DIVISÃO 4 - SOLO, AMBIENTE E SOCIEDADE

Comissão 4.3 - História, epistemologia e sociologia da ciência do solo

PEASANT AND SCIENTIFIC KNOWLEDGE ON PLANOSOLS AS A SOURCE OF MATERIALS IN THE MAKING OF NON-INDUSTRIAL POTTERY

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ABSTRACT

Ethnopedological studies have mainly focused on agricultural land uses and associated practices. Nevertheless, peasant and indigenous populations use soil and land resources for a number of additional purposes, including pottery. In the present study, we describe and analyze folk knowledge related to the use of soils in non-industrial pottery making by peasant potters, in the municipality of Altinho, Pernambuco State, semiarid region at Brazil. Ethnoscientific techniques were used to record local knowledge, with an emphasis on describing the soil materials recognized by the potters, the properties they used to identify those soil materials, and the criteria employed by them to differentiate and relate such materials. The potters recognized three categories of soil materials: "terra" (earth), "barro" (clay) and, "piçarro" (soft rock). The multi-layered arrangement of these materials within the soil profiles was similar to the arrangement of the soil horizon described by formal pedologists. "Barro vermelho" (red clay) was considered by potters as the principal ceramic resource. The

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potters followed morphological and utilitarian criteria in distinguishing the different soil materials. Soils from all of these sites were sodium-affected Alfisols and correspond to Typic Albaqualf and Typic Natraqualf in the Soil Taxonomy (Soil Survey Staff, 2010).

Keywords: local knowledge, ethnopedology, Alfisols, sodium-affected soils, non-agricultural soil uses.

RESUMO: *CONHECIMENTOS DE CAMPONESES E CIENTISTAS SOBRE PLANOSSOLOS COMO FONTE DE MATÉRIA-PRIMA PARA CONFECÇÃO DE CERÂMICA ARTESANAL*

Estudos etnopedológicos têm sidos direcionados principalmente ao uso do solo para fins agrícolas e práticas associadas. Entretanto, populações camponesas e indígenas utilizam os recursos do solo para outras finalidades, incluindo a confecção de cerâmica artesanal. Neste estudo, foi descrito e analisado o conhecimento tradicional relacionado ao uso de solos para confecção não industrial de cerâmica por agricultores ceramistas, no município de Altinho, Estado de Pernambuco, localizado na região semiárida brasileira. Técnicas etnocientíficas foram utilizadas para registrar o conhecimento local, com ênfase na descrição dos materiais de solo reconhecido pelos ceramistas, nos atributos utilizados por eles para identificar os materiais de solo e nos critérios empregados por esses para diferenciar e relacionar esses materiais. Os informantes reconheceram três categoriais de materiais de solo: "terra", "barro" e "piçarro". O arranjo em múltiplas camadas desses materiais no perfil de solo foi similar ao arranjo dos horizontes descritos por pedólogos. O "Barro vermelho" foi considerado pelos ceramistas como o principal recurso cerâmico. Os ceramistas utilizaram critérios morfológicos e utilitários para distinguir os diferentes materiais de solo. Os solos de todos os locais estudados eram Planossolos influenciados por sais. De acordo com o Sistema Brasileiro de Classificação de Solos, esses solos foram classificados como Planossolo Háplico e Planossolo Nátrico.

Palavras-chave: conhecimento local, etnopedologia, Planossolos, solos influenciados por sódio, utilização não agrícola de solos.

INTRODUCTION

Non-agricultural uses of soil have received increasing attention in recent decades from pedology and ethnopedology researchers. An increasing interest in environmental questions (and their interdisciplinary aspects) has demonstrated the relevance of investigating themes related to the diverse soil uses in urban-industrial societies (Westervelda and Hurk, 1974) and in rural areas of developing countries (Vale Jr. et al., 2007).

Most researchers still tend to focus on the genesis, classification and, principally, the production potential of agricultural soils. In spite of the great diversity of non-agricultural soil and land uses seen throughout the world (Alves, 2005), non-agricultural uses have been relatively poorly covered in research programs and publications. Pedology itself has undergone some changes in the last decades, with soil scientists paying more attention to environmental issues and the human impact on the formation and degradation of soils. We argue that these changes could favor interdisciplinary studies and so pedology and ethnopedology will probably be closer to each other.

Sodium-affected Alfisols are generally not intensively exploited and most frequently used for cattle ranching on spontaneous or cultivated pasturelands (Jacomine et al., 1973). Although these soils occur frequently in semiarid regions, studies about them are not so frequent, neither for agriculture use nor for agriculture nor for other purposes.

Nevertheless, the production of non-industrial pottery in northeastern Brazil seems to be closely associated with areas where these soils occur. Queiroz (1985) reported that the B horizon of a sodium-affected Alfisol was locally known as "barro de loiça" (pottery clay) in Vale do Acaraú (Ceará), while Alves et al. (2007) noted that the principal soil material used for making pottery in Chã da Pia (in the Agreste region of Paraíba State) were also extracted from soils with these characteristics.

Ethnopedological investigations allow the description and analysis of the soil management from the perspective of local human populations who use soil resources. These investigations may contribute to the further development of soil sciences, while reconnecting scientists with the culture of the rural population.

The main objective of this work was to describe soils used in non-industrial pottery-making by peasant artisans from three rural villages in the municipality of Altinho, in the Agreste region of Pernambuco, Brazil. We also sought to describe and analyze the categories of soil materials emerging from potters speech as compared to those shared by formal soil science practitioners.

MATERIAL AND METHODS

Description of the study site

This study was carried out in the rural region of the municipality of Altinho. The area is located on the Borborema plateau, in the Brejo Pernambucano micro-region and Agreste Pernambucano meso-region, State of Pernambuco, northeastern Brazil. The study locations belong to mapping unit PL1 (Jacomine et al., 1973), in which the climate is type BSs'h' by the Köppen classification, with average annual precipitation rates between 550 and 800 mm. The original regional vegetation is a deciduous thorn scrub-land (*caatinga*) and the landscape is slightly undulating. The study area is drained by the Una River (Figure 1). Three soil profiles were described in the immediate surroundings of the pits indicated by the potters as the main sources for their raw materials ("barreiros").

The rural populations investigated in the municipality of Altinho reside in seven different domiciles in four contiguous rural localities ("Poços Pretos", "Gameleiro", "Espinho Branco" and "Genipapo") that maintain a continuous pottery production; a total of 12 active potters were interviewed. These potters are locally known as "loiceiros" or "louceiros", that is, people who work directly and regularly in the manufacturing of utilitarian ceramics for commercial purposes. Most of these people were small land owners and/or sharecroppers whose productive activities were concentrated on small-scale self-sufficiency farming ("roçados"), clay pottery ("loiça de barro"), and animal husbandry - all of which were dependent on family labor. Non-industrial pottery making often represents a complementary source of financial income for peasant families in rural semiarid of Northeast Brazil. None of the potters had received any previous type of formal instruction in soil science.

Soil sampling and analyses

The bulk of our research activities consisted in systematic visits during the years 2009 and 2010, although infrequent visits had been made since 2005. Soil material for analysis was collected in June and September, 2010.

Field activities were undertaken in three stages, using the methods and techniques described by Alves et al. (2005, 2007). During the first phase, non-directive interviews were performed to gather information related to pottery production and other uses of soil material, using the "data-generating method" (Posey, 1986a). During the second phase, "guided tours" were made to localities where soil material was collected; semi-directive interviews were also performed in the potters' residences to obtain additional information about the raw materials used in pottery production. During the third stage, the soils indicated by the potters were collected for posterior laboratory analyses. During all stages of this research, we tried to categorize the soil types distinguished by the potters, the

Figure 1. Location map of the study area in Altinho, municipality of Pernambuco State, Brazil.

properties used to characterize each one, as well as the criteria to differentiate and relate them. Photographs were taken and sound recordings made of all interviews with the "loiceiros"; the recordings were later transcribed.

Three different clay pits ("barreiros") were indicated by the potters as the principal sources of pottery clay ("barro de loiça"), also called red clay ("barro vermelho"). The geographic coordinates of these sites were: 36º 1' 39" W ; 8º 28' 23" S (site 1); 36º 1' 31" W; 8º 29' 00" (site 2) and 36º 1' 24" W; 8º 28' 48" S (site 3). The soil profiles at these sites were described during the third research phase. After conventional descriptions and soil sampling following the guidelines proposed by Schoeneberger et al. (2002), complementary samples were collected with the help and orientation of the potters themselves. At this point, they were asked to indicate and describe the soil materials they recognized according to their knowledge (Alves et al., 2007).

In this article, the horizontal sections recognized by soil scientists in the profiles are considered "horizons", while the horizontal sections identified by the peasant potters are referred to as "layers", as exemplified in figure 2.

A total of 23 soil samples were collected, 11 from horizons and 12 from layers, and these were subsequently analyzed for physical and chemical properties by the methods proposed by Embrapa (1997, 2009): size distribution by hydrometer method; bulk and particle density ; pH in water and 1 mol L^{-1} KCl, soil/liquid ratio of 1:2.5; Ca^{2+}, Mg^{2+} and Al^{3+} extracted by 1 mol L^{-1} KCl; available K, Na and P extracted by Mehlich-1; H+Al by 1 mol L^{-1} calcium acetate at pH 7.0 and electric conductivity. The sum of bases (SB), cation-exchange capacity (CEC), base saturation (V), aluminum saturation (m), exchangeable sodium percentage, and total porosity were calculated. Organic carbon was determined as proposed by Yeomans and Bremner (1988). The soils were classified according to the Brazilian Soil Classification System (SiBCS) (Embrapa, 2013).

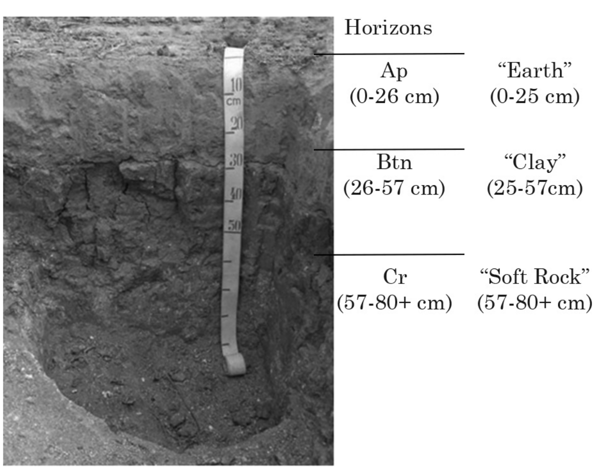

Figure 2. Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf) found in the surroundings of a clay pit used by local people to mine pottery clay ("barro de loiça") in the region Agreste of Pernambuco, Northeastern Brazil. Layers identified by local potters are indicated beside the horizons.

RESULTS AND DISCUSSION

The interviewed potters used the term "barro" (clay) to designate clay and sandy clay materials found below the surface soil layer and used to make pottery ("loiça") (Table 1). "Barro" is defined in Brazil soil science vocabulary (Curi et al., 1993) as "clay as it is found in clay pits ("barreiros"), appropriate for making bricks and roof tiles".

The potters indicated three basic types of soil materials that could be used to make pottery: "barro vermelho" (red clay) or "barro de loiça" (pottery clay), "barro preto" (black clay), and "barro de pote" (pot clay). According to the potters, these different types of clay are mixed in different proportions according to the intended function of the object to be produced. Red clay was indicated by the potters as the main component of the ceramic paste, since it was used in greater proportions and was also the only obligatory material. For this reason we decided to classify and investigate its morphological, physical and chemical characteristics.

Soil classification and categorization

Soil profiles 1 and 2 were classified as Planossolo Háplico eutrófico solódico, while soil profile 3 was classified as Planossolo Nátrico órtico típico, according to the Brazilian System of Soil Classification (Embrapa, 2013). These correspond, respectively, to Typic Albaqualf and Typic Natraqualf in the Soil Taxonomy (Soil Survey Staff, 2010) (Table 1).

The sequences of horizons differed from one profile to another: Ap-Btn1-Btn2-Cr (profile 1); Ap-Btn-Cr (profile 2); and Ap-Btn-BCn-Cr (profile 3). The A horizons had colors varying between brown and dark grayish brown. The texture in these horizons was sandy clay loam (profiles 1 and 2) and sandy loam (profile 3) (Table 1). These surface diagnostic horizons were classified as "A moderado" (moderate A, similar to ochric epipedon in Soil Taxonomy), based on the criteria of color, thickness, structure, and carbon content, as defined by the Brazilian Soil Classification System (Embrapa, 2013).

In all soil profiles, the A horizon transitioned abruptly to the Btn horizon. These Btn horizons

Table 1. Morphological properties of soils used as a source of "red clay" by peasant potters in Altinho, Pernambuco, Brazil

Hor./layer(1)	Depth	Color (moist samples)	Texture	Consistence (wet samples)	Structure
	cm				
Site 1 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)					
Ap	0-24	Dark grayish brown (10YR 4/2)	Sandy Clay Loam	Slightly plastic, Slightly sticky	Massive cohesive
Btn1	24-40	Very dark gray (10YR 3/1)	Gravelly Clay	Sticky, plastic	Strong medium to very coarse prismatic
Btn2	40-60	Gray (5Y 5/1)	Sandy Clay	Sticky, plastic	Moderate medium to very coarse prismatic
Cr	60-70+	**	**	**	**
Layers recognized by potters at site 1					
Earth	0-24	Dark grayish brown (10YR 4/2)	Sandy Clay Loam	Slightly plastic, Slightly sticky	**
$Clay_1$ (darker)	24-37	Brown (10 YR 4/3)	Clay	Very plastic, Very sticky	**
$Clay_2$ (lighter)	37-60	Brown (10 YR 4/3)	Clay	Very plastic, Very sticky	**
$Clay_3$ (darker)	60-68	**	**	----	**
Soft rock	68-80+	**	**	----	**
Site 2 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)					
A	0-26	Brown (10 YR 4/3)	Sandy Clay Loam	Slightly plastic and Slightly sticky	Massive moderately cohesive
Btn	26-57	Dark grayish brown (10YR 4/2)	Sandy Clay	Sticky and plastic	Strong medium to very coarse prismatic
Cr	57-80+	**	**	**	**
Layers recognized by potters at site 2					
Earth	0-25	Dark brown (10 YR 3/3)	Sandy Clay Loam	Slightly plastic, Slightly sticky	**
Clay	25-57	Brown (10 YR 5/3)	Clay	Very plastic, Very sticky	**
Soft rock	57-87+	**	**	**	**
Site 3 - Planossolo Nátrico órtico típico textura média (leve)/argilosa (Typic Natraqualf)					
A	0-15	Brown (10YR 5/3)	Sandy Loam	Slightly plastic, Slightly sticky	Massive moderately cohesive
Btn	15-50	Strong brown (7.5 YR 4/8)	Sandy Clay	Sticky and plastic	Moderate coarse to very coarse prismatic
BCn	50-85	Gray (7.5YR 6/1)	Sandy Clay	Sticky and plastic	Weak very coarse prismatic
Cr	85-90+	**	**	**	**
Layers recognized by potters at site 3					
Earth	0-15	Dark grayish brown (10YR 4/2)	Sandy Clay Loam	Slightly plastic, Slightly sticky	**
$Clay_1$ (looser)	15-45	Brown (10 YR 4/3)	Sandy Clay	Sticky, Plastic	**
$Clay_2$ (tighter)	45-86	Reddish brown (2.5 Y 5/3)	Sandy Clay Loam	Slightly plastic, Slightly sticky	**
Clay mixed with soft rock	86-94+	**	**	**	**

(1) In this paper, the horizontal sections are called "layers" when recognized by potters, and "horizons" when recognized by scientists.
** Not evaluated.

varied in color: they were grey and very dark grey on profile 1, dark grayish brown on profile 2, and, strong brown on profile 3. Texture was clay or sandy clay (Table 1), with a prismatic structure varying in size from medium to very coarse. Btn horizons had low permeability and high bulk densities, and often associated with a temporary perched water table (Soil Survey Staff, 2010; Embrapa, 2013). Features that indicated drainage restrictions and low aeration in the soils, were the greyish colors of the soil matrix and presence of mottles across the Btn horizon, as well as in the A horizon of profiles 1 and 3.

No genetic E horizons were found in the Alfisols studied here. Our results differed in that respect from those reported by Alves et al. (2005, 2007) who, under similar conditions, described an E horizon in four out of the five profiles of sodium-affected Alfisols from which local people mined pottery clay.

The potters recognized different materials in the profiles (Table 1), including: "terra" (earth), "barro" (clay) and "piçarro" (soft rock), as well as an occasional intermediate category of "barro com piçarro" (clay mixed with soft rock). These pottery materials were arranged in the profiles in layers similar to soil horizons described by pedologists. In some cases, the potters indicated more than one clay layer in the same pit. At site 1, for example, they recognized three contiguous clay layers. The first and third of these were said to be "darker", while the second (intermediate) clay layer was said to have a "lighter" color. Among these, only the intermediate (lighter) clay layer was indicated by the artisans as being useful for pottery making. At site 2, the potters indicated the presence of two clay types: one was "looser" ("solto") and the other "tighter" ("ligado"), but only this last one was indicated as useful for ceramics by the potters. These looser and tighter clay materials were associated, respectively, to Btn and BCn horizons. This means that not all clay (barro) material was considered useful for pottery making by the local potters.

The similarity between the layers distinguished by the potters and horizons differentiated by soil scientists is easily observable in terms of depth and thickness (Table 1). The depth and thickness of each layer corresponded very closely to those of a horizon of the same soil. For example: the upper limit of the "barro" layers was close or even identical to the upper limit of the B horizons in all three cases under study: 24 cm for both in profile 1; 25 cm for "barro" and 26 cm for Bt in profile 2; and 15 cm for both in profile 3.

Generally, "terra" (earth) was associated with the surface layer (A horizon), while "barro" (clay) was similar to the B or BC horizon, and "piçarro" (soft rock) was associated with the C horizon (Table 1). The similarities between the potters' layers and scientists' horizons can be largely explained by the fact that peasants often distinguish soils based on morphological criteria (Barrera-Bassols and Zinck, 2003), which are somewhat similar to the criteria used by soil scientists (Santos et al., 2005) to distinguish horizons in the field.

Local peoples (whether indigenous or not) are commonly able to distinguish soil types and to name them according to some soil features (Sandor and Furbee, 1996). Nevertheless, comparisons between the layers or soil materials recognized by different local populations and those used by soil scientists are rather rare in the scientific literature. The studies of Alves et al. (2005, 2007) concentrated on this theme and demonstrated that the categories (layers) "terra", "barro" and "piçarro" then recognized by the potters-farmers in Chã da Pia (Areia, Paraíba State) were very similar to pedogenic horizons described by pedologists, in terms of physical, chemical, and morphological features. The similarities between the three popular soil layers and the pedogenic horizons were very strong, as demonstrated by multivariate analyses (Alves et al., 2007).

Known examples of correspondence between popularly known soil materials and horizons or layers are the "black clay" mined by Mexican potters in Tzompantepec, Central Mexico, corresponding to the AB and partly to Ah horizons of Paleosols (Ramos-Galicia et al., 2003); "tepetate", which is a popular name to designate material extracted from petrocalcic horizons in Mexico (Williams, 1972); and "piçarra", a term used by the Yanomami (Amerindian ethnic group living along the Catrimani River, Roraima, Northern Brazil) designating what scientists would call plinthic layers (Melo et al., 2010). Understanding this local vocabulary and relating it to scientific knowledge can directly contribute to improve communication in projects of rural development. Even when popular knowledge on structures or processes seems to have no apparent similarity to what is considered scientific, new hypotheses can be proposed and formally tested by specialists (Posey, 1986b).

Morphological characterization

The generic designations adopted by the potters studied in Altinho appeared to be based on generic designations of soil materials mainly related to color and wet consistence. The most-used resource material for ceramics is called "barro vermelho" (red clay). Despite this popular designation, the color of this "red clay" according to the Munsell Soil Color Charts (Munsell, 2000) was chiefly "brown", not "red". In fact, the peasants were not expected to use the "correct" Munsell soil color chart name, since any non-trained person would find it difficult to identify the "correct" color name in that chart. Even a person with long-term formal training in soil classification can fail to correctly identify the soil color (Campos and Demattê, 2004). Differences between folk (i.e. peasant) and scientific (i.e. Munsell Color Charts) names for the same materials may be seen as a partial representation of the linguistic diversity related to soil color perception. This could be a theme for further research in ethnopedology.

The potters who participated in this study also used adjectives for soil materials based on what they felt by hand touch. They used expressions such as "solto" (loose) for "terra", "areiento" (sandy) for "piçarro", "ligado" (tight) for "barro". Therefore, it seems that local potters were able to distinguish materials in terms of soil texture and consistency. Again, this is an indication of the peasants' ability to use morphological traits when identifying and distinguishing soil materials. While discussing this issue, Williams and Ortiz-Solorio (1981) made a list of names of soil materials used by Hispanic populations and found that there were 22 vernacular names related to the criterion of color and 36 names related to the texture of those materials. In Northeast Brazil, Alves et al. (2005) recorded potters using the terms "barro azul" (blue clay), "barro preto" (black clay) and "barro vermelho" (red clay) to describe different soil materials.

In addition to morphological criteria such color, texture, and consistency, utilitarian aspects were also used by potters in Altinho to designate soil materials, as for example, "barro de pote" (waterpot clay) and "barro de loiça" (pottery clay). Likewise, Williams (1972) observed the use of utilitarian names among the Aztecs in reference to soil types such as "contlalli" ("clay for making jars"), "comatlalli" ("clay for making griddles") and "caxtlalli" ("clay for making bowls"). Other records of utilitarian terms being used to describe ceramic materials were reported by Alves (2005), such as "barro de loiça" or "barro de louça" (clay for making pottery).

Chemical and physical characterization

In relation to the granulometric composition of the raw materials used for making pottery, clay content was found to increase with soil depth. The flocculation degree was between 17 and 57 %, with the lowest values being found in the Btn horizons due to colloid dispersal provoked by high levels of exchangeable sodium (Table 2). These same trends were observed by Oliveira et al. (2003).

The soils evaluated in this study generally had water pH values ranging from 5.4 to 8.1, with highest values in deeper profile zones. These high pH values were probably related to the high levels of exchangeable bases, mainly sodium (Table 3). A predominance of Ca^{2+}, Mg^{2+}, and Na^+ among the cations was noticed, with increasing values with increasing profile depth. There was a predominance of magnesium over Ca^{2+} and the other cations. An evaluation by Oliveira et al. (2003) of the surveys organized by Jacomine et al. (1973) and Sampaio (1976) indicated that magnesium dominance is common in soils in the semi-arid region of northeastern Brazil, especially in sodium-affected Alfisol profiles.

Soil bulk density (Bd) values varied between 1.60 and 1.95 kg dm^{-3}. The B horizons had the highest Bd values, as a consequence of increasing clay content with increasing depth. Total porosity ranged from 24 to 44 %, with an inverse trend in relation to soil density. Low porosity and high levels of Na^+ commonly found in some Alfisols in semiarid lands of Northeast Brazil bring low permeability and high resistance to root penetration (Oliveira et al., 2003). These soil conditions, especially in terms of the B horizons (natric horizon B), represent some limitations to agricultural use in semiarid region. Nevertheless, these do not limit soil utility for making pottery, since local potters usually obtain most of their raw material from these horizons.

The potters described "barro vermelho" (red clay) as a "strong clay" that will burst ("pipocar") when exposed to fire, unless other materials are mixed in the ceramic paste. This is probably due to the very high clay levels and activity in this soil. Additionally, this red clay is influenced by its high sodium content, which favors the formation of large aggregates at low moisture.

The clay content of the soil increased from the surface layer called by them as "Earth" ("terra") through the "clay" ("barro"), but then decreased in the deeper "soft rock" ("piçarro") layer (Table 2). Plasticity and stickiness were observed to vary with depth, reflecting differences in soil texture and Na^+ (a strong dispersing cation). Due to the high levels of Na^+ saturation percentage (SSP), soils were classified as "solódico" (solodic) in SiBCS (6 % < SSP < 15 %) in profiles 1 and 2, and "sódico" (sodic) in SiBCS (SSP ≥ 15 %) in profile 3, according to the thresholds established by Embrapa (2013).

The selection of different clays by the Altinho potters is a very important first step in production. Ramos-Galicia et al. (2003) and Alves et al. (2007) noted that often more than one type of clay is used to make pottery. Both groups of authors reported that one particular material was always very important for the potters: either "black clay" (Ramos-Galicia et al., 2003) or "barro of loiça" (Alves et al., 2007), as similarly observed for "barro vermelho", which was the main soil resource for pottery making in this study. According to these authors, the criteria adopted by the potters for choosing a raw material are generally related to its plasticity. On the other hand, plasticity, as evaluated by pedologists (Santos et al., 2005) reflects a greater or lesser ease of modeling soil material (rolling a crude cylinder and then making a circle in one's hands, for example). Likewise, modeling is the principal technique used by the Altinho potters to form their earthenware. As such, the greater or lesser ease of modeling a given clay reflects its plasticity (as evaluated by scientists in formal soil descriptions). Accordingly, the plasticity of the clay ("barro") indicated by the potters was greatest (Table 1).

When evaluating the clay, local potters often look for ease of modeling. The choice of these materials, however, takes into consideration not only the ease of modeling, but also the maintenance of the integrity of the ceramic piece during drying and burning. The choice of one clay or another also depends on the type of object to be prepared - thus demonstrating the utilitarian criteria adopted by the local population. Some types or combinations of clay

Table 2. Physical properties of soils used as a source of "red clay" by peasant potters in Altinho, Pernambuco, Brazil

Hor./layer(1)	Fine earth fraction			WDC(2)	FD(3)	Silt/Clay	Density		Porosity
	Sand	Silt	Clay				Particle	Bulk	
	g kg-1				%		kg dm-3		%
	Site 1 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)								
Ap	691	84	225	100	56	0.37	2.50	1.70	32
Btn1	464	61	475	325	32	0.13	2.50	1.90	24
Btn2	430	95	475	375	21	0.20	2.52	1.76	30
Cr	**	**	**	**	**	**	**	**	**
	Layers recognized by potters at site 1								
Earth	700	75	225	200	11	0.33	2.62	1.64	37
$Clay_1$ (darker)	430	70	500	400	20	0.14	2.50	1.91	24
$Clay_2$ (lighter)	465	10	525	325	38	0.02	2.49	1.87	25
$Clay_3$ (darker)	560	90	350	175	50	0.26	2.82	1.22	57
Soft rock	**	**	**	**	**	**	**	**	**
	Site 2 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)								
Ap	689	86	225	125	44	0.38	2.86	1.60	44
Btn	454	96	450	375	17	0.21	2.59	1.82	30
Cr	-	-	-	-	-	-	-	-	-
	Layers recognized by potters at site 2								
Earth	680	95	225	125	44	0.42	2.67	1.62	39
Clay	449	126	425	350	18	0.30	2.55	1.89	26
Soft rock	**	**	**	**	**	**	**	**	**
	Site 3 - Planossolo Nátrico órtico típico textura média (leve)/argilosa (Typic Natraqualf)								
Ap	706	119	175	75	57	0.68	2.64	1.67	37
Btn	567	33	400	275	31	0.08	2.53	1.77	30
BCn	594	81	325	250	23	0.25	2.70	1.95	28
Cr	**	**	**	**	**	**	**	**	**
	Layers recognized by potters at site 3								
Earth	748	77	175	75	57	0.44	2.64	1.71	35
$Clay_1$ (looser)	573	78	350	275	21	0.22	2.66	1.87	30
$Clay_2$ (tighter)	587	88	325	200	38	0.27	2.70	1.96	27
Clay mixed with soft rock	**	**	**	**	**	**	**	**	**

(1) In this paper, the horizontal sections are called "layers" when recognized by potters, and "horizons" when recognized by scientists; (2) WDC: water-dispersed clay; (3) FD: flocculation degree. ** Not evaluated.

were more frequently used when the objects being made will hold water, while others were chosen when making cooking vessel. However, "barro vermelho" (red clay) was the only material that was widely used. According to the interviewees, this red clay is suitable for making utilitarian objects for cooking (pans and cooking pots) or holding water (water pots and jars), as well as for making little sculptures (miniatures of humans and animals). The widespread choice of "red clay" can be associated to its high plasticity and stickiness, which justifies its use for various types of ceramic pieces by artisans.

Comparisons between the results of this study (Tables 1, 2 and 3) and those of Alves et al. (2005, 2007) show high similarities in terms of the physical, chemical and morphological aspects of the soils. There was not merely a coincidence of soil types (sodium-affected Alfisols) from which local potters obtain their main raw material, although this coincidence *per se* is also noteworthy. There were also strong similarities between the vernacular names of the soil layers and the ways in which they are organized into vertical sequences in the rural village of Chã da Pia (Alves et al., 2005, 2007) and the information presented here for Altinho. Interestingly, this information was obtained from two distinct rural populations that apparently had no recent contact with each other. In addition, there were various other similarities between

Table 3. Chemical properties of soils used as a source of "red clay" by peasant potters in Altinho, Pernambuco, Brazil

Hor./ layer(1)	pH (1:2.5)		Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	S(2)	Al^{3+}	H+Al	T	V(3)	m(4)	ESP(5)	OC(6)	P	EC(7)
	H_2O	KCl														
			cmol$_c$ dm^{-3}								%			g kg^{-1}	mg dm^{-3}	dS m^{-1}
Site 1 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)																
Ap	6.2	4.8	4.0	3.9	0.81	0.06	8.7	0.05	1.55	11.29	86	0.5	7	5.21	0.06	0.30
Btn1	6.7	4.7	7.8	10.2	2.57	0.08	20.3	0.00	1.80	22.10	91	0.0	11	5.05	0.06	0.40
Btn2	6.9	4.9	10.8	21.2	2.70	0.04	34.8	0.00	1.35	36.19	96	0.0	7	5.37	0.56	0.80
Cr	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Layers recognized by potters at site 1																
Earth	6.0	4.4	3.3	3.3	0.41	0.11	7.1	0.05	1.47	8.6	82	0.7	4	5.05	0.10	0.20
$Clay_1$ (darker)	6.7	4.8	9.0	17.6	2.68	0.03	29.3	0.00	1.72	31.0	94	0.0	8	5.02	0.20	0.70
$Clay_2$ (lighter)	7.0	4.9	8.7	8.2	2.97	0.05	19.9	0.02	1.15	21.1	94	0.1	14	5.93	0.29	0.70
$Clay_3$ (darker)	7.3	4.8	8.0	17.8	2.57	0.05	28.4	0.00	0.92	29.4	96	0.0	8	3.22	0.54	1.14
Soft rock	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Site 2 - Planossolo Háplico eutrófico solódico textura média/argilosa (Typic Albaqualf)																
Ap	6.1	4.5	3.2	2.7	0.41	0.19	6.6	0.00	2.06	8.7	76	0.0	4	6.47	0.74	0.17
Btn	6.8	4.4	6.6	16.3	3.64	0.07	26.6	0.00	1.67	28.3	94	0.0	12	6.40	2.65	0.75
Cr	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Layers recognized by potters at site 2																
Earth	6.1	4.3	3.6	4.1	0.41	0.13	8.3	0.05	2.25	10.5	78	0.6	4	8.27	0.96	0.37
Clay	7.0	4.5	6.9	18.0	3.64	0.06	28.6	0.10	1.32	29.9	95	0.3	12	6.09	2.90	0.72
Soft rock	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Site 3 - Planossolo Nátrico órtico típico textura média (leve)/argilosa (Typic Natraqualf)																
Ap	5.4	4.2	1.4	2.5	0.17	0.22	4.3	0.02	2.04	6.4	68	0.5	2	7.07	0.50	0.38
Btn	6.1	4.1	3.0	6.7	2.35	0.15	12.3	0.05	2.12	14.4	85	0.4	16	6.79	0.04	0.53
BCn	8.1	6.4	2.4	7.4	3.11	0.05	13.0	0.00	0.27	13.3	97	0.0	23	4.29	0.26	3.68
Cr	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Layers recognized by potters at site 3																
Earth	6.2	4.6	1.2	1.0	0.60	0.42	2.9	0.00	1.67	4.5	63	0.0	3	5.62	1.00	0.29
$Clay_1$ (looser)	6.1	4.1	2.7	7.0	1.90	0.17	11.8	0.05	1.82	13.6	86	0.4	14	6.00	0.05	0.65
$Clay_2$ (tighter)	7.7	6.0	2.5	7.2	3.83	0.01	13.6	0.07	0.30	13.9	97	0.5	27	4.04	0.01	2.89
Clay mixed with soft rock	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

(1) In this paper, the horizontal sections are called "layers" when recognized by potters, and "horizons" when recognized by scientists; (2) S: sum of basic exchangeable cations; (3) V: base saturation; (4) m: aluminum saturation; (5) ESP: exchangeable sodium percentage; (6) OC: organic carbon; (7) EC: electrolytic conductivity. ** Not evaluated.

the potter culture of the two human populations investigated, such as the technique used for modeling the pieces (without using a potter's wheel and without molds, in both communities), as well as the common usage of initiating the piece by modeling and then concluding it with coils. These communities were also both rural populations living in semiarid lands (Agreste), but near the "Brejos de Altitude" (humid highlands) in their respective states (Paraíba and Pernambuco). "Brejo" is a popular name for the lands originally covered by a seasonal evergreen forest of higher altitude, with a deciduous element in the flora, somewhat similar to the Atlantic Forest found along the eastern coast of Brazil. In both cases, the "brejos" are naturally surrounded by the savannah-like vegetation of lower altitudes ("caatinga").

If ethnopedologists could spend more time studying and working among societies who deal not only with agriculture (e.g., urban people, rural artisans and others), then ethnopedology could gain a more comprehensive approach. Research would not be so concentrated on themes such as the arable layer and the agricultural management of soil and land. As shown in this study, working among peasant potters is a promising way to discover and value local soil knowledge in a wider approach than generally used before.

CONCLUSIONS

The material most often used by the potters mainly to confer plasticity to the ceramic paste was identified as "barro vermelho" (red clay).

The potters consulted in the rural region of Altinho recognized, indicated, and gave names to various categories of soil materials found in pits where they extracted clays. The main categories were "terra" (earth), "barro" (clay), and "piçarro" (soft rock). The multi-layered arrangement of these materials along the soil profiles was similar to the arrangement of the horizons described by pedologists. The distinctions made by local potters among the different soil materials and layers were based on morphological and suitability criteria.

Three clay pits from which the potters extracted red clay were identified by pedologists and peasant potters. The soils at these sites were sodium-affected Alfisols, and were similar to those found in other ethnopedological studies with peasant potters in northeastern Brazil.

The ethnopedological approach used in this study was useful for disclosing a stock of culturally situated information on soils among local peasant potters. This information may help soil scientists in the quest for a better understanding of local systems of soil knowledge and use.

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