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GEOMORPHOLOGICAL STUDY AND DESCRIPTION OF SEDIMENTS OF THE LOWER COURSE OF THE BRUMADO STREAM MICROBASIN, SANTA RITA DURÃO/MARIANA MG

GEOMORPHOLOGICAL STUDY AND SEDIMENT DESCRIPTION OF THE LOWER COURSE OF THE BRUMADO STREAM MICRO BASIN, SANTA RITA DURÃO/MARIANA MG

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SUMMARY
The Iron Quadrangle is an important metallogenic region consisting of a Precambrian lithology which has a large collection of bibliographic materials. The Córrego do Brumado Basin is located on the eastern edge of the quadrangle, close to the district of Santa Rita Durão and inserted on the reverse flank of the local structure called Santa Rita Synclinal. This approach focuses on the geomorphology of the region with subsequent analysis of sediments collected in the lower course of the stream. With a bibliographical survey and analysis of regional maps, it was possible to recognize the study area and recognize the strategic points to be visited. The collected samples were examined using a binocular magnifying glass to obtain data on the aspects of the grains and their mineralogy. The local geomorphology was analyzed following the classification of the IBGE geomorphological guide. In the analyzed scenario, geological agents and geomorphological factors act on the evolution of the basin's fluvial geomorphology, as represented in the lower course of the stream, where flooding processes and their low energy contribute to the modeling of the landscape.
Key words: Geomorphology. Sedimentary. Iron Quadrangle. Weathering.

ABSTRACT
The Quadrilatero Ferrifero is an important metallogenic region constituted by pre-Cambrian lithology that has a great collection of bibliographic materials. The Córrego do Brumado basin is located on the east edge of the quadrangle and next to the district of Santa Rita Durão and inserted in the reverse flank named Santa Rita synclinal. This approach focuses on the regional geomorphology with post analysis of the sediments collected in the low stream of the river. With bibliographic research and topographical chart analysis, it was possible to recognize the study field and recognize the strategic visitation points. The collected samples were examined through a binocular loupe to obtain details about the aspects of their grains and mineralogy. The local geomorphology was analyzed following the

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classification of the IBGE geomorphological guide. In the scenario, the geological and geomorphological agents act in the evolution of the basin fluvial geomorphology, as represented in the low stream, where the flooding bank and your low energy contribute to the landscape shaping.
Keywords: Geomorphology. Sedimentary. Iron Quadrangle. Weathering.

1. INTRODUCTION

The Brumado stream microbasin is located on the eastern edge of the Iron Quadrangle, in the central portion of the state of Minas Gerais. The area is located on the reverse flank of the Santa Rita Syncline, a megastructure characterized as a sub-regional scale fold with an axial NW-SE direction with roots in the adjacent basement of the Santa Bárbara Complex and sectioned by the Água Quente fault, occurring, in its core, schists, phyllites and quartzites, all ferruginous, belonging to the Piracicaba and Sabará groups (FERREIRA; FONSECA, 2001). The sediments in the lower course of the worked stream are related to the lithostratigraphic units of the Cauê Group, Cercadinho Group, Chapada de Canga Formation and Fonseca Formation.

Geomorphology has been using various tools such as surface structure, landscape physiology and local geology to understand and differentiate different phases of relief formation, thus being able to exemplify young, mature and senile stages (CASSETI, 2005). Therefore, relief forms and surface deposits have an intimate connection with lithology and weathering mechanisms. Thus, balance is achieved when the different compartments of a landscape present the same average erosion intensity (CASSETI, 2005). According to Sant'Anna (1994), the sedimentation environment of the Fonseca Formation suggests the presence of flattening at the time of its formation, which is confirmed by floodplain deposits, with laminated clayey sediments, which indicate a meandering river system in low-lying areas. without tectonic action.

1.1 OBJECTIVE

1.1.1 General objective

The present study aims to present analyzes of the lithology of strategic points in the Fonseca Basin along with the properties of the sediments of the Fonseca microbasin.

Córrego do Brumado and explain how geomorphological and geological processes shape and act on the relief of this region.

1.1.2 Specific objectives

The specific objectives of the work are:

- Generate location, geological, hypsometric and slope maps of the study area.

- Generate an explanatory table with a description of the collected sediments.

- Manual transverse profile of the locations where sediment samples were collected and or rocks.

1.2 LOCATION AND ACCESS

The studied region is located on the eastern edge of the Iron Quadrangle, central portion of the state of Minas Gerais in the municipality of Mariana. The main access road to the area is MG 129, which connects Mariana to Santa Bárbara. The municipality of Mariana is located approximately 118 km southeast of Belo Horizonte, access is made from the city of Mariana, taking the 4th road that connects this city to Santa Barbara until the state highway MG 129, heading towards to the municipality of Catas Altas, at the junction turn left towards Santa Rita Durão.

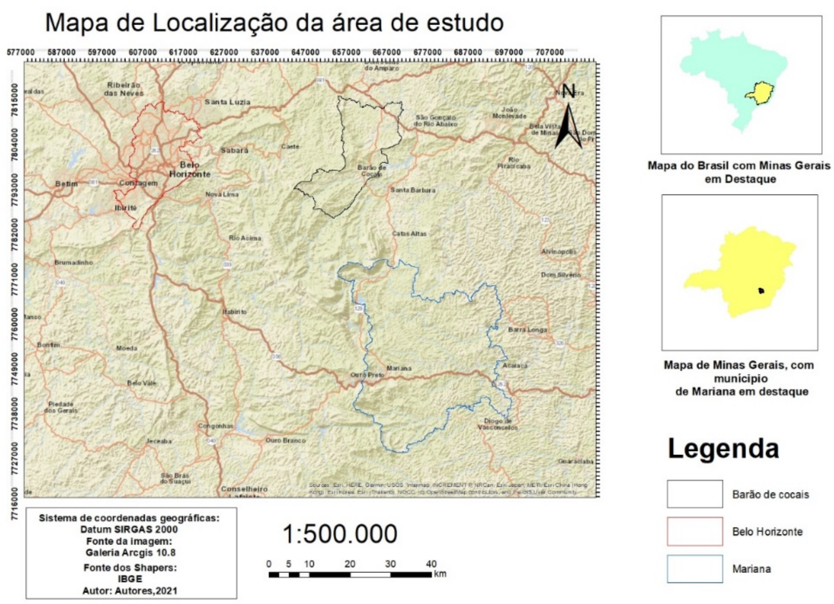

Figure 1: Location map of the study area with the main highways.

1.2.1 Brumado Stream

The sub-basin area is between parallels 23º9�something and 23º10‟south and meridians 43º26‟and 43º25‟west, and is approximately 6 km² (ROSSI, 2014). The upstream portion of the main channel course has a low load of bottom sediments, the water flow is preferably laminar and calm, becoming disturbed at one time or another when the slope drops, it does not have an alluvial plain, a large part of its sediments are clayey and muddy, and its drainage is sub-rectangular, as the terrain is fractured. In general, the outcrops visited in the lower course of the Brumado Stream Basin were poorly preserved, and it was not possible to clearly define most of the sedimentary structures.

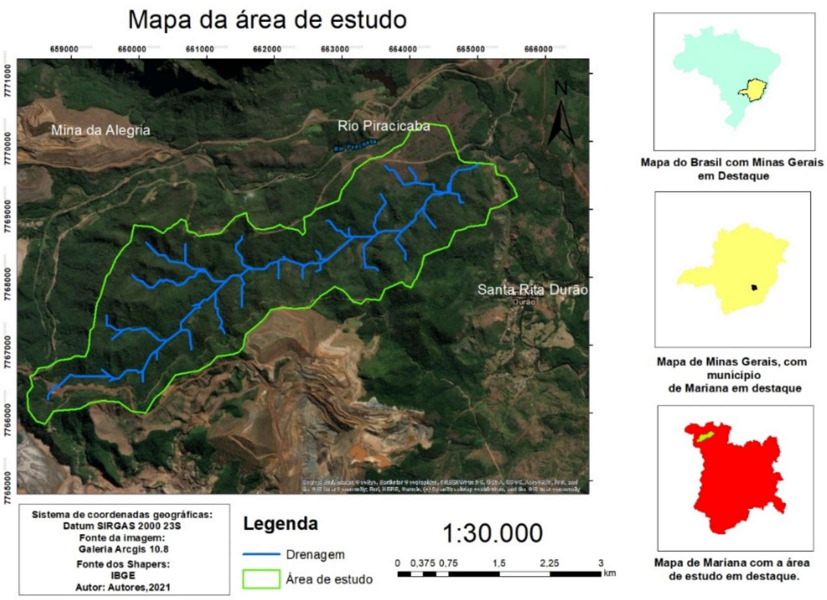

Figure 2: Location map of the study area with the watershed highlighted.

2 THEORETICAL FOUNDATION

2.1 REGIONAL GEOLOGY

The Iron Quadrangle, a geological structure whose shape resembles a square, covers an area of approximately 7000 km2 and extends between the old capital of Minas Gerais, Ouro Preto to the southeast, and Belo Horizonte, the new capital to the northwest. It is the southern continuation of Serra do Espinhaço. Its basement and surrounding areas are composed of tonalitic-granitic gneisses of Archean age (> 2.7 billion years old) (ROESER, 2010).

The Minas Supergroup, which is up to 6000 m thick, is composed mainly of pelitic and quartzose metasediments and lies discordantly above the Rio das Velhas green belt, and is divided from base to top into the Caraça, Itabira, Piracicaba and Sabará Group (ROESER, 2010). Structurally, the Córrego do Brumado basin is inserted on the reverse flank of the Santa Rita Syncline, a megastructure characterized as a sub-regional scale fold of axial NW-SE direction with roots in the adjacent basement of the Santa Bárbara Complex and sectioned by the Hot Water (ROSSI, 2014)

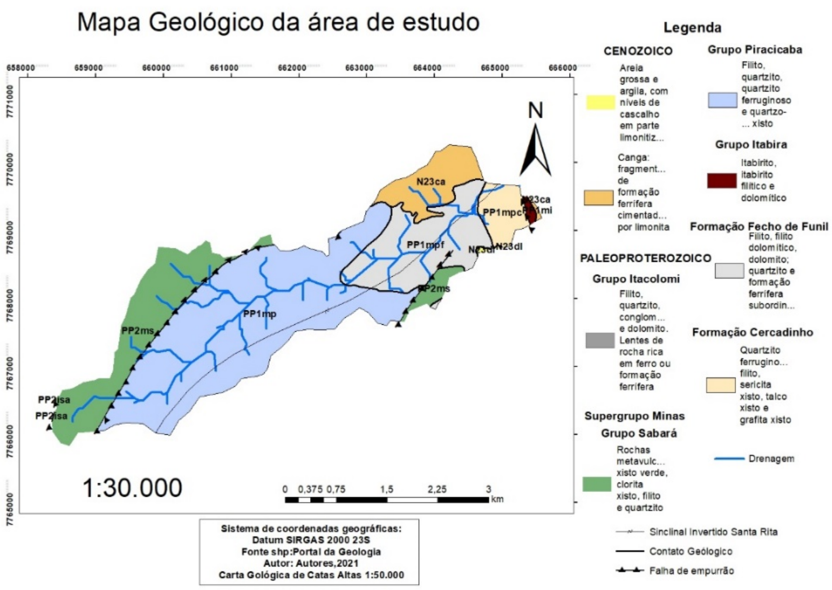

Figure 3: Geological map of the study area.

2.1.1 Fonseca Training

The Fonseca Formation is found in the Fonseca Basin, which in structural terms is a graben limited by normal faults (SANT'ANNA; SCHORSCHER, 1997) and is inserted in the lithostratigraphic context of the Iron Quadrangle, which presents Cenozoic deposits on the pre- -Cambrian (GORCEIX, 1884; DORR, 1969). The filling of this basin is restricted to the Fonseca Formation, which initially included, in addition to sedimentary rocks of clayey-sandy grain size and lignites of lacustrine and fluvial origin, the cover of ferruginous canga (MAXWELL, 1972).

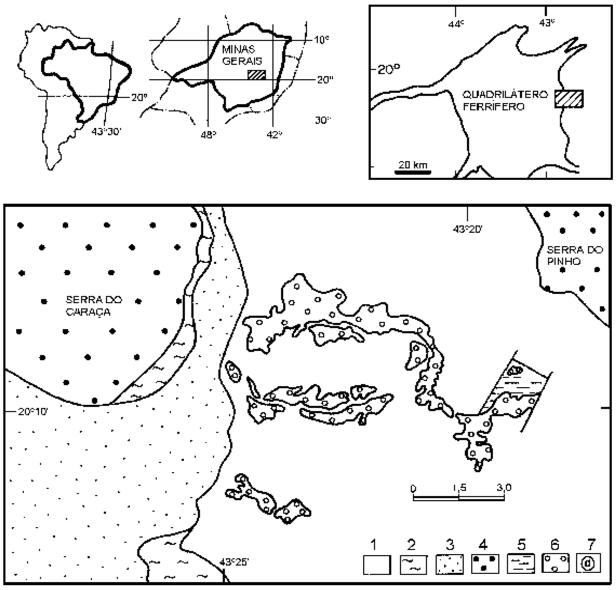

Figure 4: Location of the Fonseca basin in the regional geological context of the Iron Quadrangle and geology of the Fonseca basin region: 1- TTG Association, 2- Rio das Velhas Supergroup, 3- Minas Supergroup, 4- Espinhaço Supergroup, 5- Fonseca Formation. Source: (Sant'Anna, 1994)

2.1.2 Geomorphological and physiographic aspects

The Córrego do Brumado basin is inserted in the geomorphological unit called Platô de Canga, a structure embedded in the form of a valley with the northern limit of the Upper Crest Unit of the Caraça Massif and to the south the hill seas of the TTG complex of Santa Barbara (SANT 'ANA, 1994). The basin slope map demonstrates the dominance of three types of relief features in the area: gently undulating, undulating and strongly undulating.

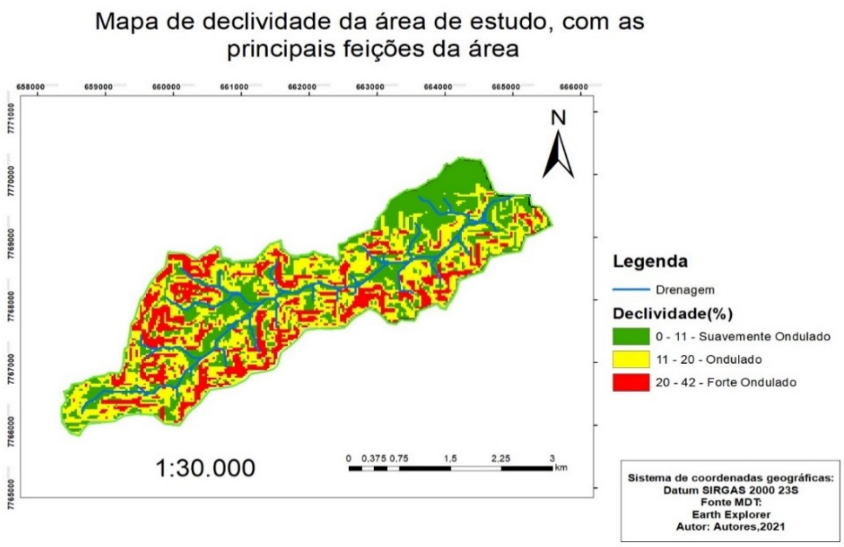

Figure 5: Slope map of the study area.

As for the altimetry of the area, it can be seen through field collections and the hypsometric map that it varies from 821m to 939m.

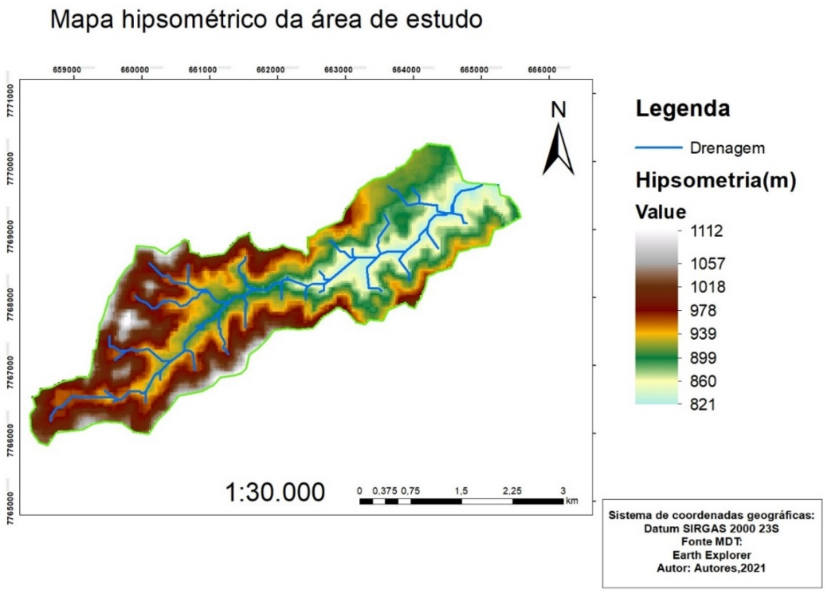

Figure 6: Hypsometric map of the study area.

Two distinct climate types occur in the region: the first corresponds to a humid climate with hot summers, average annual rainfall between 1,100 and 1,500mm, average annual temperature between 19.5 and 21.8 ºC, especially in the lower elevations. The second has milder summers, lower average annual temperatures (17.4 – 19.8 ºC), with an annual rainfall of 1,800mm in the highest portions (SOUZA, 2004).

3 METHODOLOGY

The works of Sant'Anna (1994), Maizatto (2001) and Rossi (2014) were reviewed and used as a basis for the work, helping to choose the study site along with a cartographic survey in which Folha's topographic and geological maps were analyzed. of Catas Altas (1:50,000). From this, it was possible to recognize the study area and demarcate strategic points to be visited as well as interpret the results obtained. The hypsometric, geological, slope and study area maps were produced after delimiting the river basin using the Arcgis 10.8 platform.

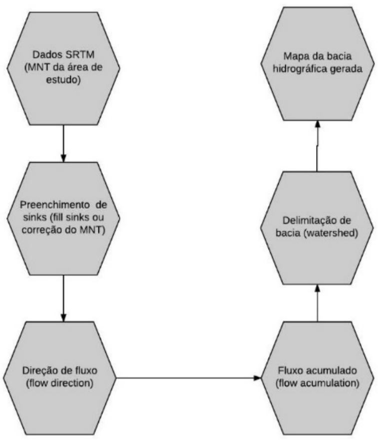

Figure 7: Flowchart of the steps followed to delimit the basin.

3.1 FIELD WORK

The visit to the field took place at seven accessible points, five points were carried out in the Brumado stream microbasin, which are in the lower course of the main channel. three points in the left interfluve of the river belonging to the Fonseca Formation. The criteria for choosing the points was accessibility, as the stream passes through private properties owned by the mining company Vale.

In these, geomorphological analyzes were carried out and collections of colluvium, eluvium, alluvium, lignite, ferruginous sandstone and BIF sediments were carried out, the latter belonging to the Fonseca Formation. To analyze the provenance of the sediments and their characteristics such as the degree of rounding of the grains, the degree of sphericity, the type of surface, the degree of selection and mineralogy.

To analyze the geomorphology of the region, the checklist provided by the Technical Manual of Geomorphology of (IBGE, 2009) was used and to collect sediments at different points, the National Guide for Collection and Preservation of Samples (CETESB-AGÊNCIA NACIONAL DA ÁGUAS, 2011), the sediments were stored in transparent plastic bags and identified with labels containing location data.

Figure 8: Collected sediments: A and B: Alluvium, C and D: Colluvium, E: Ferruginous Sandstone (Fonseca Formation), F: BIF (Fonseca Formation), G: Eluvium- Lignite (Fonseca Formation), H: Eluvium- Phyllite.

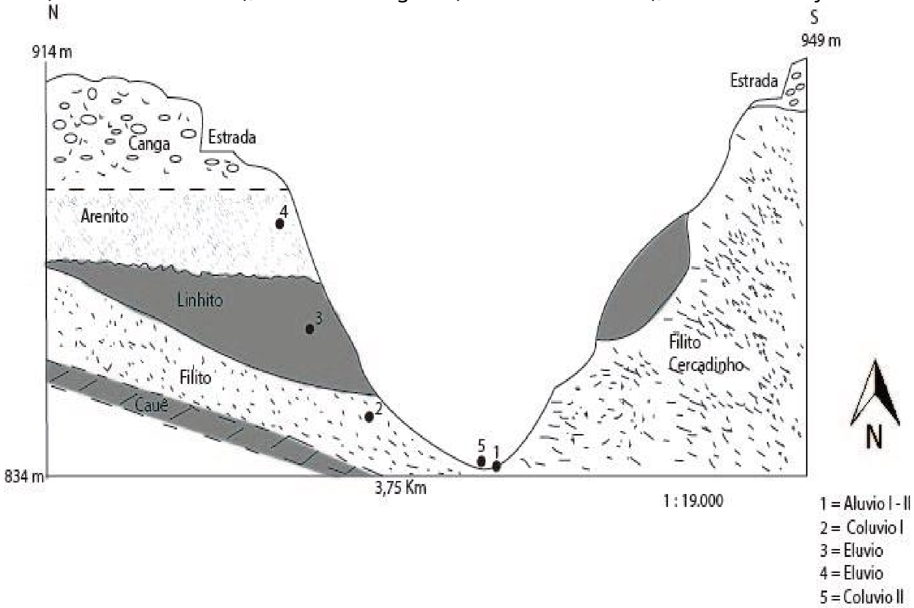

Figure 9: Manual transverse profile of the basin with collection points.

3.1 LABORATORY ANALYSIS

After the visit to the field, on October 8, 2017, the samples were taken to the Sedimentary Petrography Laboratory of the UNI-BH faculty, the samples were crushed using a porcelain container and a tamper made of the same material until the sand fraction. The material from each sample was divided individually into different petri dishes and the following aspects were analyzed using a binocular magnifying glass: degree of rounding of the grains, degree of sphericity, surface type, degree of selection and percentage of mineralogy. In this way, a table and later graphs were created correlating the level of work suffered by the samples and the percentage of mineralogy.

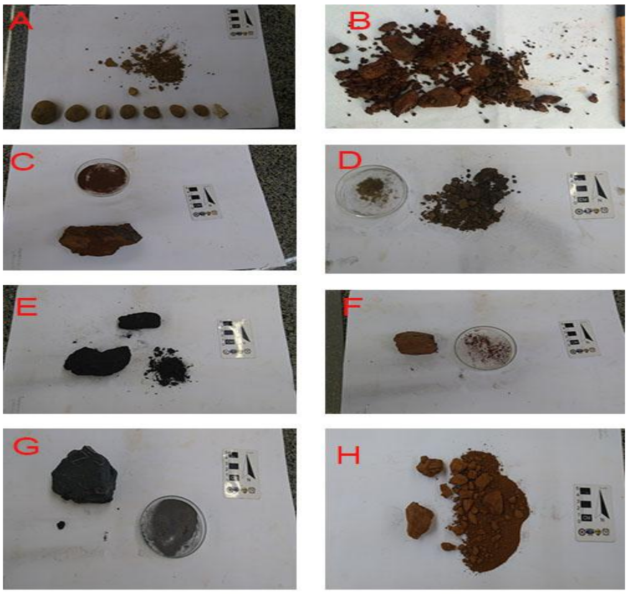

Figure 10: Collected sediments: A and B: Alluvium, C and D: Colluvium, E: Eluvium-Lignite (Fonseca Formation), F: Eluvium-Phyllite, G: BIF, H: Ferruginous Sandstone.

4 RESULTS AND DISCUSSIONS

4.1 CHARACTERIZATION OF GEOMORPHOLOGY

The Canga Plateau morphostructural unit occupies the northeast region of the Iron Quadrangle where the top surfaces are structured by rocks from the Fonseca Formation and supported by rocks from the Minas Supergroup, locally defined as the Santa Rita Synclinal, which includes the Brumado stream basin. According to the analyzes carried out, it was possible to identify different geomorphological components inserted in the Canga Plateau Unit, in this way we will use the classification according to the Geomorphological Technical Manual (IBGE, 2009).

The Brumado stream basin presents a succession of valleys with concave and convex surfaces with asymmetrical and flattened tops, the drainage of the valley is irregular to sub-rectangular, with the bed of the main channel not fitted and branched with a distance between the upper margins 50m, its irregular characteristic gives it an aspect adapted to the structural lineament with smoothed and disguised edges of colluvial nature.

The depositional model is fluvial with a narrow alluvial terrace and low banks. The banks are narrow with their main form associated with colluvium ramps, there are also small sandy banks of decantation basins along the secondary channels. The vast majority of its slopes are concave and convex with an interspersed occurrence of talus deposits and rocky outcrops. The scarps inserted in the valley are of the erosive type with an unfolded shape and the formation of a cornice.

Regarding morphogenetic processes, the importance of fluvial deposition processes with secondary action related to gravity flow, including creeping, mudflows, metric depth ravines and later formation of clay and silt deposits and detrital paving of the floodplain, is highlighted. .

Figure 11: Overview of the 3 geomorphological compartments. A) Superior ridges. B) Intermediaries. W) Devastated land.

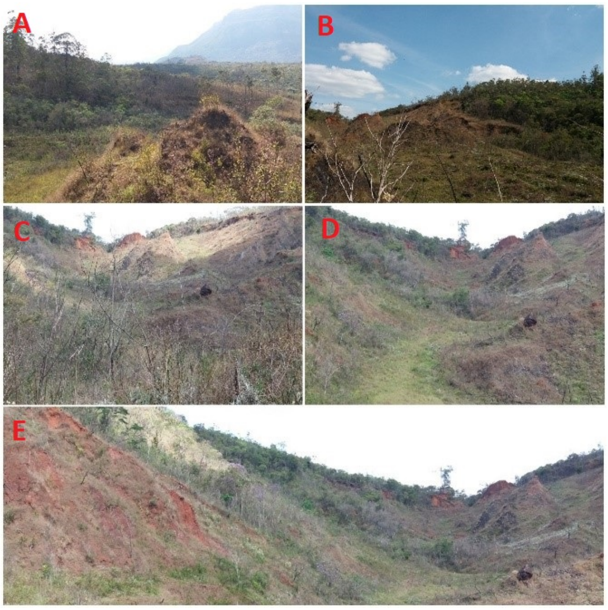

Figure 12:A and B top of the slopes. C and D slopes with intense ravinement and linear erosion processes. AND) Valley with concave slopes of ephemeral river flows.

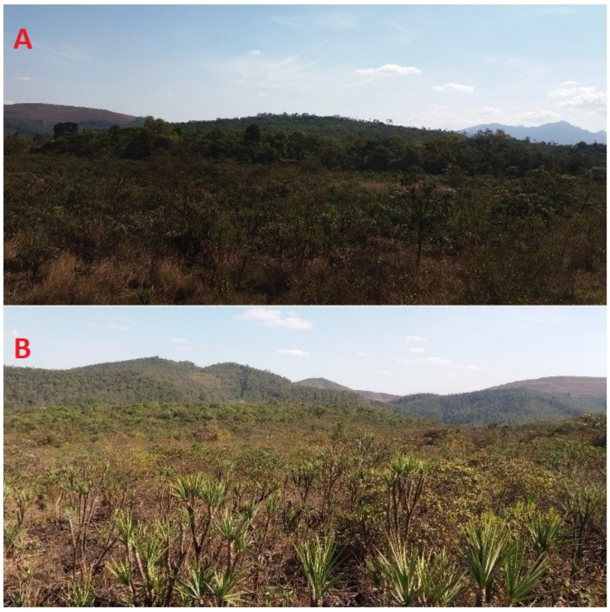

Figure 13:A) Canga plateau in the foreground. B) Interfluve of the right bank of the Córrego do basin Foggy in the background.

4.2 SEDIMENT ANALYSIS

After analysis in the laboratory, a table was created with a description of the samples collected and their respective coordinates.

Table 1: Description of collected sediments.

Sample	Degree of rounding of grains	Degree of Sphericity dos Grãos	Surface dos Grãos	Degree of Selection	Mineralogy (%)	Location
Alluvium I	Very angular	Sub-rounded	Translucent and Opaque	Low	25% Quartz, 75% Clay minerals	664483.65 mE/ 7769226.34 m S
Alluvium II	Very angular	Sub-rounded	Opaque	Low	10% Quartz, 25% Iron oxide, 55% Clay minerals	664369.69 mE/ 7769209.57 m S
Sandstone Ferruginous	Very angular	Sub-rounded	Translucent and Opaque	High	10% Mica, 20% Iron oxide, 70% Quartz	665432.52 mE/ 7769301.41 m S
BIF	Very angular	Sub-rounded	Translucent and Opaque	High	10% Oxide Iron, 90% Quartz	665373.71 mE/ 7769353.15 m S
Colluvius I	Rounded	Sub-rounded	Opaque	High	10% Quartz, 90% Clay minerals	664708.26 mE/ 7769392.09 m S
Colluvium II	Very angular	Sub-rounded	Translucent and Opaque	Low	20% Quartz, 80% Clay minerals	664793.58 mE/ 664793.58 m E
Eluvius I	Very angular	Sub-rounded	Translucent and Opaque	High	30% Quartz, 70% Organic matter	665332.82 mE/ 7769422.77 m S
Eluvius II	Very angular	Sub-rounded	Translucent and Opaque	Low	40% Quartz, 60% Clay minerals	663216.29 mE/ 7768675.70 m S

FINAL CONSIDERATIONS

With the advancement of studies and equipped with the results, it was possible to verify how erosion and deposition processes act on the physiological composition of the Córrego do Brumado basin. The sediments examined showed an indication of a genesis proximal to the source area, correlating its mineralogy with the rocks surrounding the basin, which corroborates the fact that the current dynamics of deposition along the embedded stream bed do not form banks thick with sediment. In the lower course of the stream, flooding processes and low energy contribute to the deposition of pelitic material on the convex banks of the valley, thus characterizing the current morphogenic actions that act on the evolution of its fluvial geomorphology.

Structurally, the rocks present in the area included in the basin demonstrated brittle behavior, which influenced the drainage of the stream and made it possible for the uplift of certain areas included in the limit of the basin, becoming a catalyst for relief-forming agents. The geomorphological and geological processes identified can exemplify the intrinsic relationship between endogenous and exogenous agents, thus representing what was proposed by Hack (1960) where the modeling of the current relief is the result of the balance between the agents of the environment, whether static or dynamic.

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