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ANALYSIS OF COLLUVIUM DEPOSITS IN SERRA DOS CAVALOS - CARUARU / PERNAMBUCO

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Abstract

The present work aims to analyze two colluvium deposits in Serra dos Cavalos/PE, in an attempt to understand and/or correlate the geomorphological dynamics in this Altitude Brejo which has elements of biodiversity and geodiversity distinct from the surrounding areas. For this, a bibliographic survey, office work, field work and laboratory activities were carried out. The study area is located in the Planalto da Borborema and morphostructurally classified as the Pernambuco-Alagoas Structural Summit, specifically in the area belonging to the municipality of Caruaru/PE. Based on the sedimentological analysis, the two points have a sediment matrix classified as siltic sand and sandy silt. The grains for sediment selection were very poorly selected. Asymmetry ranged from very negative to positive. Kurtosis, a measure of the flattening of the particle size distribution curve in relation to the normal curve, was classified as very platykurtic (flat) and the environment presented a very high hydrodynamics. Thus, the colluvial sediments were derived from the remobilization of the eluvial mantles of alteration of the crystalline basement, through a high hydrodynamics, that is, a nearby source area and small crawls. The data presented here offer unprecedented results and can be used for planning and environmental and territorial management.

Keywords: Deposits; Sedimentological analysis; Serra dos Cavalos.

ANÁLISE DOS DEPÓSITOS DE COLÚVIO NA SERRA DOS CAVALOS – CARUARU / PERNAMBUCO

Resumo

O presente trabalho tem por objetivo analisar dois depósitos de colúvio na Serra dos Cavalos/PE, na tentativa de compreender e/ou correlacionar a dinâmica geomorfológica nesse Brejo de Altitude que possui elementos da biodiversidade e geodiversidade distintos das áreas circuvizinhas. Para isso, foi realizado um levantamento bibliográfico, trabalhos de gabinete, trabalhos de campo e atividades laboratoriais. A área de estudo está situado no Planalto da Borborema e morfoestruturlamente classificada de Cimeira Estrutural Pernambuco-Alagoas, especificamente na área pertencente ao município de Caruaru/PE. Com base na análise sedimentológica, os dois pontos possuem uma matriz de sedimentos classificada em areia síltica e silte arenoso. Os grãos para seleção dos sedimentos tiveram resultado de muito pobremente selecionado. A assimetria variou em muito negativa a positiva. A curtose, medida do achatamento da curva de distribuição granulométrica em relação a curva normal, foi classificada em muito platicúrtica (achatada) e o ambiente apresentou uma hidrodinâmica muito alta. Assim, os sedimentos coluviais foram derivados da remobilização dos mantos eluviais de alteração do embasamento cristalino, através de uma hidrodinâmica elevada, ou seja, área fonte próxima e pequenos rastejos. Os dados aqui apresentados oferecem resultados inéditos e podem ser utilizados para fins de planejamento e gestão ambiental e territorial.

Palavras-chave: Depósitos; Análise sedimentológica; Serra dos Cavalos.

ANÁLISIS DE DEPÓSITOS DE COLÓN EN SERRA DOS CAVALOS - CARUARU / PERNAMBUCO

Resumen

El presente trabajo tiene como objetivo analizar dos depósitos de coluviones en Serra dos Cavalos / PE, en un intento de

comprender y / o correlacionar la dinámica geomorfológica en este Brejo de Altitud que tiene elementos de biodiversidad y geodiversidad distintos de las áreas circundantes. Para ello se realizó un relevamiento bibliográfico, trabajo de oficina, trabajo de campo y actividades de laboratorio. El área de estudio está ubicada en el Planalto da Borborema y morfoestructuralmente clasificada como Cumbre Estructural Pernambuco-Alagoas, específicamente en el área perteneciente al municipio de Caruaru / PE. Con base en el análisis sedimentológico, los dos puntos tienen una matriz sedimentaria clasificada como arena silítica y limo arenoso. Los granos para la selección de sedimentos se seleccionaron muy mal. La asimetría varió de muy negativa a positiva. La curtosis, una medida del aplanamiento de la curva de distribución del tamaño de partícula en relación con la curva normal, se clasificó como muy platicúrtica (plana) y el ambiente presentó una hidrodinámica muy alta. Así, los sedimentos coluviales se derivaron de la removilización de los mantos eluviales de alteración del basamento cristalino, a través de una alta hidrodinámica, es decir, un área fuente cercana y pequeños arrastres. Los datos aquí presentados ofrecen resultados sin precedentes y pueden utilizarse para la planificación y la gestión ambiental y territorial.

Palabras-clave: Depósitos; Análisis sedimentológico; Serra dos Cavalos.

1. INTRODUCTION

Understanding the geomorphological dynamics of a given unit and/or geographic landscape using specific methods has grown considerably in recent years within Physical Geography, making it possible to analyze various surface processes that are subject to relief morphodynamics by exogenous and endogenous agents. This occurs, thanks to methodologies already established, such as detailed mapping, dating, sedimentological analysis, soil micromorphology, geochemistry and others (SILVA, et al., 2016; GUIMARÃES, 2016; SOUSA, et al., 2019; ARRUDA & GUIMARÃES, 2019; TAVARES, et al., 2019; XAVIER, et al., 2020; ARRUDA & GUIMARÃES, 2020).

The external geodynamics of the relief, represented by its correlative features, shapes and deposits, were inherited from punctual processes that occurred in the Quaternary Period and are associated with the various environmental changes generated in this short geological time interval (SILVA, 2019). In addition, it is in this short period of time that man emerges as the main modifying and transforming agent of this landscape, causing significant increases in inputs of energy and matter, often enabling changes, reorganizations in systems and processes, affecting all local dynamics and elements to him connected (ARRUDA, et al., 2021).

For geomorphology, the sediments generated and stored on the surface can be understood as the result of the various elements acting in the physical environment (SILVA, 2013; RAMOS, 2014; MELO, 2014). When there is any significant change in the landscape, the slopes are true testimonies that record the input of energy through the deposition of materials from the changing rock or from old sediments, or previously stabilized soils, produced in the geological past. It is known that the sediment deposited at the foot of this slope becomes the main clue to the ancient characteristics of the environment and often to the processes that produced it (GOIS, et al., 2021).

According to Silva (2013), the relief when exposed to weathering processes allows the formation of sediments that can remain in situ or can be transported by gravity, and/or by large-scale precipitation events. When these sediments are deposited at the foot of slopes, or in other sectors of the slope, they are classified in the literature as colluvium.

According to Melo (2014), through sedimentological analysis, colluvium are used as a data source to reconstruct the erosive history and geomorphic dynamics of a given place, through data such as hydrodynamics, granulometric dispersion, asymmetry, kurtosis and others. Reiterating the above statement, Melo et al (2014), consider that the response-process model in a given landscape are preserved and can be observed through the geometrical variation of the sediments, composition and spatial distribution. Although in the case of recent deposits, the current surface of any terrain can be directly affected, in response to the depositional system and local events (FÔNSECA & CORRÊA, 2012).

Given the assertions, the choice of Serra dos Cavalos is justified by the absence of scientific works, as it is a large Altitude Brejo, with scenic, scientific and educational value, dynamic from the point of view of the elements of geodiversity and biodiversity, and for having an intense process of landscape modification that is driven by the forms of uses brought about by human occupation over the years. The chosen cut presents a strong connection between the slope, the river springs and the anthropic processes.

Thus, the article in question, aims to analyze the geomorphological dynamics from the morphostratigraphic analysis of slope deposits in Serra dos Cavalos in the rural region of Pernambuco. Therefore, a literature review, field survey and laboratory analysis were carried out.

2. CHARACTERIZATION OF THE STUDY AREA

Serra dos Cavalos is located in the central-eastern portion of the state of Pernambuco, covering the northern municipalities of Caruaru, Bezerros and São Caetano, which are part of the Microregion of Vale do Ipojuca. In the southern portion, there are the municipalities of Altinho, Agrestina and São Joaquim do Monte, belonging to the Microregion of Brejo Pernambucano (Figure 1).

Within the chosen section, there is the Professor João Vasconcelos Sobrinho Municipal Natural Park. It is an area of integral protection of the elements of the local fauna and flora, belonging to the municipality of Caruaru - PE. It is located about 20km from the municipality's headquarters, in the Agreste Central region of Pernambuco. The same was created for the development of Education and Environmental Awareness, in addition to Scientific Research. The Park is linked to the Executive Secretariat for Sustainability, of the Municipal Secretariat for Sustainability and Rural Development of Caruaru.

Geologically, the area presents terrains of Pre-Cambrian origin belonging to the Crystalline Complex of the Province of Borborema, formed by granodiorites with gradation to granites and tonolites of color, and varied particle size (CPRM, 2014; SILVA, et al., 2017). The entire mountain range is formed by

intrusive bodies delimited by steep slopes under the influence of the weather association, clearly visible in the landscape (SOUSA, et al., 2018).

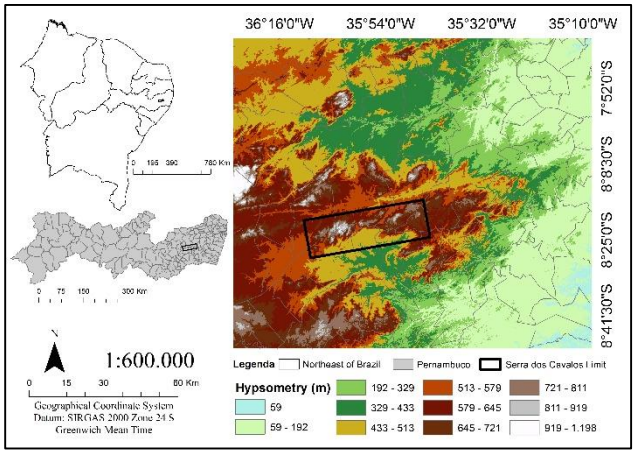


Figure 1 - Location of Serra dos Cavalos which comprises the entire polygon in red on the map above, covering several municipalities in the Agreste of Pernambuco. Source: Authors (2018).

From a geomorphological point of view, Serra dos Cavalos is inserted within the morphostructural unit of the Planalto da Borborema (SOUSA, et al., 2018), which presents itself as a set of elevated lands, consisting of crystalline terrains of varying ages that expand throughout the northeastern east of Brazil. Its geographic boundaries are marked by a discontinuity of topographic unevenness, usually associated with a segment with an amplitude of about 100m in relation to its surroundings (CORRÊA et al., 2010).

The ridges, higher areas, are superimposed according to the regional trend, NE-SW direction, characterized by deep and embedded valleys, associated with structural controls, indicating tectonic movement, possibly Neo-Cenozoic, associated with the reactivation of old structures, causing important sets of river springs (AMORIM, et al., 2016; SANTOS, et al., 2018).

Due to these geomorphological peculiarities, the climatic characteristics of the study area is As' - tropical rainy according to the classification of Koppen and Geiger (1928), presenting a dry summer, with an average temperature of 24ºC. The average annual precipitation oscillates between 650 and 800 mm (CPRH, 1994), with rainfall distribution delimiting two distinct seasons, the rainy, between April and July, and the dry, corresponding to the other months of the year. (SOUSA, et al., 2018).

In this way, the research unit is characterized, within the literature, as an Altitude Swamp, which according to Lins (1989) "represents areas of exception in the context of the Agreste Zone, favored by milder natural conditions than those of the caatingas surrounding." In this specific case, the relief becomes a geographical barrier that naturally prevents a good part of the wet winds from passing, which reach higher altitudes, cooling and providing the formation of fog and precipitation (RODRIGUES et al., 2008).

The Brejos de Altitude are specific areas, located on the perimeter of the droughts in northeastern Brazil. They are defined as having a humid or sub-humid tropical climate in higher areas, in some cases even subtropical (SILVA et al., 2017). Due to the high altitude of some morphosculptures, the mountain provides the necessary conditions for the development of a fauna and flora that bring together characteristics of the Atlantic Forest. They are recognized as a true refuge of this regional biodiversity, which suffered geographical isolation during the Pliocene and Upper Pleistocene (ARRUDA, 2018) (Figure 2).

Figure 2 - Residual massif with vegetation cover belonging to the municipality of Caruaru. Source: Authors (2018).

According to Rodrigues et al (2013), the area has a predominance of subevergreen, subdeciduous and deciduous forests on its tops. Also according to the authors, there are, in some points, the transitional vegetation between the deciduous forest and the hypoxerophilic caatinga.

As presented by Silva and Cavalcanti (1989), the Serra dos Cavalos, depending on the altitude, the slopes and the actions of the southeast trade winds, works as an orographic barrier, responsible for the adiabatic cooling of these atmospheric layers, creating an area with characteristics specific thermal and hydrological areas known as areas of exception. Under these conditions a broadleaf evergreen forest vegetation develops, with large trees.

3. METHODOLOGY

The research was developed from a vast literature review, field investigations with collection and laboratory processing.

In the field, two sampling areas were selected (Figure 3), the first was the slope of a summit surface at an altitude of 770 meters (Figure 4). The second point is located on a colluvial ramp at 550 meters of altitude and at a distance of about 1.5 km from the first (Figure 5), both in the municipality of Caruaru/PE. The samples were separated, prepared and processed in the Laboratory of Geomorphology and Geotechnologies of the Department of Geographical Sciences at UFPE.

Figure 3 - Location of collection points. Source: Google Earth Pro (2018).

Figure 4 - First collection point. The collections were carried out between 0.20cm, 0.80cm and 1.30cm – from the base to the top. Source: Authors (2018)

Figure 5 - Second collection point. The collections were carried out between 0.30cm and 0.80cm – from the base to the top Source: Authors (2018).

The samples were named (Frame 1) and stored in plastic bags, weighing about 1000g each. All sampled were identified through tags and their points were recorded on GPS.

Frame 1 - Location, nomenclature and depth of samples collected in the field. Source: Authors, 2018.

Location of Samples	Sample Names and depth
Summit surface	CCSC20 – 0,20 Cm CCSC80 – 0,80 Cm CCSC130 – 1,30 Cm
Colluvial ramp	CC30 – 0,30 Cm CC80 – 0,80 Cm

In the laboratory phase, for the granulometric processing, it was necessary to separate 100g of each sample, which occurred by quartering, and later they were added in a beker with a solution of sodium hexametaphosphate (solute). The solution is composed of 1 liter of distilled water and 5g of the solute, which are stirred until all the solute is completely dissolved. The material was then taken to a mechanical stirrer for 30 minutes to deflocculate the fines and leave the grains well washed.

Subsequently, the material was taken to the 62 µm sieve where the very fine sediments were evacuated by rinsing in tap water and the minerals that were retained in the sieve were taken to dry in an oven at 60º as presented by Silva and Corrêa (2009) and Ramos et al. (2014).

Consecutively, the samples were again weighed and sieved on rotap for a time of 10min, in a set of sieves, with intervals of 2000mm - 1000mm - 500mm - 250mm - 125mm - 63mm - base, for the determination of very fine sand, fine sand, sand medium, coarse sand, very coarse sand, gravel, following the Udden Wentworth size classification (1922).

To corroborate with the granulometric data, it is necessary to estimate the amount of fines present in the material through the pipetting method for each sample collected through the method presented by Gale & Hoare (1991), which consists of obtaining 20g of representative sample by the quartering method . The technique consists of the following steps: 1) place the material quartered in a 63um sieve, 2) add a funnel and a beaker under the pan in order to reuse all the washing of the sediment; 3) the solution used for washing is composed of 1L of distilled water (solvent) added with 5g of dispersant (solute); 4) once ready, the solution is poured into the sediment under the sieve so that the liquid goes down through the funnel and into the beaker; 5) After completing the volume in the beaker, the solution needs to be stirred for 30 seconds with the help of a stick; 6) it is necessary to mark the time necessary for the sedimentation of the clay, following Stokes' law.

Afterwards, a pipette up to 5cm is introduced for the removal of clay sampling. The collected material needs to be transferred to a Becker and then to an oven with a temperature varying from 100° to 115° degrees, enabling the sample to dry. Finally, the residue on the Becker needs to be weighed on a precision balance, in order to quantify the fine sediments present in the samples. It should be noted that the total weight between both materials must reach 100% of their initial weight.

The data obtained in the dry and wet sieving process resulted in specific values for each particle size fraction. These were subjected to treatment following the statistical parameters of Folk & Ward (1957) (Figure 6), and the average diameter, the degree of selection, the degree of asymmetry and kurtosis were

calculated (Frame 2, 3 and 4) as seen in Silva and Corrêa (2009); and for the classification of sediments, the Pejrup and Folk diagram was used using the SysGran 3.0 software, freely available on the internet as presented by Ramos et al. (2014).

Frame 2 - Folk and Ward's (1957) quantitative scale to describe the degree of selection.

Selection degree	Value
Very well selected	< 0,35
Well selected	0,35 a 0,50
Moderately selected	0,50 a 1,00
Poorly selected	1,00 a 2,00
Very poorly selected	2,00 a 4,00
Extremely poorly selected	> 4,00

Frame 3 - Folk and Ward's (1957) quantitative scale to describe the degree of asymmetry..

Asymmetry	Value
Very negative asymmetry	-1,00 a -0,30
Negative asymmetry	-0,30 a -0,10
Approximately symmetric	-0,10 a 0,10
Positive asymmetry	0,10 a 0,30
Very positive asymmetry	0,30 a 1,00

Frame 4 - Folk and Ward's (1957) quantitative scale for describing kurtosis values.

Kurtosis	Value
Very platykurtic	< 0,67
Platykurtic	0,67 a 0,90
Mesokurtic	0,90 a 1,11
Leptokurtics	1,11 a 1,50
Very leptokurtics	1,50 a 1,30

After separating the particle size fractions, the morphoscopy procedure was performed for each sample, where 100 randomly chosen grains from the 0.250 mm fraction were selected and analyzed for rounding, sphericity and grain mineralogy in an electronic magnifying glass. This analysis allows for the qualitative and quantitative characterization of the material, enabling the identification of the operating processes during the depositional dynamics. This method is of paramount importance in the evaluation of processes and production of eluvial and colluvial sediments (RAMOS, et al., 2014).

In order to classify the degree of roundness of the sediments, the following categories were defined: very angular (0.5); angular (1.5); subangular (2.5); under-rounded (3.5); rounded (4.5); and well rounded (5.5); and for the degree of sphericity, the following categories were defined: high sphericity (0.5 and 4.5); medium sphericity (-2.5) and low sphericity (0.5), whose rounding was previously calculated according to the procedure described by Tucker (1995) (Figure 6).

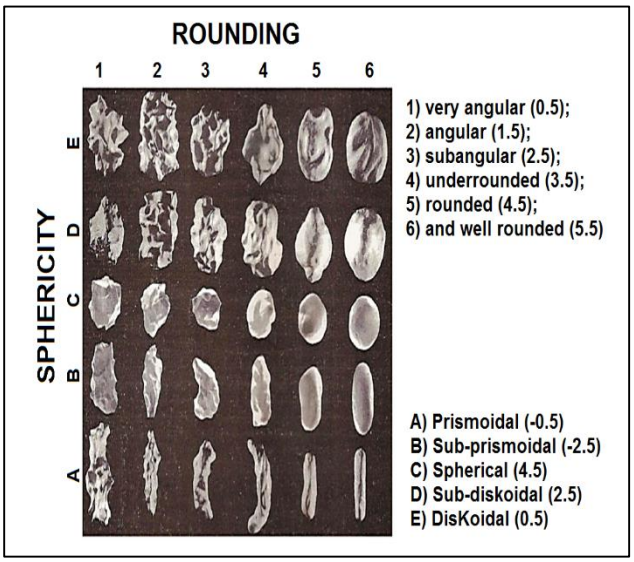


Figure 6 - Representative diagram used to measure and analyze the different degrees of roundness and sphericity of deposits. Source: Adapted from Powers (1982).

4. RESULTS AND DISCUSSION

The evaluation of particle size dispersion according to Folk and Ward (1957) for the matrix (sand and silt/clay fractions) of the Serra dos Cavalos structural massif indicates that the sediments are very poorly selected (Table 1). This indicates that sedimentation occurred quickly, reaffirming the low selection capacity of the transport agents acting in the two collection areas.

According to Camargo Filho and Bigarella (1998), in order to have the selection coefficient, it is necessary to understand the entire sedimentation process that acts on the material in loco through the methods mentioned above. Thus, the deposits have a very heterogeneous particle size distribution and tend to be poorly selected. This result corroborates the finding in the two collection sites.

Table 1 - Selection, asymmetry and kurtosis statistics of samples collected in the Serra dos Cavalos structural massif. Source: Authors, 2018.

SAMPLES	SELECTION	ASYMMETRY	CURTOSIS
CC30	3,095 Very poorly selected	0,2155 Positive	0,6323 Very platykurtic
CC80	2,883 Very poorly selected	0,1227 Positive	0,5818 Very platykurtic
CCSC80	2,721 Very poorly selected	-0,8275 Very negative	0,6101 Very platykurtic
CCSC20	2,597 Very poorly selected	-0,8289 Very negative	0,5839 Very platykurtic
CCSC130	3,091 Very poorly selected	-0,8265 Very negative	0,6348 Very platykurtic

Asymmetry is a measure that interprets the textural distribution and provides indications about the nature of the transport flow of these sediments, which can be unidirectional, based on positive asymmetry, or bidirectional, when the asymmetry is negative (ARRUDA, 2020, in press). When the asymmetry values are classified as very positive, the material is related to the genesis of sandy-clay facies, when the values refer to a very negative classification, the present material has a sandy-clay and siltic-clay texture (BIGARELLA et al., 1975).

Practically all samples had very negative asymmetry, with the exception of CC30 and CC80, which were classified as having positive aspects, hence a unidirectional flow. This caveat may be intrinsically linked to rocky nature and local weathering agents.

The analyzes based on and postulated on the methods presented by Folk and Ward (1957), on the other hand, aimed to characterize and understand the depositional units (Figure 6). For the two deposit areas, the values obtained in the modal classes for the sediment matrix, whether they are sand and silt/clay fractions, reflected both the aspects of the material transport process and its pedological maturity.

For both points, a variation between siltic sand and sandy silt was obtained. This result corresponds to an environment with geochemical capacity to produce minerals in the silicic fractions, since the fine material was trapped with the coarse sediments and that this silicic material does not have cohesion and plasticity.

In an attempt to correlate the sedimentological texture and the transport process of this material, the Pejrup diagram (1988) is used, which demonstrates the hydrodynamics in which the sediments were subjected until they were stored in geomorphic treading (ARRUDA, 2020, in press).

Thus, observing the diagram of the samples collected in the massif (Figure 7) it is possible to observe that the samples CC30, CC80, CCSC80, CCSC20 and CCSC130 were exposed to a very high and very significant hydrodynamics, with a fraction of granules < 3% (in the presence of finer sediments), and were also exposed to a high hydrodynamics, with a fraction of granules > 3% (presence of coarser sediments).

Thus, these two deposition environments had a material with low viscosity characteristics. This result suggests that the deposition had a high level of energy, being a remnant of a flow originated from energy inputs associated with moments of intense precipitation that acted transporting material over small distances.

To complete the sedimentological discussion, another methodological parameter used was morphoscopy (Tables 2 and 3), where the degree of roundness, sphericity and mineralogy of the grains was analyzed and interpreted. (SILVA, 2013).

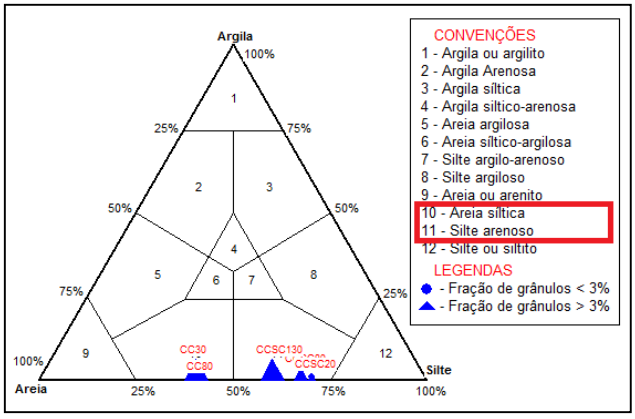
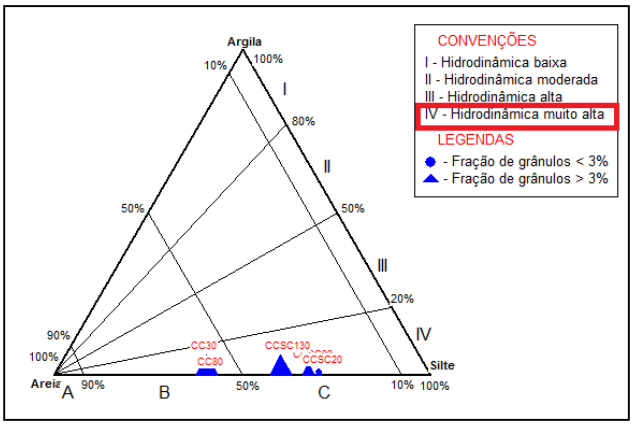


Figure 6: Texture triangular diagram according to Folk and Ward for the analyzed sediments. Source: Authors, 2018.



. Figure 7: Pejrup hydrodynamic diagram for the collected and analyzed sediments. Source: Authors, 2018.

Using this analysis, it was possible to characterize the deposited material qualitatively and quantitatively, providing the correlation between the operative processes and their depositional dynamics. The more the material is rounded, the more wear process it had during its passage, in this way, the sediment was very transported. When this mineral is angular, its source area is close and has undergone little transport process. Tables 2 and 3 therefore represent the subjective classification given during the execution of this analysis.

Table 2 - Morphoscopic analysis of the 0.250mm fraction from collection point 1 in the sedimentary slope of the Serra dos Cavalos structural massif. Source: Authors, 2018.

DISTRIBUTION BY SIZE – POINT 1	**HETEROGENEOUS**
AGGREGATION	Little Aggregation
SPHERICITY	10% Prismoidal 39% Subprismoidal 38% Spherical 11%Sub-Discoidal 2% Discoidal
ROUNDING	15% Too Angular 49% Angular 21%Sub - angular 5% Sub - rounded 5% rounded 5% well rounded
SURFACE TEXTURE	60% Brilliant 29%Polish 11% Matte
OPACITY	51% Transparent 35% Opaque 14%Translucent
MISCELLANEOUS MINERALS	Mica, feldspar, quartz, coal

Table 3 - Morphoscopic analysis of the 0.250mm fraction from collection point 2 in the sedimentary slope of the Serra dos Cavalos structural massif. Source: Authors, 2018.

DISTRIBUTION BY SIZE – POINT 2	**HETEROGENEOUS**
AGGREGATION	Little Aggregation
SPHERICITY	1% Prismoidal 46% Subprismoidal 50% Spherical 2%Sub-Discoidal 1% Discoidal
ROUNDING	59%Very Angular 36% Angular 3%Sub - angular 1% Sub - rounded 0% rounded 1% well rounded
SURFACE TEXTURE	75% Brilliant 13% Polished 12% matte
OPACITY	83% Transparent 13% Opaque 4% Translucent
MISCELLANEOUS MINERALS	Mica, feldspar, quartz, coal

Therefore, the morphoscopic analysis showed a very heterogeneous distribution regarding the shape of the grains, with high sphericity and a predominance of grains ranging from very angular to angular in their degree of roundness (MELO, et al., 2012). These parameters suggest little variation in sediment transport processes, which are apparently transported by mud runs with a nearby source area. Thus, the morphology of the grains is mainly due to the alteration of the parent rock, with little morphological alteration due to transport.

The analyzed profiles presented varied sediments in different stages of alteration. During the morphoscopy process, the presence of feldspars, mica and quartz was identified in the 250mm fraction. There is a certain predominance of relatively fast or very fast transport, trapping the material on the slope. Due to the anthropic use in some parts of the slopes (Figure 8), distinct fragments were found, such as coal, because near the collection points, the use of the soil by agriculture is intensive.

Figure 8 - Family farming in the summit area. Source: Authors, 2018..

It is noteworthy that the statistical analyzes now considered corroborate the hypothesis presented by Silva (2013), Ramos (2014), Melo (2014), Silva (2019), Melo (2019) and Arruda (2020) that there is a certain control in the mantles of alteration, morphologically conditioned by climatic variations. The sum of these processes results in the supply of materials for hillside environments. This material was transported through a high energy transport regime, which was confirmed by the analysis of the Pejrup diagrams (1988), where the dominant hydrodynamics during the stabilization process at the foothills was very high..

Thus, it can be stated that these sediments deposited in colluvial slopes have a textural homogeneous appearance. Thus, it is suggested that both packages may have evolved by the same weathering, transport and deposition processes. These deposits were derived from mud runs, through punctual episodes during torrential rains in a semiarid climate with a proximal source area.

Based on the analysis methods used to understand the landscape by geomorphology, it is possible to infer the use of slope deposits as possible paleoclimatic and paleoenvironmental markers, providing an understanding of the surface and morphodynamic processes. Therefore, it is suggested the development of further research, using specific means associated with the morphostratigraphic approach and paleoenvironmental reconstruction, to understand the temporality of sedimentation

and environmental evolution for Serra dos Cavalos, in order to obtain an average of relative ages that can fill gaps on events of large magnitude and low occurrence that occur in the region.

5. CONCLUSIONS

According to the results obtained through the in situ observation of sedimentary deposits, it was found that these were derived from the remobilization of eluvial mantles of alteration of the crystalline basement, which were restructured into colluvial deposits of different thicknesses, associated with climatic cycles of different signs and mediated by distinct vegetation patterns.

The use of the methodology employed in this research allowed to evaluate the surface dynamics of slope sectors in these high areas, linked to a response model system that may be linked to different climatic regimes..

As shown, sediments stored at the foot of a slope have considerable information for environmental studies. In the use of specific methods added to sedimentological analysis, it is possible to interpret and understand the morphology of the relief in question.

Based on the sedimentological analysis, the area has: 1) At Point 01 – sediments with a matrix texturally classified as siltic sand. The degree of selection of the sediments was very poorly selected. The asymmetry of this deposit ranged from very negative to positive. Its kurtosis was classified as very platykurtic and the environment presented a very high hydrodynamics; 2) At Point 02 – the sediments have a matrix texturally classified in sandy silt. The degree of selection of these sediments resulted in very poorly selected. The asymmetry at this point was very negative. Its kurtosis and hydrodynamics were also very platykurtic and very high, that is, deposition sometimes slow, sometimes fast and a variable rework for both points.

As for morphoscopy, the analyzed samples have a very heterogeneous distribution in terms of grain shape, high sphericity and a predominance of grains ranging from very angular to angular in their degree of roundness. This may be associated with low variation in sediment transport processes, which are transported by mud runs with a nearby source area.

It is notorious that today, the influence of weathering processes associated with anthropic processes, generate a certain vulnerability in the relief of the study area. It can also be concluded that the area is directly influenced by anthropic actions. Therefore, this degraded environment interferes in the modification of the most varied aspects of its slopes, such as in the production, transport and deposition of sediments.

Therefore, we suggest the development of more research in the geomorphological scope for the area, using this work as a starting point, considering that the two points used can be added to others, in different geomorphological contexts and/or using more specific methods such as: sediment geochemistry, dating, phytolithic assemblage and mapping of micro-plots of storage areas in order to assess the level of sensitivity of these landscapes to changes and/or climate change and land use by anthropic actions.

6. REFERENCES

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