Ethnopedology: Popular and scientific classification of a soil profile in the quilombola community Os Rufinos, Pombal-Paraíba

https://doi.org/10.56238/sevened2024.010-069

Rodolfo Trigueiro de Almeida[1], Jussara Silva Dantas[2], Jefferson Luan de Araújo Regis[3], Leonardo José Silva da Costa[4], Tiago Silva Santos[5], Rosy Carina de Araújo Ventura[6] and Francisco Alves da Silva[7]

ABSTRACT

The culture of a people is measured by what it produces as a manifestation, material or immaterial, of its daily expressions, whether symbolic, discursive or in the spectrum of a domestic economy that has its essence founded as a mold of expression of the culture and identity of the place. Thus, in this work we seek to understand the form of soil classification according to the use and destination of this soil for the production of ceramics in the Quilombola Community the Rufinos in the municipality of Pombal-PB. The study of local soil names can contribute to the advancement of formal knowledge, as well as to the development of socially appropriate management strategies. If a quilombola names some soils based on the characteristics of the arable layer, this does not mean that he or she is necessarily unaware of what is below this layer. Ethnopedology enables the dialogue between popular knowledge and technical scientific knowledge, debating the connection of knowledge between what we already know and what we can still learn. Popular knowledge originates from the personal experience of each individual, transmitted from one generation to another, through facts, stories and arguments, through daily contact with variations in climate, vegetation and soil. Seeking to understand natural resources from a less technical point of view, but sufficient for the development of its activities. Thus, in this work, it was possible to describe a soil profile according to the conditions of use of the community and also according to the scientific society.

Keywords: Clay, Artisanal production, Quilombola.

[1] Master's Degree in Agroindustrial Systems - UFCG
E-mail: rodolfotrigueiro1@hotmail.com
LATTES: 1125915094620025
[2] Doctor in Agronomy (Soil Science) - UNESP
Professor of the Academic Unit of Forest Engineering - UFCG
E-mail: jussara.silva@professor.ufcg.edu.br
LATTES: 3581069049274613
[3] Agronomist Engineer - UFCG
Master's student in the Graduate Program in Forest Sciences - UFCG
E-mail: jefferson.luan@estudante.ufcg.edu.br
LATTES: 8607189801282679
[4] Master's Degree in Forest Sciences - UFCG
Doctor student in the Graduate Program in Forest Sciences - UNESP
E-mail: engleonardo.ambiental@gmail.com
LATTES: 7974052206561965
[5] Agronomist Engineer - UFCG
Miriri Alimentos e Bioenergia S/A
E-mail: tiiagosantos1993@gmail.com
LATTES: 3072168760296274
[6] Environmental Engineer - UFCG
E-mail: rosycaryna@hotmail.com
LATTES: 4530371679477528
[7] Master in Tropical Horticulture
Doctor student in the Graduate Program in Agricultural Engineering - UFCG
E-mail: chico.lis@hotmail.com
LATTES: 7603029169428951

INTRODUCTION

The culture of a people is measured by what it produces as a manifestation, material or immaterial, of its daily expressions, whether symbolic, discursive or in the spectrum of a domestic economy that has its essence founded as a mold of expression of the culture and identity of the place. Thus, the place of orality gains prominence when the community becomes an object of study and is given the prerogative to speak of itself through its residents (Rufino, 2018).

Popular knowledge originates from the personal experience of everyone, transmitted from one generation to another, through facts, stories and arguments, through daily contact with variations in climate, vegetation and soil. Seeking to understand natural resources from a less technical point of view, but sufficient for the development of its activities, ethnopedology emerges, which enables the dialogue between popular knowledge and technical scientific knowledge, debating the connection of knowledge of what we already know with what we can still learn, awakening an essential dialogue between farmers and soil science researchers (Araújo *et al*., 2013).

Ethnopedological studies have been predominantly discussed regarding its agricultural use, giving little attention to other fields of activity. Soils are not only natural substrates, but a way of representing the cultural identity of a given place, carrying the history and trajectory of the place, from analyses made in the physical, chemical and biological components, we can thoroughly understand in a broader and contextualized way their relationship in the social and environmental context (Ferreira; Falcon, 2023).

Small farmers and/or local artisans select their working material called "earthenware clay" used as a ceramic resource based on the hard resistance it presents cracks in the soil, such characteristics are defined by the manifestation of the physical forces of cohesion and adhesion between soil particles and other materials. These cracks are caused by the activity of the high-activity clay fraction, which presents more accentuated expansion and contraction due to the effect of pedogenetic processes (Alves *et al*., 2005; Santos *et al.,* 2015).

To a large extent, the soils that fall into the classes of Planosols are used for the production of pottery, as they have specific characteristics that are valued by local artisans. This portion is extracted from the 2Bt horizon affected by Na, which is characterized by a high activity of the clay fraction (Alves *et al*., 2005).

In this way, this research aimed to study the relationship of man with the knowledge of the soil under the popular perspective of artisanal production, correlating with the classification of soils in the scientific environment, evidencing the values of the local culture and tradition regarding the use of "earthenware clay" permeated in the experiences lived with the place and with nature. In the search to identify the ethnopedological view of the remaining quilombo community called "Os Rufinos".

MATERIAL AND METHODS

The research was developed with the remaining quilombola community called "Os Rufinos", located on the São João I site, in the rural area of the municipality of Pombal-PB, high hinterland of Paraíba, with geographic coordinates 6º42'37" S and 37º45'35" W, with an elevation of 170 m.

A field visit was made to the place used by the artisans to remove the "earthenware clay", called by them "hole", which is actually a trench opened manually and used for years for the extraction of the raw material, which was used to describe the soil profile. In sequence, the artisans described the soil profile according to their popular knowledge, explaining each layer of the soil according to the use and purpose given by them. Then, the description of the soil profile was carried out, in a scientific way, using the recommendations of the Manual of Soil Description and Collection in the Field of Santos *et al.* (2015).

With the horizons defined in the soil profile, each one was collected, forming the samples that were separated into bags, identified and sent to the Soil and Plant Nutrition Laboratory of the Center for Agrifood Sciences and Technology of the Federal University of Campina Grande, Pombal Campus, for physical and chemical analyses.

In the field, morphological analyses of each horizon were performed, where the color according to the Munsell® Chart, the structure, porosity and roots, consistency, transition between the horizons and the presence of nodules and concretions were verified, following the guidelines given by Santos *et al.* (2015). Throughout the field classification process, the popular knowledge explained by the artisans and the scientific explanations made by the team were discussed.

Laboratory analyses consist of physical characterization and chemical characterization. The samples were air-dried, undisturbed and passed through a 2.00 mm mesh sieve, obtaining air-dried fine earth (TFSA) for physical and chemical characterization. The particle size analysis (sand, silt and clay) of each horizon was performed using the ASTM n° 1 - Type 152H hydrometer method (with Bouyoucos scale in g $^{L-1}$), of each horizon of the profiles described according to the Manual of Soil Analysis Methods of Embrapa (Teixeira *et al*., 2017).

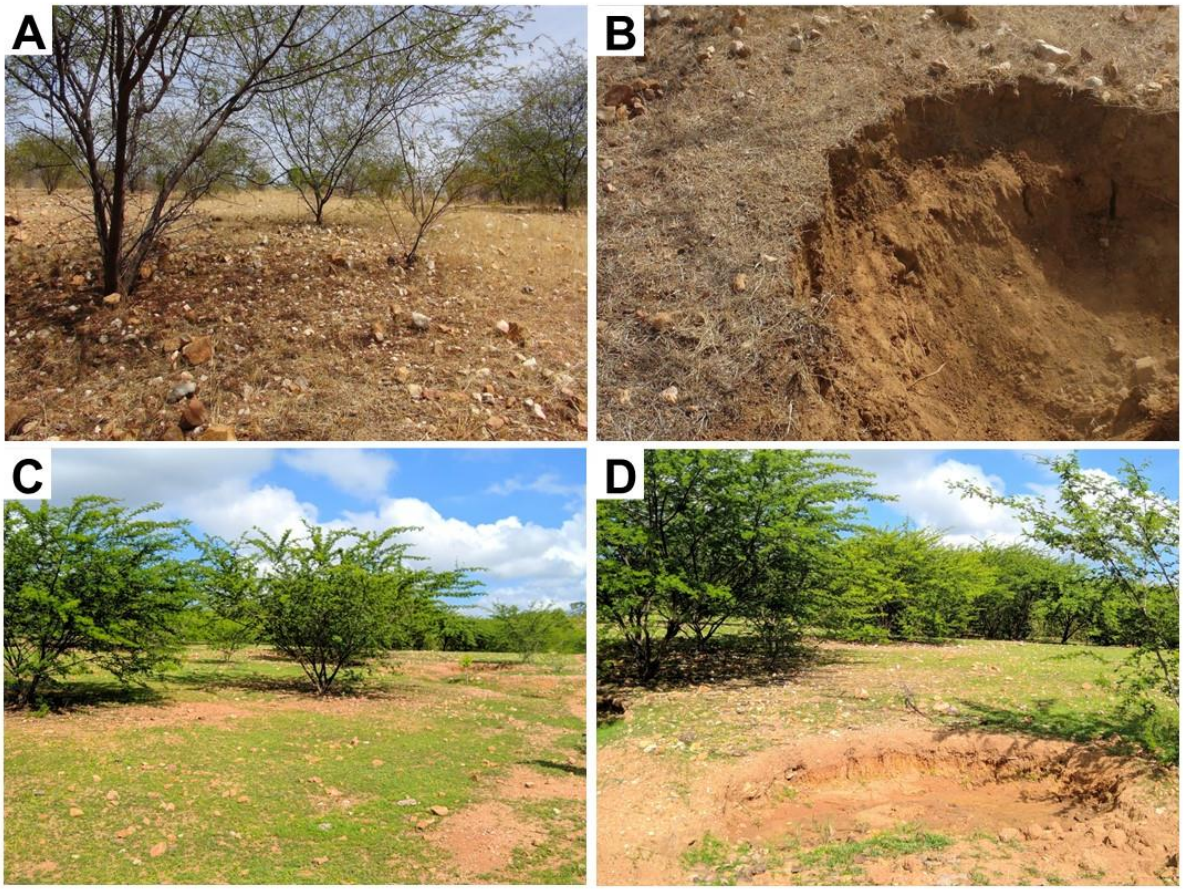
Regarding the chemical analysis of the soil, the following were as follows: pH in CaCl2 0.01 mol $^{L-1}$, in the ratio 1:2.5 (soil:solution); exchangeable calcium, magnesium and aluminum, extracted with 1 mol L-1 KCl solution, quantified by titration with 0.0125 mol L-1 EDTA standard (Ca and Mg); Al by titration with 0.025 mol L-1 NaOH solution; exchangeable potassium and sodium extracted with 0.05 mol L-1 solution and 0.0125 mol L-1 H2SO4 were quantified by flame photometry; available phosphorus extracted and determined by colorimetry (Teixeira et al*., 2017).*

The classification of the soil profile was carried out using the 5th edition of the Brazilian Soil Classification System – SiBCS (Embrapa, 2018), being classified at the level of subgroups, that is, up to the fourth categorical level.

RESULTS AND DISCUSSION

The landscape presented in figure 1 is characterized by a semi-arid environment in which we have the environment in the dry and rainy season, making it possible to observe the low vegetation cover around the soil profile or "hole" also called by the residents of the quilombola community. In the area, the black jurema (*Mimosa tenuiflora*) is the dominant species, which according to Azevêdo *et al*. (2012) is a pioneer, native to the semi-arid region, presenting a deep root system that allows its development in degraded soils, notably in the initial and secondary occupation of degraded areas or in the process of degradation. In addition, the soil surface presents stony material indices of varying classifications and sizes.

Figure 1. Presentation of the landscape where the clay extraction "hole" is located and the soil profile described, where A and B correspond to the dry season and C and D to the rainy season.



Source: personal archive.

The popular description made by the artisans is presented in table 1, which consists of the community's perception of dividing the soil into layers according to its usefulness for the production purposes for which this soil is intended. In the discourse of the artisans, materials were recognized in horizontal layers, as relatively independent parts, and not as units of a three-dimensional body.

Table 1. Popular description of the soil profile according to the craftsmen.

1st layer	0-22 cm, SURFACE SOIL, loose soil and good for planting swiddens with corn and beans.
2nd layer	22-69 cm, EARTHENWARE, hardened earth, difficult to break, very good for the production of clay pieces.
3rd layer	69-81 cm, EARTHENWARE CLAY + ARMADILLO DOUGH, is an earth that has the clay of crockery mixed with another kind of earth, which is not good for producing clay pieces.
4th layer	81-87 cm+, ARMADILLO DOUGH, is the pure earth that does not have good clay to produce the clay pieces.

The first layer was called surface soil, in view of the characteristics of a looser and darker soil, which in their perception, is an ideal soil for the cultivation of annual crops in the swidden system, such as corn and beans. In the extraction of the soil for the manufacture of ceramics, this layer is discarded and thrown around the "hole".

The second layer of soil, the thickest with 47.0 cm, constitutes the clay of crockery, a material that is extracted for artisanal production, which according to the artisans is a hardened earth, being evident the concentration of clay, which they call clay, with a structure that is difficult to dismantle, requiring the use of tools such as the pickaxe to carry out the extraction.

The third layer of the "hole", they call the mixture of the previous layer (earthenware clay) with the next layer (armadillo mass), what differs from this material is the presence of material that mixes, and according to one of the artisans, experience is required to carry out the separation of these layers, in case of confusion, at the time of collection, If this material is used in the manufacture of ceramic pieces, the finish will not be of good quality, and the pieces may crack, making them useless for commercialization.

The fourth and final layer of soil is the armadillo mass itself. This name was given because it is a layer without any use in the artisan activities of the community, referring to the armadillo, a local species of the Caatinga fauna, which usually uses burrows dug deep in the soil to shelter, in this way, in the perception of the community, in this depth of the soil, there is no need to extract material, leaving it available for the armadillo to make its home.

Figure 2 shows the soil profile, in the perception of a "hole" for the extraction of the material and its division into layers, according to the use attributed by the artisans.

Figure 2. Presentation of the soil profile with the popular classification.

Source: personal archive.

The general description of the profile under study is presented in Table 2. Located in a BSh climate area of the Köppen-Geiger classification, gentle undulating relief and elevation of 170 m in relation to sea level. Having the lithology of gneisses and migmatites, with geological formation in Super Suite I - calcialcaline granite suite of medium to high potassium and Neoproterozoic chronology. The original material is due to reworked materials from coarse granite and granodiorite alteration products to porphyritics associated with diorite and intermediate mixing phases.

Table 2. General description of a soil profile in the quilombola community "Os Rufinos", Pombal – PB.

GENERAL DESCRIPTION
PROFILE 01
DATE - 04.08.2018
PREVIOUS CLASSIFICATION - BRUNO NON-CALCICO (Embrapa, 1979).
SiBCS CLASSIFICATION - NATRIC PLANOSOL Typical carbonate, medium texture little gravel, eroded phase, smooth undulating relief.
MAPPING UNIT - SNk
LOCATION, MUNICIPALITY, STATE AND COORDINATES - Quilombola Rural Community "Os Rufinos", Sítio São João I, 22 km from the Center of the Municipality of Pombal, Paraíba, coordinates 6°42'37" S and 37°45'35" W Gr.
SITUATION, SLOPE AND VEGETATION COVER ON THE PROFILE - Described and collected in a manually opened trench, in a clay extraction barrier for the manufacture of handmade pottery, with soft undulating relief and native vegetation cover.
ELEVATION - 170 m.
GEOLOGICAL FORMATION - Super Suite I - Medium to high potassium calcialcalin granite suite
CHRONOLOGY - Neoproterozóico
SOURCE MATERIAL - Granite and granodiorite coarse to porphyritic associated with diorite and intermediate mixing phases.
STONY - Not stony.
ROCKY - Not rocky.
LOCAL RELIEF - Soft wavy.
REGIONAL RELAY - Soft wavy**.**
EROSION - Slight.
DRAINAGE - Moderately drained.
PRIMARY VEGETATION - Hyperxerophilic Caatinga.
CURRENT USE - Extraction of clay for making ceramic material.
CLIMATE - BSh according to Köppen-Geiger.
DESCRIBED AND COLLECTED BY - Jussara Silva Dantas, Rodolfo Trigueiro de Almeida, Jefferson Luan de Araújo Regis, Leonardo José Silva da Costa, Tiago da Silva Santos, Rosy Carina de Araújo Ventura and Francisco Alves da Silva.

Table 3 shows the morphological characteristics of the soil according to the scientific aspect. It is possible to observe that there is no homogeneous pattern in the behavior of texture, structure and consistency (Table 2). The Bt1 horizon, used for the extraction of soil for use in the manufacture of ceramic pieces, has a columnar structure, characteristic of soils with a high concentration of clay, also evidenced in the consistency when wet, being very plastic and very sticky, which explains its favorable condition for the artisanal work carried out in the quilombola community.

Table 3. Morphological description of a soil profile in the quilombola community "Os Rufinos", Pombal – PB.

And	0-22 cm, dark brown (7.5YR 3/3, wet), dark yellowish brown (10YR 4/4, dry); sandy loam little gravelly; moderate very small to large, subangular blocks; soft, crumbly, non-plastic and non-sticky; Smooth and clear transition.
Bt1	22-69 cm, bruno-forte (7.5YR 5/8 wet); loamy loam, little gravel; small to very large, columnar strong; too hard, too firm, too plastic, and too sticky; Smooth and clear transition.
Bt2	69-81 cm, yellowish-brown (10YR 5/4, wet); sandy loam loam; small to large strong, angular blocks; very hard, firm, slightly plastic and slightly sticky; Smooth and clear transition.
BT3	81-87 cm+, dark yellowish-brown (10YR 4/4, moist); little gravel france; small to large strong, angular blocks; abundant and strong waxiness; slightly hard, crumbly, slightly plastic and non-sticky; Smooth and clear transition.
Observations: 1. Soil with absence of A horizon, A was eroded; 2. Manganese effervescence at Bt1 horizon; 3. Effervescence for calcium carbonate in the Bt3 horizon.	

Vertical cracking was observed, with cracks of 2 to 5 mm wide in the Bt1 horizon. No cracking was observed on the soil surface. Dark manganese punctuations were also observed in the Bt1 horizon and whitish calcium carbonate punctuations in the Bt3 horizon. With characteristics of abundant and strong waxiness in the Bt3 horizon, and no mottling was identified during the profile.

The texture analysis reveals a predominance of the sand fraction in all horizons of the profile, with higher levels of coarse sand in the superficial horizons, with the exception of the Bt1 horizon in which the clay fraction predominates, (Table 4). The fine sand fraction was the one with the highest amounts in the Bt2 and Bt3 horizons and the coarse sand fraction was higher in the E and Bt1 horizons.

Table 4. Physical attributes of a soil profile in the quilombola community "Os Rufinos", Pombal – PB.

Hor.	**Prof.**	**SAND GROSS**	**SAND FINE**	**AT**	**ARG**	**SIL**	**S/A**	**GD**	**GF**
	cm	---------- **g.Kg^{-1}** ----------						-----**%**-----	
E	0-22	273	374	647	130	223	1,7	35	65
Bt1	22-69	171	211	382	396	222	0,5	74	26
Bt2	69-81	100	438	538	199	263	1,3	70	30
Bt3	81-87	89	427	516	198	286	1,4	59	41

Hor.: Horizon; Prof.: Depth; TA: Total Sand; ARG: Clay; SIL: Silt; ADA: Clay Dispersed in Water; S/A: Silt-Clay Ratio; GD: Degree of Dispersion, GF: Degree of Flocculation.

The E and Bt1 horizons showed acidic pH, while the Bt2 horizon showed neutral pH and Bt3 alkaline pH analyzed the pH in water. The organic matter contents were in relation to the soil texture. Regarding the bases found in the horizons, it can be seen that the contents of Ca+2 and Mg+2 were much higher in the Bt3 horizon. Na+ increases in depth, and was very expressive in the Bt3 horizon, characterizing the soil under study with nautical character (Table 5).

Table 5. Chemical attributes of a soil profile in the quilombola community "Os Rufinos", Pombal – PB.

Hor.	Prof.	pH		M.O.	Na+	Towards	P	Mg+2	Ca+2	Al+3	H+Al
	cm	H2O	CaCl2	g $^{kg-1}$	-------mg/dm3------			-------- cmolc dm^{-3} ---------			
E	0-22	6,1	-	6,73	0,17	43,01	4	2,1	3,4	0,0	3,1
Bt1	22-69	5,6	-	7,34	1,96	66,47	0,8	14,1	11,2	0,0	4,5
Bt2	69-81	7,0	-	3,26	3,97	35,19	792	13,3	11,0	0,0	0,0
Bt3	81-87	7,8	-	2,04	6,46	46,92	506	17,2	14,7	0,0	0,0

Hor.: Horizon; Prof.: Depth; M.O.: Organic Matter; Na+: Sodium; K: Potassium; P: Phosphorus; mg+2: magnesium; Ca+2: Calcium; Al+3: Aluminum; H+Al: Hydrogen+Aluminum.

The horizons of the profile under study show nutrient availability, with high values of sum of bases (SB), high cation exchange capacity (CEC), with zero levels of exchangeable aluminum (Al3+) and consequently of saturation by Al3+ (m) (Tables 5 and 6). Analyzing the profile under study, there were high concentrations of exchangeable bases (K+, Na+, Ca2+, Mg2+) (Table 5), and base saturation (V) (Table 6). The Bt3 horizon showed whitish punctuations that effervesced in the presence of HCl, being characterized with carbonate character, and the Bt1 horizon showed dark punctuations that effervesced in the presence of hydrogen peroxide (hydrogen peroxide volume 10).

Table 6. Chemical attributes of a soil profile in the quilombola community "Os Rufinos", Pombal – PB.

Hor.	Prof.	SB	t	CTC	V	m	PST
	cm	--------- cmolc dm^{-3} ----------			---------- % ----------		
E	0-22	5,8	5,8	8,9	65	0	1
Bt1	22-69	27,4	27,4	31,9	86	0	7
Bt2	69-81	28,4	28,4	29,4	100	0	14
Bt3	81-87	38,5	38,5	38,5	100	0	15

Hor.: Horizon; Prof.: Depth; SB: Sum of Exchangeable Bases; T: Effective Cation Exchange Capacity; CTC: Cation Exchange Capacity at pH 7.0; V: Base Saturation Percentage; m: Percentage of Saturation by Aluminum; PST: Percentage of Sodium Exchangeable.

The study profile showed a flat and clear textural change, columnar structure (figure 3) in the Bt1 horizon, being classified as Planosol in the first categorical level, being classified as Nátric in the second categorical level. Carbonate at the third categorical level and at the fourth categorical level was classified as typical.

Figure 3. Columnar structure of the Bt1 horizon.

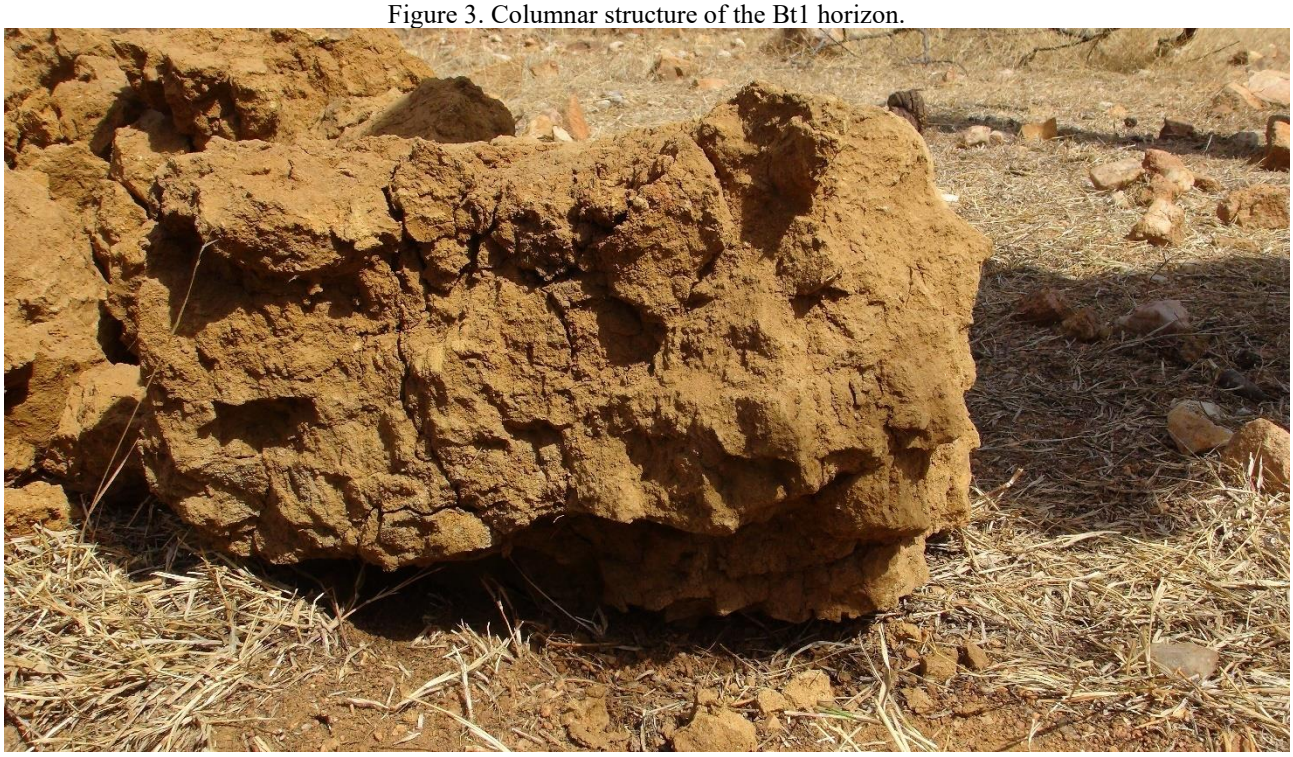


Figure 4. Presentation of the soil profile.

CONCLUSION

1. The studied profile was appropriately classified in the Brazilian Classification System up to the fourth categorical level, being classified as a typical Carbonate NATIC PLANOSOL.

2. The craftsmen were able to distinguish, identify and name, in their own way, the following soil materials along the profiles: "surface earth", "earthenware", "armadillo clay + pottery clay", "armadillo clay". These materials were distributed in strata along the soil profile, in a manner comparable to the arrangement of the pedogenetic horizons.

3. The color, consistency, and amount of cracks were used by the artisans and researchers to distinguish soil samples, although they were used in different ways by these two groups.

4. The ceramic material most used by local craftsmen was "earthenware" with a high concentration of clay, which was evaluated mainly using sight and touch. In the area studied, the clay corresponded to a specific layer of soil, belonging to the Bt1 horizon of Planosols affected by Na.

5. It is recommended that ethnopedological research be constant and address the knowledge of artisans about soil variations, both on the surface (arable layer) and indicated by them as good soil to produce, and in depth, considering that such studies in specific contexts contribute to the advancement of pedology and to a better understanding and appreciation of the knowledge of these important authors of Brazilian culture.

REFERENCES

1. Alves, Â. G. C., et al. (2005). Caracterização etnopedológica de Planossolos utilizados em cerâmica artesanal no Agreste Paraibano. *Revista Brasileira de Ciência do Solo, 29*(3), 379–388.

2. Araújo, A. L. de, et al. (2013). Etnopedologia: uma abordagem das etnociências sobre as relações entre as sociedades e os solos. *Ciência Rural, 43*(5), 854–860.

3. Azevêdo, S. M. A. de, Bakke, I. A., Bakke, O. A., & Freire, A. L. de O. (2012). Crescimento de plântulas de jurema preta (Mimosa tenuiflora (Wild) Poiret) em solos de áreas degradadas da Caatinga. *Engenharia Ambiental – Espírito Santo do Pinhal, 9*(3), 150-160. Disponível em: https://www.researchgate.net/publication/312451092_Crescimento_de_plantulas_de_jurema_preta_Mimosa_tenuiflora_Wild_Poiret_em_solos_de_areas_degradadas_da_caatinga. Acesso em: 27 de maio de 2024.

4. Nascimento Ferreira, N., & Lima da Costa Falcão, C. (2023). Etnopedologia, um estudo sobre os artesãos da areia de Beberibe/CE. *Revista Territorium Terram, 4*(06). Disponível em: http://periodicos.ufsj.edu.br/territorium_terram/article/view/5174. Acesso em: 27 fev. 2024.

5. Rufino, T. B. (2018). A formação da comunidade quilombola remanescente ‘Os Rufinos” no município de Pombal-PB (2011-2018). (Trabalho de Conclusão de Curso, Licenciatura Plena em História). Centro de Formação de Professores, Universidade Federal de Campina Grande, Cajazeiras, Paraíba, Brasil.

6. Santos, H. G., et al. (2018). *Sistema Brasileiro de Classificação de Solos* (5ª ed., revista e ampliada). Brasília, DF: Embrapa.

7. Santos, R. D., Lemos, R. C., Santos, H. G., Ker, J. C., & Anjos, L. H. C. (2015). *Manual de descrição e coleta de solo no campo* (7. ed.). Viçosa, MG: Sociedade Brasileira de Ciência do Solo.

8. Teixeira, P. C., et al. (2017). *Manual de métodos de análise de solo* (3. ed., rev. e ampl.). Brasília, DF: Embrapa.