

# Peopling Brazil took place much earlier than in North America?

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## **ABSTRACT**

Starting with Clovis theory, there have been investigations with purpose to establish dates of arrival of settlers in North and South America. The first Clovis findings indicated 11.5 ka BP as the earliest settlement in New Mexico, USA. Dillehay (2000) claimed that people lived in Monte Verde, Southern Chile, 12.5 ka BP. Guidon and collaborators (1986, 1991) by radiocarbon dating of charcoals found in several archaeological sites at Serra da Capivara National Park (SCNP), PI, Brazil, ages varying from 6 to 48.5 ka BP. Watanabe et al. (2003) and Sastry et al. (2004) dated by Thermoluminescence (TL) and Electron Paramagnetic Resonance (EPR) techniques, respectively, calcite covering wall paintings at SCNP and calcite covering carvings found at Montalvania, MG, Brazil, and obtained ages as old as about 50 ka BP.

## INTRODUCTION

Many data indicating date of early settlers in both North and South American continent have been published; however, no clearest definition has been reached. Waters et al. (2007) in a recent paper stated that there is an emerging archaeological record that supports a pre-Clovis human occupation of the Americas. They also present few results by other authors of human occupation of both North and South American continent much earlier than that of Clovis site.

Guidon and Delibrias (1986) and Guidon and Arnaud (1991) obtained by radiocarbon dating of a large number of charcoal pellets found in several archaeological sites at Serra da Capivara National Park, São Raimundo Nonato, PI, Brazil, ages ranging from 6000 to 50,000 years BP. These results are not fully accepted as yet.

The above National Park is world known due to more than thousand wall paintings found in one place. In 1990, at Toca (rock shelter) da Bastiana in this Park a portion of a white substance covering the surface of the rock came off, revealing a painting whose existence was unknown until then. This substance analyzed by X-Ray Fluorescence (XRF) to be calcite was dated by EPR technique to be approximately 27,000 years BP. This result was not published at that time. About eight years later the remaining calcite (in small amount) was dated by Watanabe et al. (2003) by both TL and EPR techniques. The outcome of such measurements was  $(35,900 \pm 3500)$  years BP by TL technique and  $(35,350 \pm 3300)$  years BP by EPR method. In 2003, a material proved by XRF to be a mixture of ~63% calcite, 34 %  $\text{SiO}_2$  and 3%  $\text{Al}_2\text{O}_3$ , was found covering carvings in a rock shelter called Poseidon, at Montalvânia, MG, Brazil. The separated quartz grains dated by TL and EPR method were found to be about 9000 years old. After correcting the age of the original mixture, Sastry et al. (2004) obtained ages of  $(55,000 \pm 5000)$  years BP by TL technique and  $(48,000 \pm 3500)$  years BP by EPR technique. Neves and Pucciarelli (1998) from anthropometric measurements of the skull of 13 years old girl unearthed at Lapa Vermelha, about 800 km south of Montalvânia, have shown that it deals with negroid type skull. This is contrary to the usual belief that all the American Indians are of mongoloid type.

## EXPERIMENTS

September 2006, wall paintings covered with calcites were found in three rock shelter in the Iraquara County, Chapada Diamantina, State of Bahia. Such calcites have been collected. The collected samples were numbered: (1) for that from shelter Malone, (2) from shelter Lapa do Caboclo and (3) from shelter Eduardo. The X-ray diffraction confirmed the samples being calcites. Figure 1 shows X-ray diffraction of sample 2 together with a standard calcite one. Figure 2 presents a picture of shelter (1) showing wall paintings and calcite covering partially paintings.

The calcite samples were crushed and sieved to retain grains 0.080 to 0.180 mm size. In each case (samples (1) to (3)), divided into six to seven portions, they were irradiated with 0, 5, 10, 20, 40, 80, 160, 250, and 500 Gy  $\dot{\alpha}$ -doses. Figure 3 shows glow curves of sample 2 for different dose-values. Figure 4, Figure 5 and Figure 6, respectively shows TL intensity as function of  $\dot{\alpha}$ -doses. Accumulated dose values (Dac), are indicated in the figures, namely for, respectively, sample 1, 2 and 3,  $\text{DacH}''169.5 \pm 15.5$  Gy,  $\text{DacH}''48.72 \pm 5.0$  Gy and  $\text{DacH}''115.2 \pm 9.5$  Gy.

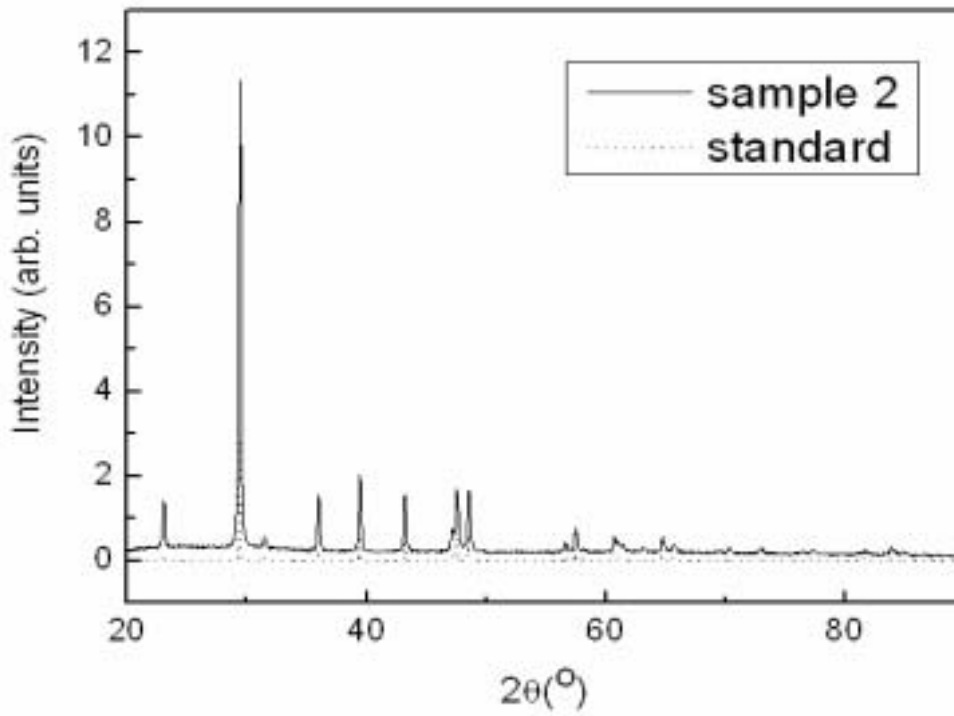


Fig. 1. X-ray diffraction of calcite sample from shelter (2) Lapa do Caboclo.



Fig. 2. Picture showing wall paintings and calcite mineral covering partially paintings of sample (1), shelter Malone

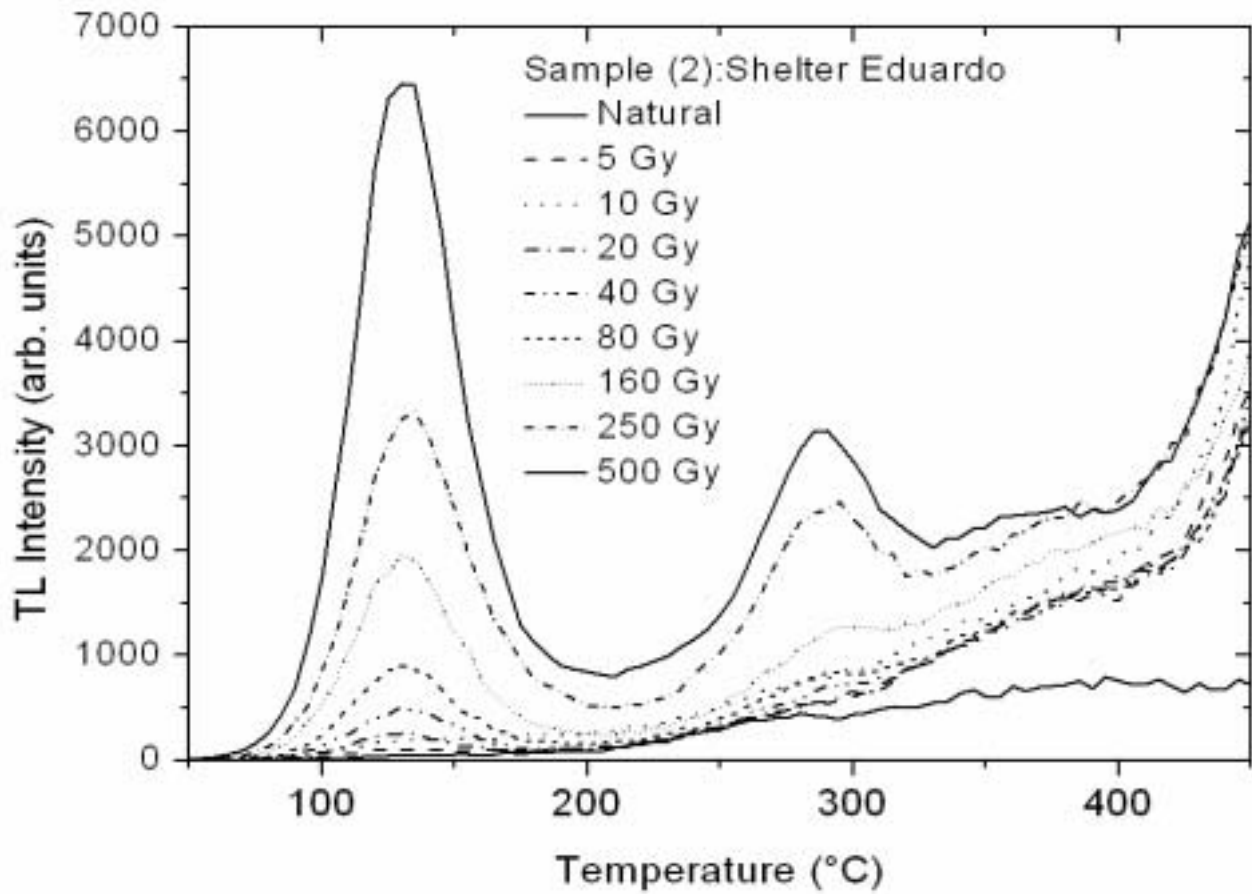


Fig. 3. TL glow curves of sample (2) from Shelter Lapa do Caboclo irradiated with additional doses from 0 (natural) to 500 Gy of  $\alpha$ -ray.

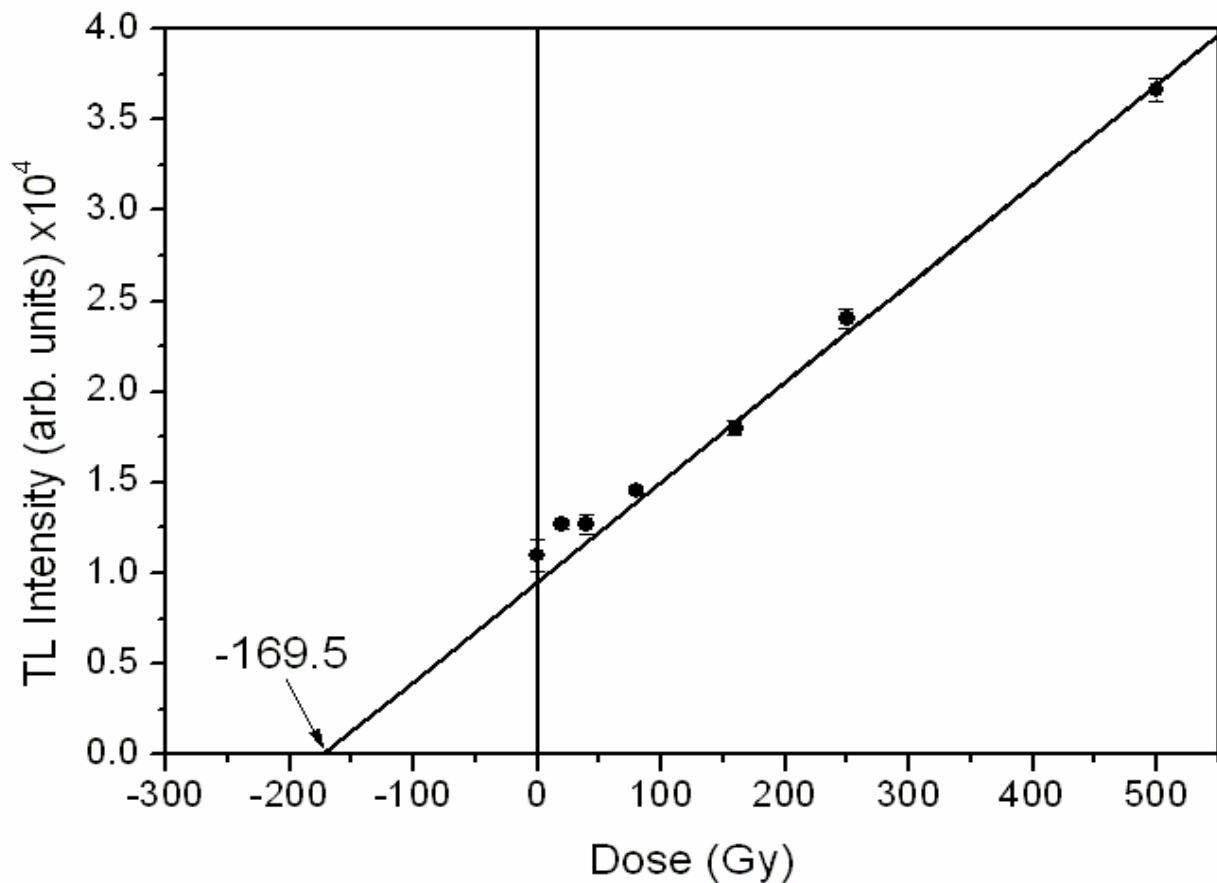


Fig. 4. TL intensity vs. radiation dose for calcite from sample (1), shelter Malone. An accumulated dose  $D_{ac}$  of about 169.5 Gy is obtained

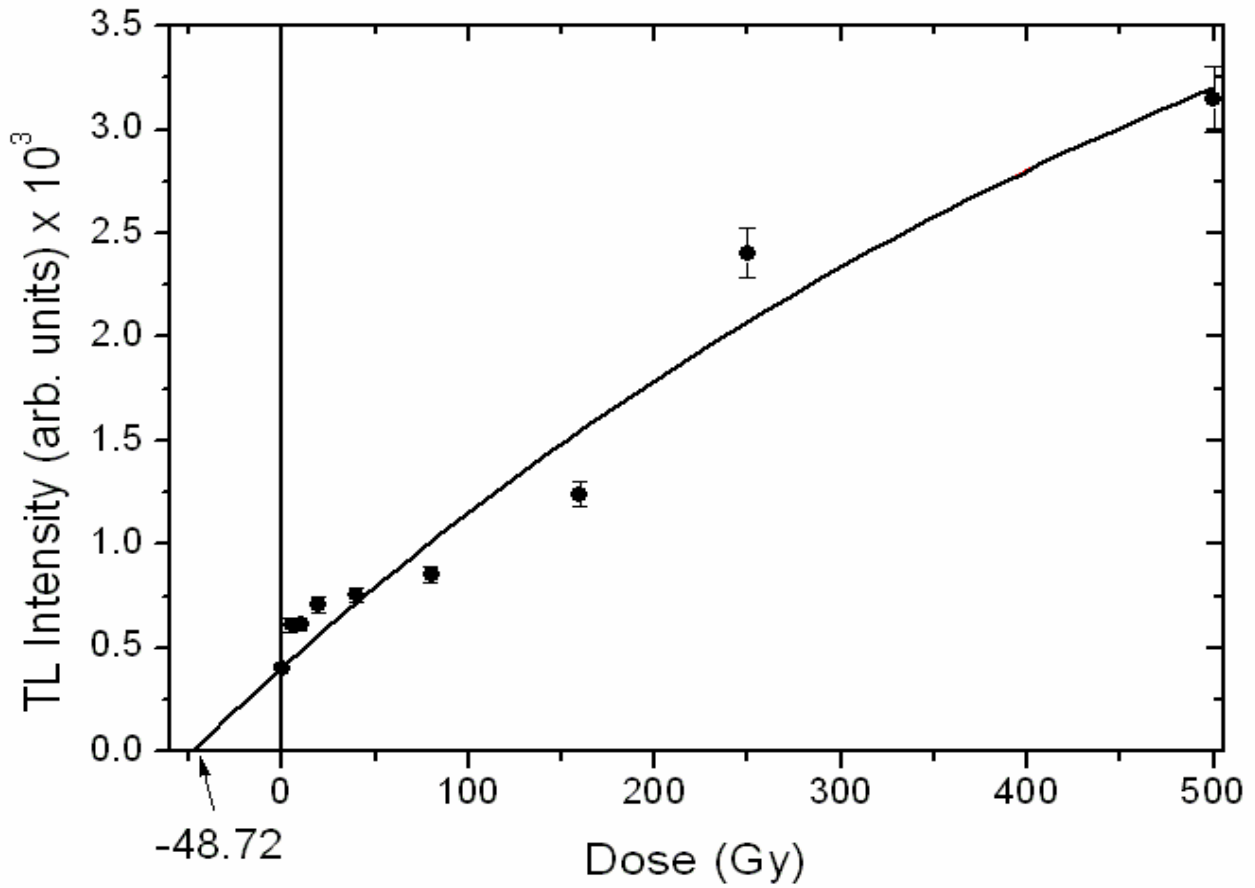


Fig. 5. TL intensity vs. radiation dose for calcite from sample (2), shelter Lapa do Caboclo. An accumulated dose  $D_{ac}$  of about 48.72 Gy is obtained.

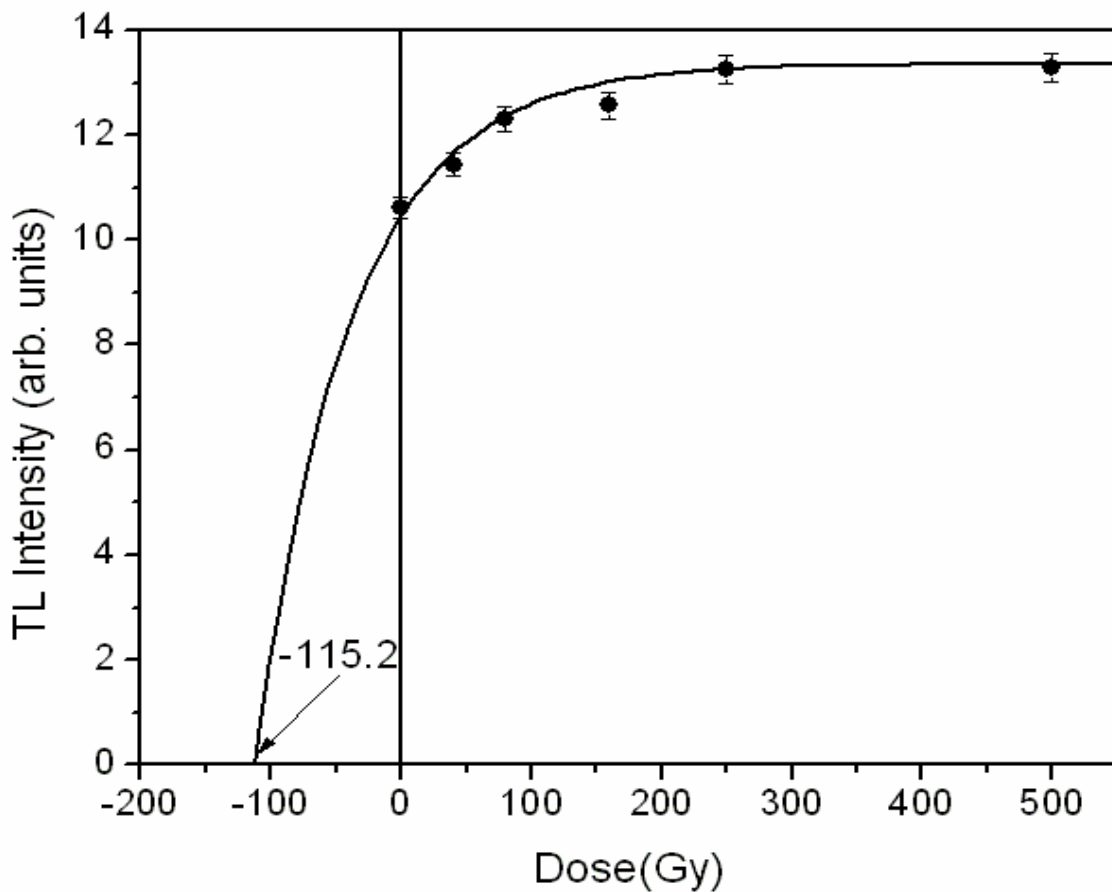


Fig. 6. TL intensity vs. radiation dose for calcite from sample (3), shelter Eduardo. An accumulated dose  $D_{ac}$  of about 115.2 Gy is obtained.

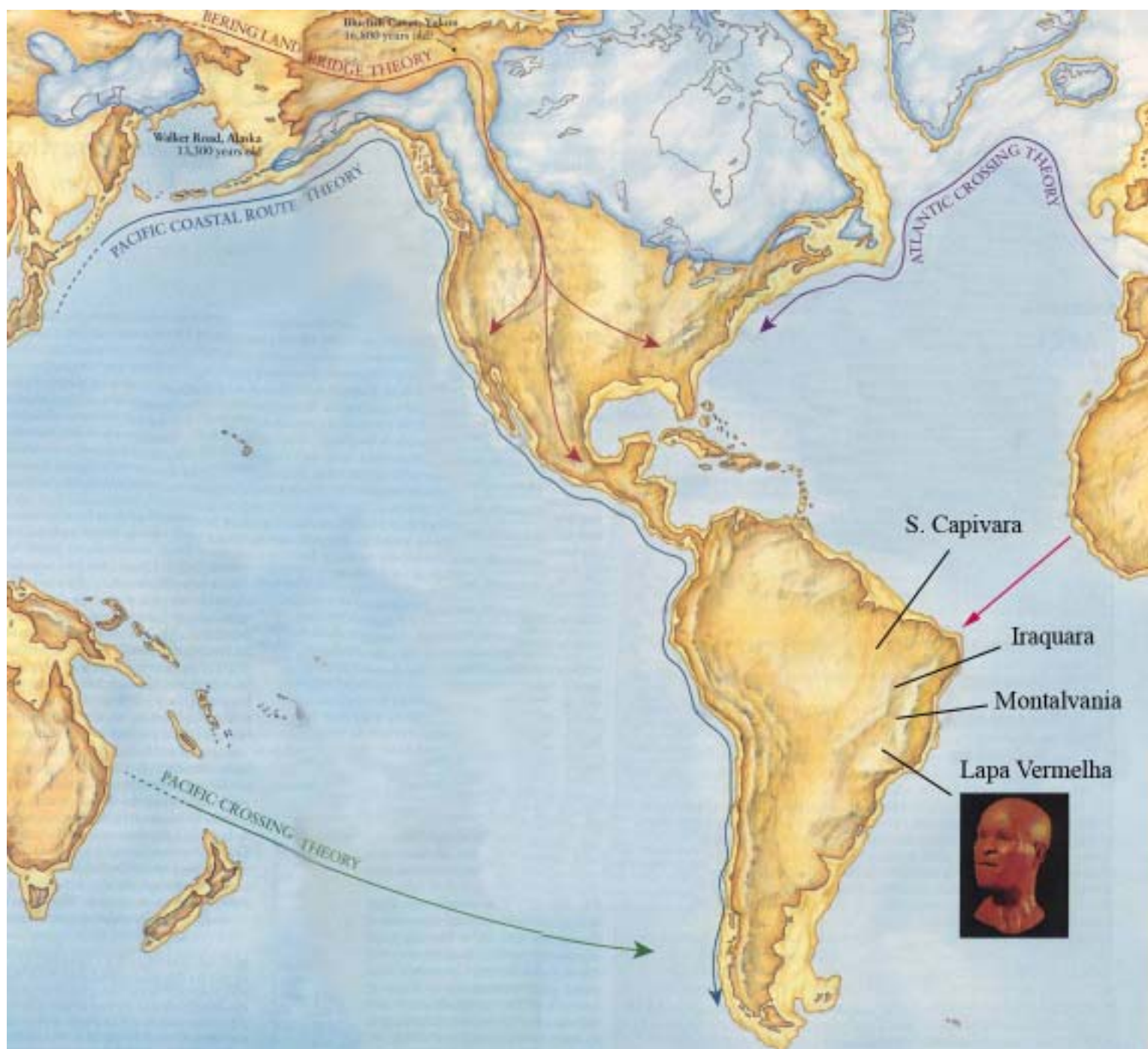


Fig. 7. Map showing: (1) relative positions of Serra da Capivara Naional Park, Iraquara, Montalvânia and Lapa Vermelha, (2) Several migration route to reach North and South America and Africa - Brazil oute here proposed. This map is taken from Scientific American, September 2000, Vol. 283, Number 3.

For the determination of annual dose rate (Dan), fragments of rock from the wall close to paintings in each shelter have been collected. They were analyzed in a ICP-MS mass spectrometer. Table 1 lists uranium (U), Thorium (Th) and Potassium (K) concentrations.

	Shelter Malone (1)	Shelter Lapa do Caboclo (2)	Shelter Eduardo (3)
K	425.55	479.45	1461.6
Th	1.08	0.40	3.44
U	7.47	1.18	3.92

Table 1. Concentrations of U, Th, and K of the rock with paintings on their surfaces, in ppm

Using Ikeya (1993) Table 4.5 for Dan calculation and from “age of the sample = Dac/Dan”, the Table 2 for Dan and Age-values is obtained. Cosmic rays contribution of 0.25 mGy/a was added.

	Shelter Malone (1)	Shelter Lapa do Caboclo (2)	Shelter Eduardo (3)
Dan (mGy/year)	3.293±0.3	2.17±0.2	1.04±0.1
Age (ka BP)	51.5±5.2	46.08±4.5	46.85±4.5

Table 2. Annual dose rate Dan (mGy/year) and Age (ka BP)

## COMENTS

The possibility that the thin calcite covering rock wall painting could be formed in different times was examined using transmission electron microscopy (TEM) scan. Only a homogeneous mass of calcite without layers has been observed, that is, no evidence was found that calcite covering was formed in two or more stages.

The other hypothesis to be considered is the possibility that rains carried old calcites mixed in the solution of limestones and deposited such old calcites on the wall paintings mixed to more recently formed calcites. The question is how such old calcites were not dissolved by low pH rain.

The third hypothesis formulated was the possibility that old calcites have been leaked through narrow cracks from rocks to its surface with paintings. A very detailed observation of the surface around painting did not show any such calcite leaked from the interior of the rock wall to its surface. In fact, if such leakage has occurred, some kind of damage to paintings should be observable. No such effect was found.

It is then quite possible that the first settlers in the region of São Raimundo Nonato, Iraquara, Montalvania and Lapa Vermelha, stretching almost parallel to sea coast, arrived as early as 50,000 years BP, crossing Atlantic Ocean from west most African coast to extreme east coast of Brazil, Figure 7. In fact, the distance between these two points is about 3000 km which is close to the distance Miami – Minneapolis in USA. It is far shorter compared to that between northeast Asia and Brazil or the alternative suggested route from Polynesia to west coast of South America.

The fact that present day american indians are of mongoloid type indicates that they possible arrived through Bering Strait, about 15,000 to 12,000 years ago. According to Neves and Pucciarelli (1998), in Brazil, they exterminated earlier settlers.

## CONCLUSION

The present work's results reinforce Guidon et al. (1986, 1991), Watanabe et al. (2003) and Sastry et al. (2004) data, namely before 50,000 years ago, the region stretching from São Raimundo Nonato, Chapada Diamantina, Montalvânia and to Lapa Vermelha, inland but almost parallel to Brazilian Northeast coast, have been peopled, much earlier than first settlers arrived in North America. There is a great possibility that someway people from western coast of Africa crossed Atlantic Ocean to reach north eastern coast of Brazil. The distance separating these points is much shorter than other routes previously proposed.

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## Footnotes

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