



Research paper

Pre-historic production of ceramics in the Amazon: Provenience, raw materials, and firing temperatures



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ABSTRACT

The chemical–mineralogical properties of prehistoric ceramics found in the Amazon were investigated with the aim of elucidating the production technology, the raw materials used, and the origin of these materials. For this, sherds were obtained from three archeological sites located in distinct regions of the basin. The mineralogical composition of the samples was determined by X-ray diffraction, optical microscopy, thermal analyses, FT-IR, and SEM-EDS, while the chemical composition was measured using ICP-OES and ICP-MS. The manufacturing process consisted of the coiling technique with the smoothing of surfaces, and the addition of organic and mineral non-plastic materials. The pots were fired at ± 600 °C, leading to the formation of an amorphous metakaolinite matrix in which a number of different types of non-plastic materials can be found. These non-plastic materials, together with the phosphates found in the samples, represent the principal differences in the chemical and mineralogical composition of the sherds from different sites. The raw material (clay) used for the production of the ceramic sherds from the Da Mata and Jabuti sites had the same geological origin, and were distinct from those of Monte Dourado 1 in relation to the intensive use of crushed rock. Cariapé was found throughout the region, and the shells reflect the proximity of the Jabuti site to the ocean. The phosphates found in the matrix probably formed during the use of the pots to prepare food, and could not have been part of the raw material, given that they would not have resisted the firing temperature. The evidence indicates that the potters used the materials available locally for the production of ceramics. The use of cariapé at all the sites confirmed that this practice was widespread in the region, representing an important cultural trait of the production of ceramics in the prehistoric Amazon.

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1. Introduction

In archeological studies, ceramic objects represent an important investigative tool, and the analysis of samples can provide important insights into the origin of the raw materials (clays, non-plastic materials) (Dias et al., 2013; Prudêncio et al., 2006, 2009), possible commercial and cultural interchanges among communities, evidence on technological differences (e.g., modeling, coiling, and throwing), as well as the firing temperatures, based on the mineralogical transformations occurring

during the manufacture of the items (Iordanidis et al., 2009; Mohamed et al., 2010; Trindade et al., 2010, 2011). Chemical and mineralogical analyses of samples are used to evaluate these parameters, and have been applied to sherds retrieved from a wide range of archeological sites, especially in Europe (Fermo et al., 2008; Gimenez et al., 2006; Hein et al., 2004; Iordanidis and Garcia-Guinea, 2011; Kramar et al., 2012; Maritan et al., 2013; Montana et al., 2011; Moropoulou et al., 1995; Papadopoulou et al., 2004; Rathossi and Pontikes, 2010; Romani et al., 2000).

In the Amazon, similar studies have been and are being developed, although perspectives on the diversity of raw materials, manufacturing techniques and firing temperatures are still limited (Costa et al., 2004a, b, 2009, 2011, 2012). Studies of anthropogenic soils, especially Amazonian Dark Earth (ADE) are far more numerous (Costa and Kern, 1999; Costa et al., 2013; Glaser et al., 2001; Kern and Kämpf, 1989; Lehmann et al., 2003; Lemos et al., 2011; Lima et al., 2002; Mescouto et al., 2011; Schmidt et al., 2014; Silveira et al., 2011; Smith, 1980; Woods et al., 2009).

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Given these shortcomings, the present study investigated the production of archeological ceramics in the Amazon, with regard to the origin of raw materials (clay and non-plastic materials), the manufacturing processes, and firing temperatures through the chemical and mineralogical characterization of samples from different sites, in order to evaluate the potential technological variation in the productive process in distinct pottery-making populations, providing new insights into the complexity of the prehistoric occupation of the Amazon.

2. Materials and methods

2.1. Materials

For the present study, sherd vessels were obtained from three archeological sites in the Brazilian Amazon – Monte Dourado 1, Jabuti and Da Mata (Fig. 1) – based on their geographical distribution and the availability of material for analysis. All the samples were representative of the sides of the pots and were not embossed or painted.

2.1.1. Monte Dourado 1

The Monte Dourado 1 site (central coordinates: UTM 22M 329403/9928604) is located on the right margin of the Jari River, in the district of Monte Dourado, part of the municipality of Almeirim and in the Brazilian state of Pará. The samples from this site (CF-MD1) were collected by Scientia Scientific Consultants Ltd. in May, 2011, and were kindly provided for the present study by this company.

Monte Dourado 1 is a habitation site with Amazonian Dark Earth (ADE) deposits containing high densities of ceramics and smaller quantities of stone tools. This site covers a total area of 235,200 m² (560 m × 420 m), delimited using 401 boreholes. The ADE horizon reaches a depth of 70 cm in some places. The excavations were conducted in artificial layers of 10 cm until no more archeological remains were encountered (Scientia, 2011). The results of the analysis of the style of pottery found at this site have not yet been made available.

2.1.2. Da Mata

The Da Mata site (central coordinates: UTM 22M 595850/9715416) is located in the municipality of São José do Ribamar, in the eastern extreme of São Luís Island, in São José Bay and in the Brazilian state of Maranhão. The samples from this site (CF-DM) were also collected by Scientia Scientific Consultants Ltd. in 2009, under the supervision of Dra. Dirse Clara Kern, who kindly provided the material for the present study.

Da Mata is a cemetery and habitation site, which was delimited using 132 boreholes, of which, 68 produced archeological material. The ADE horizon extended from the surface to a depth of 30 cm. The excavations were conducted in artificial layers of 10 cm until no further archeological remains were encountered (Scientia, 2009). As for the Monte Dourado 1 samples, information on the pottery style is still unavailable.

2.1.3. Jabuti

The Jabuti site (central coordinates: UTM 22M 0550771/9358220) is located on the Atlantic coast of the municipality of Bragança in northeastern Pará. The samples from this site (CF-JAB) were collected by a team of archeologists from the Emilio Goeldi Paraense Museum in Belém coordinated by Dra. Maura Imazio da Silveira.

This site is also of the habitation type, and is characterized by a number of patches of ADE, with depths ranging from 60 cm to more than 1 m in places, and large quantities of ceramic material distributed on the surface and lower down. The excavations were conducted in artificial layers of 20 cm until archeological remains were absent. The pottery is of the Mina tradition, described by Simões (1981), and typical of the sambaqui middens of the Amazon region (Silveira et al., 2011).

2.2. Methods

The samples (Table 1) were dried at ambient temperature, and then the attached allochthonous substrate and products of weathering were removed carefully with distilled water. Due to the large amount of material, the sherds from Monte Dourado and Jabuti were subdivided to obtain a sample of 300 g for each site, which was equivalent to the sample collected from the Da Mata site. The samples were classified by thickness, based on the criteria established by Alves (1988), Rye (1981), Braun (1983) and Schiffer et al. (1994), which are normally used for the classification of archeological ceramics. All the sherds analyzed in the present study were either 9 mm thick or less, and were thus classified as thin or very thin, or were at least 12 mm thick, being recorded as medium or thick. The thickness of the samples is an important parameter here, given that the evidence indicates that the thinnest pots were used for cooking.

Following cleaning and the classification of the sherds by their thickness, the sherds were described mesoscopically using a ZEISS-Stemi 2000-C stereomicroscope and photographed with an attached Canon PowerShot G6 camera. During this examination, the coloration of the samples (based on the Munsell color system), their texture, and the non-plastic materials they contained were identified and recorded. Samples were then selected for the mineralogical study using optical and electron microscopy, while the rest of the material

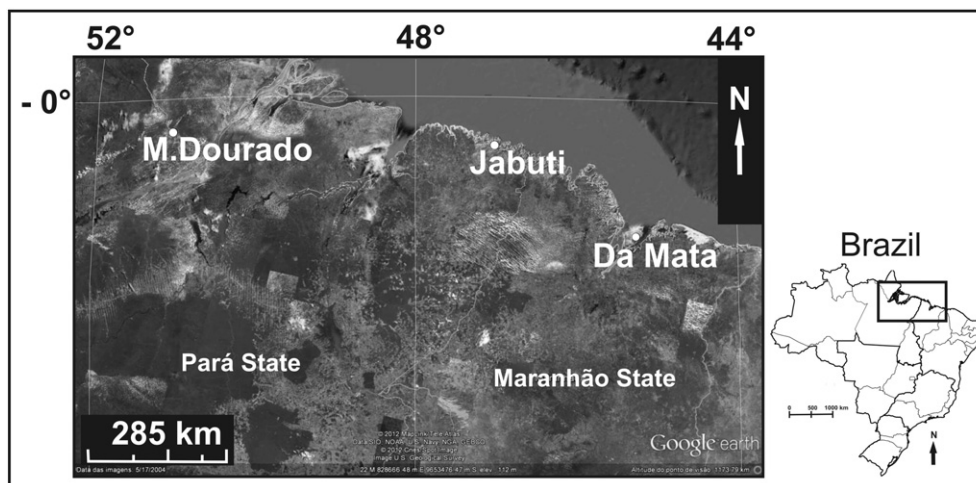


Fig. 1. Localization of Monte Dourado 1, Da Mata and Jabuti sites.

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