity, comparable to the sensitivity of quartz from their parent gneiss. However, significant increase in OSL sensitivity is observed in quartz grains from soils of the plateau top, where longer soil residence time increases the chance of sensitization due to repeating fire and/or solar exposure-burial events (Figure 4).

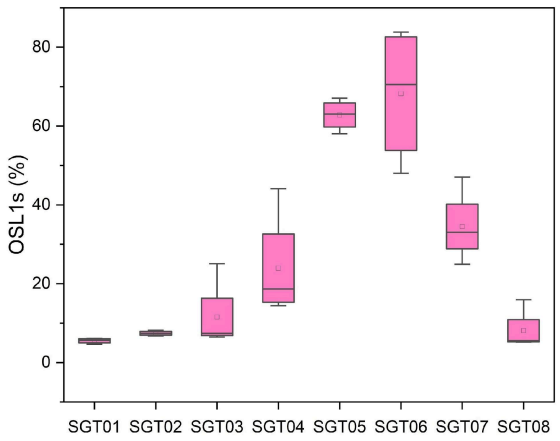

Figure 4. OSL sensitivity (relative sensitivity of the first second of light emission) of quartz grains from hillslope soil (SGT01), hillslope stream (SGT02), upper plateau (SGT03), plateau top (SGT04), upper (SGT05) and lower layer (SGT06) of a Holocene beach ridge, soil over a coastal bedrock remnant mound (SGT07) and from its weathered gneiss (SGT08).

Enjoy the trip!

Reference

Almeida, F.F.M. & Carneiro, C.D. 1998. Origem e evolução da Serra do Mar. Revista Brasileira de Geociências 28(2), 135-150.

Organization

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