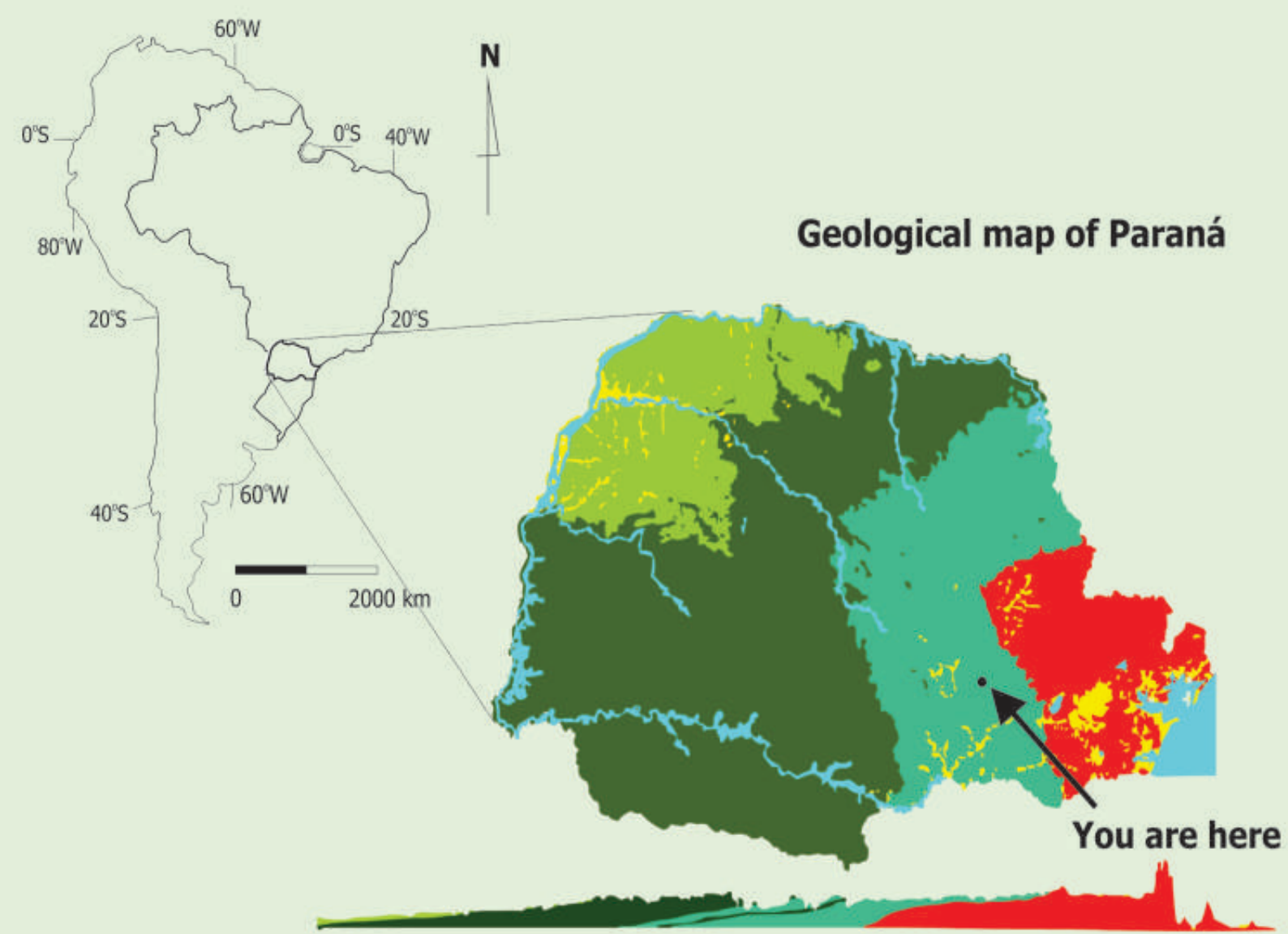


Geology of Paraná



EON	ERA	PERIOD	EPOCH	Age (millions of years)	Features	Geology
Phanerozoic	Cenozoic	Quaternary	Holocene	Today	Humanity, Northern Hemisphere glaciation	Sediments
			Pleistocene	1.1		
			Pliocene	1.8		
			Miocene	5.3		Sediments
			Oligocene	23		
		Tertiary	Eocene	34	Primates proliferate	
			Paleocene	55		
			Cretaceous	65	First horses appear	
			Jurassic	142	Dinosaurs appear; flowers	
			Triassic	206	First birds and mammals appear	
	Mesozoic	Paleozoic	Permian	248	First Dinosaurs appear	
			Carboniferous	290	Trilobites disappear	
			Devonian	354	Reptiles, primitive large land animals	
			Silurian	417	Amphibians appear	
			Ordovician	443	Terrestrial plants appear	
		Pre-cambrian	Cambrian	495	First fishes	
			Proterozoic	545	First shells; trilobites prevail	
			Archean	2500	First multicellular organisms	
			Hadean	4000	First unicellular organisms	
				4560	Earth forms	

Lapa sandstone formation

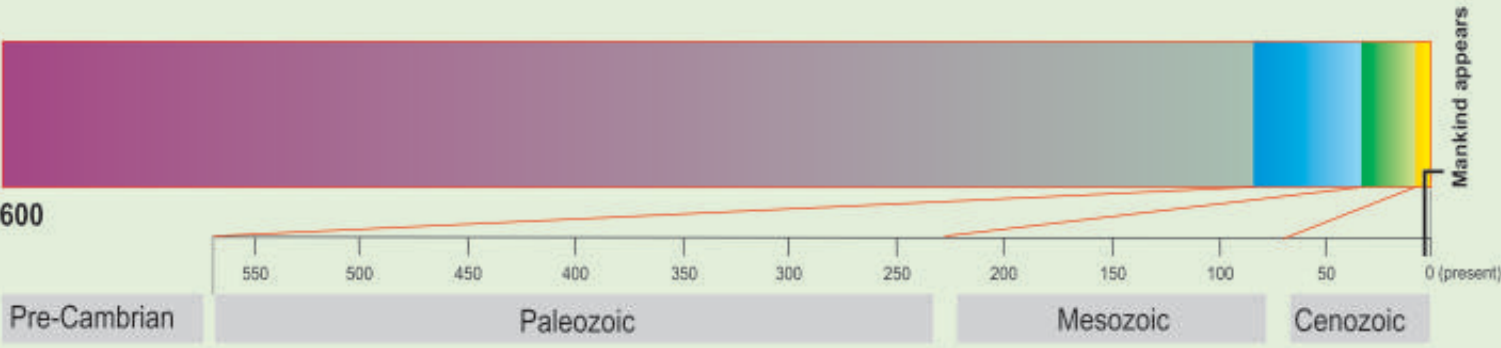
The geological evolution of Paraná is followed when the state is crossed westward. The oldest rocks, formed more than three billion years ago, are found on the coastal plain. There, and all over Serra do Mar and the First Plateau, igneous and metamorphic rocks of Archean to early Paleozoic age outcrop in the region known as the PARANÁ SHIELD, whose strong relief reflects how resistant to weathering its rocks are.

From the Devonian scarp known as São Luiz do Purunã to the western border of the state, the Paraná Shield is overlain by the PARANÁ BASIN, a massive sequence of sedimentary and volcanic rocks of Silurian to Cretaceous age that sustains the state's second and third plateaus. In the early stages of the basin's evolution, South America and Africa were still unseparated parts of a supercontinent called Gondwana, and their geographic locations were very different from today's.

The PARANÁ BASIN evolved for more than 300 million years, in long transgression-regression

Geological time

If the 4.6 billion years of geological history were scaled to one single year, Mankind would



Geological Site

Lapa

The Monk's Cave - sandstone



The Monk's Cave is one of the main natural sights in Lapa. Carved into the reddish glacial Lapa Sandstone, which closely resembles the Vila Velha Sandstone, this feature of the Serra do Monge ridge near the City of

The ridge on which the Monk's cave lies consist of a rock type of the Itararé Group known as the Lapa Sandstone.

This sandstone formed 300 million years ago in Carboniferous times, when South America, Africa, Oceania, and India still formed a large



Carboniferous Period, 310 million years ago. Deposition of the sands that formed the Lapa sandstone.



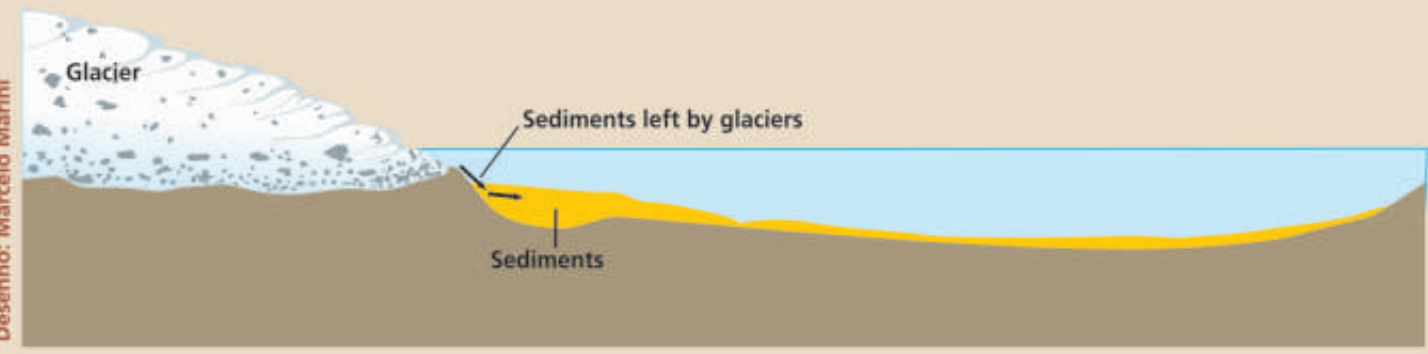
Present - Current distribution of continents and evidences of glaciers

How did Lapa Sandstone form?

The deposition of the sands from which the Lapa Sandstone formed took place along a subaqueous channel one kilometer wide and a hundred kilometers long that now corresponds to the Serra do Monge ridge. The channel represented the limit between glacial and shallow water environments, and it was formed or from the erosive action of rivers, or by glacier melting torrents, or even by catastrophic events such as disruption of huge ice barriers. As time went by, compaction of these sands resulted in the sandstone as we observe it today. The sandstone now appears as a ridge because its original host rocks, siltite and shale, are less resistant to erosion.



Simulated view of the region at the time Lapa Sandstone deposited, based on a current scene of Iceland.



Channel infilling with sediments that formed the Lapa Sandstone.



The rocks



Sandstone relict showing cliffs and cornices.



Lower part of the ridge: shale, grayish varvite; upper part: Chocolate-colored shale.



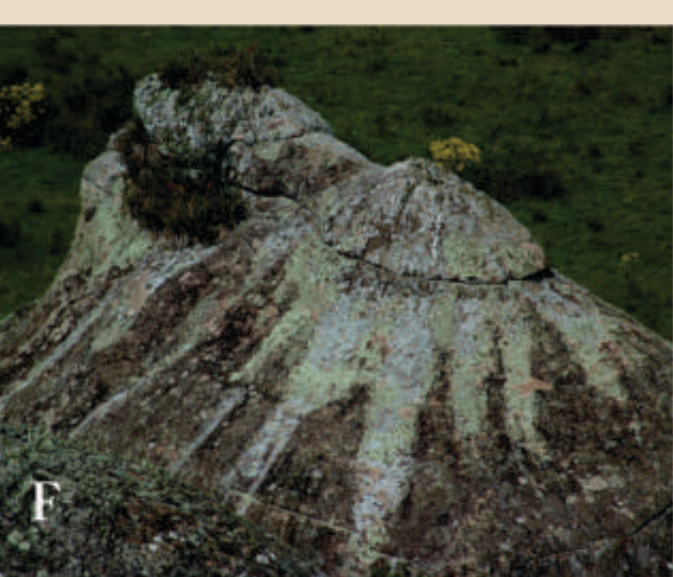
Chocolate-colored shale.



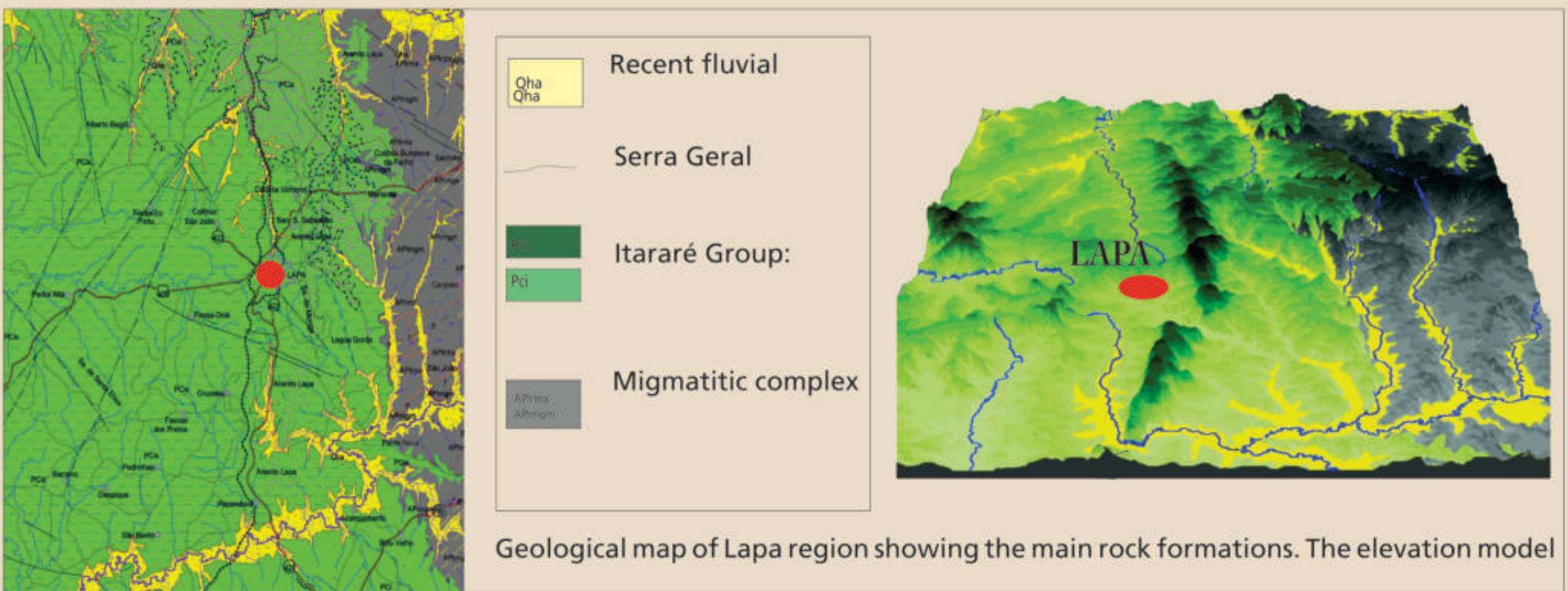
Pink sandstone with dissolution basin.



Geological contact: sandstone (top) and shale (bottom) near typical relief with round and dome-like forms.



Typical relief with round and dome-like forms.



Paraná Basin

The Paraná Basin represents a vast elongated depression that was filled with sediments up to six kilometer thick. It extends for approximately 1,400,000 km². In the State of Paraná, it corresponds to the second and third plateaus. In the early stages of its evolution, the distribution of continental masses was quite different from the current one. Africa and South America were still part of a megacontinent called Gondwana.

Stone Carving



Stone carving for ornamental or structural purposes is an ancient technique brought from Europe by the Portuguese. Widely used in 16th, 17th, and 18th centuries, stone carving experimented an almost complete decline in the 19th Century. Stone

Not only the sandstones that form the Serra do Monge ridge are in this region. Glacial shales, diamictites, and conglomerates of the same age are also present.

Shale, with its characteristical lamination, result from decantation of very fine clay or silt sediments in low-energy aqueous environments like ponds. The incidental presence of coarser rock fragments within a shale body indicates the presence of floating ice (icebergs). Such rock fragments drop into the unconsolidated mud below as ice melts.

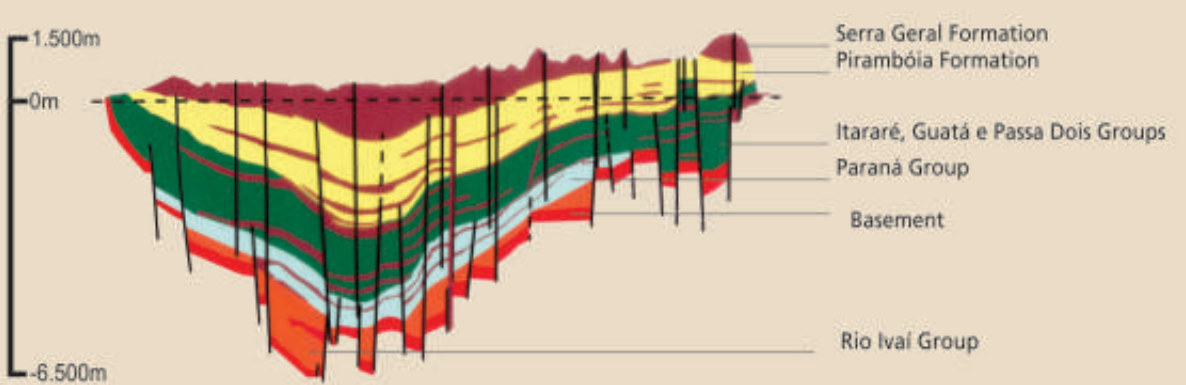
The diamictite that occur by the shale



Small crystalline water falls typical of this type of bedrock are present in



Location of Paraná Basin in Brazil and cross-



Realization: GOVERNO DO PARANÁ SECRETARIA DE ESTADO DA INDÚSTRIA, DO COMÉRCIO E ASSUNTOS DO MERCOSUL

Partners: PARANÁ TURISMO SECRETARIA DE ESTADO DO TURISMO

MINEROPAR MINERAIS DO PARANÁ SA

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Art design: Arno Siebert Antonio Liccardo Andre Ramiro Pierin Gil F. Piekarz