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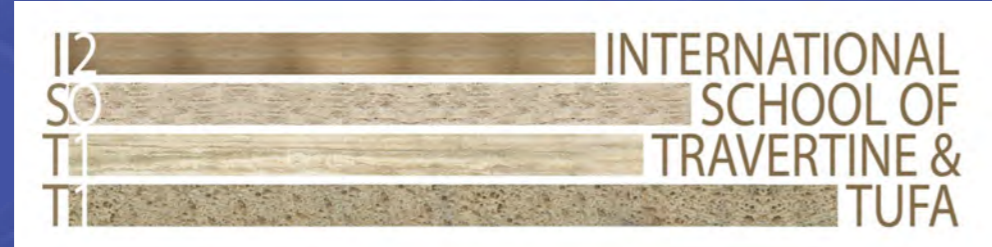
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In copertina: The "Balena Bianca" travertine body at Bagni San Filippo (Siena - Italy) (E. Capezzuoli).

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NOTE BREVI E RIASSUNTI

A cura di: Enrico Capezzuoli, Andrea Brogi, Marianna Ricci, Adele Bertini



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Quaternary tufas in the Serra do André Lopes, southeastern Brazil

LUIS HENRIQUE SAPIENSA ALMEIDA (*), WILLIAM SALLUN FILHO (**),
 IVO KARMANN (***) & PAULO CESAR BOGGIANI (***)

KEY WORDS: *tufa, karst, Quaternary, waterfall.*

INTRODUCTION

Active and ancient deposits of tufas occur along drainage channels in the Serra do André Lopes region, state of São Paulo, southeastern Brazil, associated with the karstic system developed on a dolomitic plateau with a superhumid subtropical climate. The predominance of autogenic waters enables groundwater to become enriched in calcium carbonate, with low terrigenous sediment content. In the Serra do André Lopes region, the occurrence of tufas was mentioned in geological mapping studies dating from the 1980s. According to CAMPANHA *et alii*, 1985, tufas are very common in the region, with two principal ancient occurrence: 1-Sapatú, on the watercourses known as Córrego Angico and Córrego Sapatú; 2- Frias, on the watercourse known as Ribeirão do Fria.

DEPOSITS FEATURES

The Sapatú deposit is associated with the drainage channel represented by the Angico River drainage, on the northwestern slopes of the highlands, with significant deposition of tufas, not only in the form of ancient deposits, but also in active deposits in the current drainage channel. The ancient hillside deposits have an apparent thickness of around 12 m and a real thickness of approximately 3 m, with a minimum width of 30 m. These are composed of stratified friable tufas with irregular to plane-parallel layering and layers on a millimetric to centimetric scale, in accordance with the inclination of the slope. In general, the Sapatú deposits



Fig. 1 – Tufas in Sapatu deposit.

is comprised of phytohermal tufas, with micrit, oolitic, peloidal and pisolithic portions of allochthonous tufa, with intraclasts of phytohermal tufa and reworked pisolites, lithic fragments, abundant fossils of terrestrial gastropods and molds of plant trunks and branches (Fig. 1). Two of the dated sequences cover the period from 10,194 to 3,375 cal yrs BP.

The Frias deposits is located at the southwestern portion of André Lopes Highlands region, associated with the Claro River, with active and eroded deposition on the riverbed, as well as associated ancient hillside deposits. These are a rigid laminated tufa, with a large quantity of dispersed clasts, generally matrix-supported, of varying sizes, with levels of cemented conglomerates (clast-supported), being able to be classified (according to PENTECOST, 2005) as a cemented rudite, formed in a high-energy environment.

The active deposits in current drainage channels, including Sapatú and Claro rivers, the morphology typically observed, according to PEDLEY (1990), was that of hillside waterfalls and dams (Fig. 2), varying according to the declivity and flow rate of the drainage. It is possible to observe various types of plant remains, gastropod shells, living gastropods in dry portions of the riverbed, lithic fragments and terrigenous sediments. In some levels, laminated structures show rounded stromatolitic formations, in the shape of domes or stromatolitic columns, characterizing autochthonous deposits.

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Fig. 2 – Barrage and dam system of tufa deposition, at the Arivá River.

The hydrochemical parameters of some drainage channels showed a high magnesium and calcium content, high conductivity and pH up to 8 (Table 1). At some drainage channels the water is less saturated in

carbonate due to mixing with water circulating in non-carbonate rocks. In the case of the Ostras River, after crossing 10 km in the cave, its resurgence has no tufa, and the reasons for a lack of deposition require further detailed studies.

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TABLE 1

Hydrochemical parameters (collected in March, 2011 – rainy season/summer).

River	pH	Temp. (°C)	HCO ₃ ⁻ (mg/l)	Total Hardness (mg/l CaCO ₃)	Saturation Index (Calcite)	Ca (mg/l)	Mg (mg/l)	Mg:Ca
With active tufa deposition								
Angico (Sapatú deposit)	8.4	20.1	185.2	159.13	0.69	34.7	17.6	0.83
Claro (Frias deposit)	8.6	20.7	188	162.5	0.97	34.9	18.3	0.85
12	8.4	20.5	135	114.2	0.50	24.8	12.7	0.83
Arivá 1	8.7	19.7	192	171.1	1.04	36.7	19.3	0.86
Arivá 2	8.6	18.8	204	169.3	0.89	36.3	19.1	0.86
Araçá	8.6	19.1	161	136	0.77	29.4	15.2	0.84
Without active tufa deposition or ancient deposits								
Ostras (Caverna do Diabo entrance)	8.3	19.3	94.5	82.7	0.11	17.5	9.49	0.88
Ostras (Caverna do Diabo resurgence)	8.6	20.2	139	121.4	0.67	26.2	13.6	0.84