

**Serra da Piedade, Iron Quadrangle, state of
Minas Gerais:**

*from the myth of Sabarabuçu towards the historical, geological,
natural and religious heritage*

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Serra da Piedade, Iron Quadrangle, state of Minas Gerais:

*from the myth of Sabarabuçu towards the historical, geological,
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The Piedade Mountain Range (The Mountain of Our Lady of Pity) is situated between the towns of Sabará and Caeté at the northern border of the Quadrilátero Ferrífero (Iron Quadrangle) of Minas Gerais, Brazil. It represents an important site of geological heritage, due to its excellent exposures of banded iron formation (itabirite) of Paleoproterozoic age, which indicates a change of the global atmosphere. It is also intimately related to the history of gold exploration in the Brazilian hinterland during the 17th century. Its scientific value as well as the beautiful landscapes was acknowledged since the early 19th century by many European travelers. With the construction of a small chapel on top of the mountain in the 1760's, it became also a religious reference. Both, the National and the State Institute of Historic and Artistic Heritage included the site in their lists of natural and cultural heritage.

Keywords: Serra da Piedade, Minas Gerais, Brazil; Quadrilátero Ferrífero (Iron Quadrangle); Minas Supergroup; Cauê Itabirite.

INTRODUCTION

The Iron Quadrangle (Quadrilátero Ferrífero) in Minas Gerais state shows an unique geological assemblage with many testimony of the geo-ecologic evolution of the Earth and the mining history, from the gold rush in the 17th and 18th century on until the modern iron-ore mining. Among the geological heritage one of the most representative sites is the Serra da Piedade (Fig. 1) which constitutes an important geosite, not only of scientific interest (geological and botanical), but also from the pedagogic, touristic, and cultural point of view due to its unique geologic-cultural landscape. Therefore its preservation is not only a concern of Minas Gerais but of whole country.

The Serra da Piedade is part of the larger Serra do Curral, which constitutes an overturned homocline of the Minas Supergroup. Its ridge is formed by itabirites of the Cauê Formation, which encloses a range of hematite ore bodies.

It is outstanding in the landscape with its exuberance and offers from top a 360° panoramic view from the Serra do Espinhaço and the Rio das Velhas basin (Lagoa Santa) to the North, Belo Horizonte to the East and a great part of the Quadrilátero Ferrífero to the South, including Serra do Caraça.

LOCATION

The massif of the Serra da Piedade is situated on the border line of the municipalities of Sabará and Caeté, MG, about 50 km NE from Belo Horizonte (geographic co-ordinates 43°40'33"W; 19°49'20"S; UTM E 638.669, N 7.807.634; altitude 1746m), forming the eastern edge of the Serra do Curral at the northern border of the Iron Quadrangle (Fig. 2). The access to the peak may be done from Belo Horizonte through BR-262/381 until the intersection to Caeté, then following a tar road of approx. 6 km, which climbs the hill

LANDSCAPING AND HISTORICAL VALUE

The history of the Serra da Piedade is closely linked to the “bandeirismo”* in Brazil which led to the occupation of Minas’ territories and is one of the most remarkable landmarks, together with the Pico de Itabira, Pico do Itacolomi, and others, used by the first “Bandeirantes” to cross the region in search of the legendary Sabarabuçu. The remainders of Fernão Dias’ expedition found rich alluvial gold deposits along the Rio das Velhas, at the foot of this mountain range, resulting in the first gold rush in history and hence originating the territorial conformation of Minas Gerais.



Figure 1 - Crucifix flanked by Maria and St. John at the top of the Serra da Piedade, State of Minas Gerais, sculpture by the Romanian artist Vladi Poenaru, representing the symbiosis of religion and nature. Photo: M.M.M.Machado

First, in the middle of the 17th century, the occupation of Minas Gerais occurred through the expeditions prospecting precious metals and gems. The king of Portugal, increasingly concerned with the discovery of those resources, which he was sure to exist in the remote hinterland, stimulated the expeditions sending letters to adventurers, promising prizes and honors to those who found those resources. The peak of the Serra da Piedade was their guide during their exploration, since it could be seen from almost everywhere (Fig. 3 and 4).

A serious economical and financial crisis took place in Portugal during the 17th century, aggravated by the decline of the sugar industry in Brazil due to the competition of the Caribbean sugar. The many legends about enormous mineral wealth fed the dreams of Portuguese and Bandeirantes. One of those legends was about the legendary mountains which glittered in the sunshine and which the Indians called Itaberabassu (ita = rock; bira = shining; uçu = big), corrupted to Sabarabuçu.

This legend lived in the imagination of the Portuguese since the beginning of the century and stimulated various expeditions to the hinterland taking different directions, among which the expeditions of Francisco Bruza de Spinosa and João Aspilcueta

Navaro, Brás Cubas and Sebastião Fernandes Tourinho.

Another expedition which left São Paulo in search of the famous mountains where great wealth in silver and emeralds was assumed, was the “bandeira” of Fernão Dias Paes Leme, which departed on July 1674 and was composed by more than thirty “Paulistas” (São Paulo born people), among them his lieutenant Matias Cardoso de Almeida, his son in law Manuel Borba Gato and his son Garcia Rodrigues Paes, besides many Indians. Fernão Dias settled in Lagoa Santa, where he spent four years until he recomposed his “bandeira”, departing then northwards to cross the Serra do Espinhaço and committing the command to his son in law Borba Gato.

In 1701 the governor of Rio de Janeiro, Artur de Sá Menezes visited the region on his first trip to Minas Gerais. When he saw the Serra da Piedade he asked Borba Gato about the existence of emeralds and silver. Even informed that those minerals had not been found there yet, the governor named the future city of Sabará as Sabarabuçu in an improper and hasty way, and the Serra da Piedade was known by this name for long time (Vasconcellos, 1946).

* Bandeiras/bandeirantes/bandeirismo = First Brazilian expeditions to the hinterland in conquest of new land, gold and precious stones. The bandeiras started in São Paulo and were formed by Brazilians, while the “Entradas” were led by Portuguese citizens, starting from the coast.



Figure 2 – Location of the Serra da Piedade in the Minas Gerais. Source: Google Earth

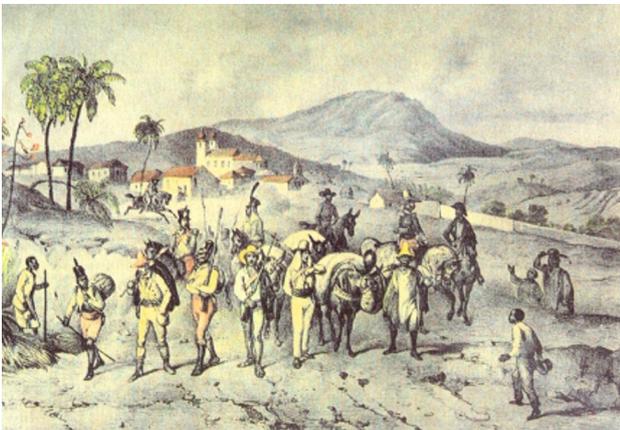


Figure 3 – Diamond convoy passing through Caeté with the Serra da Piedade in the background. (Draft by J.M. Rugendas, 1824).

Even without having found silver or emeralds, the expedition was important for the discovery of gold, due to the researches of Borba Gato and Garcia Rodrigues Paes in the Rio das Velhas and its tributaries.

According to Renger (2006), the absence of a scrivener in the *Bandeiras* does not allow an exact reconstitution of the facts; probably the notice of the discovery of gold was spread around the *paulistas* who,

little by little moved to the new mines in the last decades of the 17th Century, when the gold findings increased extraordinarily.



Figure 4 – View of the Serra da Piedade looking from Caeté (in the foreground). Photo F.E.Renger

SITE DESCRIPTION

Serra da Piedade is part of the bigger structure of the Serra do Curral, which has local names such as Serra Azul, Fecho do Funil, Itatiaiuçu, Três Irmãos, Serra do Rola Moça, Serra da Piedade, among others. This mountain range marks the northern boundary of the Iron Quadrangle, morphologically sustained by rocks of the Minas Supergroup. The sequence is composed of clastic and chemical sediments. The latter constitute banded iron formation (Cauê Itabirite) and carbonate rocks of the Gandarela Formation (Renger et al. 1994).

Due to its mineral resources, the Iron Quadrangle became long ago a preferential target of geological studies and mapping. Peter Claussen's map of 1841 was the first to be published (fig.8)

The Serra da Piedade is formed by rocks of the Minas Supergroup: itabirites (banded iron formation) of the Cauê formation (Itabira Group) and phyllites of the Cercadinho formation (Piracicaba Group). The itabirite outcrops of the Cauê formation reach considerable thickness, very expressive in didactic and scientific terms (Fig. 5: a,b,c).

In some places in the surroundings of the serra the itabirites are mined, causing disputes between mining companies and the natural heritage.

The geological context of the Iron Quadrangle is characterized by three rock associations, two of Archean age represented by granite-gneiss terrains and by the greenstone belt of the Rio das Velhas Supergroup, and one metasedimentary Paleoproterozoic sequence containing banded iron formations of the Minas Supergroup. The deposition of the so called Banded Iron Formations (BIF) occurred worldwide mainly between 2,5 and 2,0 Ga;

they correspond to about 15% of the total volume of Proterozoic sediments. The BIF's of the Paleoproterozoic belong to the Lake Superior type, constituted by rocks of millimetric to centimetric lamination, the result of chemical rhythmic precipitation of iron and silica (or carbonate), due to the increase of oxygen in the paleoatmosphere. They rarely contain clastic material and are associated to chert, dolomite, quartzite, argillite and volcanic rocks. The Cauê formation of the Minas Supergroup was deposited at about 2,4Ga. It contains many compact hematite ore bodies of hydrothermal formation (Rosière et al., 2005). Folding of the sequence occurred during Paleoproterozoic times, at about 2,1Ga (Alkmim and Marshak, 1998).

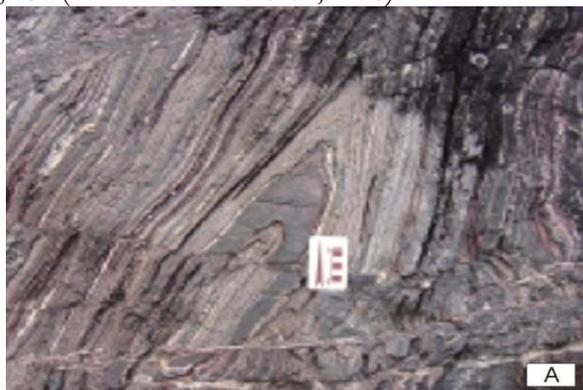


Figure 5 - Itabirite outcrops at the Serra da Piedade: a) semi-open folds in thinly laminated itabirites; b) chevron folds; c) differential lixiviation of quartz layers, emphasizing the hematite layers. Photos: a) C.M.Noce; b) U.Ruchkys de A.; c) F.E.Renger



Figure 6 - Iron ore mining at the northern foothills of the Serra da Piedade. Photo: M.M.M.Machado



Figure 7 - Excavation in canga at the foothills of the Serra da Piedade; canga is used for road construction. Photo: M.M.M.Machado

The itabirites are covered widely by a canga surface which helps to sustain the relief. The term canga refers to the superficial layers formed by the detrital weathering produce of the itabirites cemented by iron hydroxydes (Fig. 7). This weathering and the formation of canga surfaces developed during early Tertiary (Spier, 2005).

The Serra da Piedade had its scientific and landscape recognized by many foreign travelers, such as Auguste de Saint-Hilaire, the German naturalists J.B. von Spix and C.F.P. von Martius (who climbed the Serra in 1818) and Baron von Eschwege. The latter published in 1832 his contributions to the geology of Brazil, which includes a topographic map showing the valley of the Sabará River (Fig. 9). It also contains the very first geologic description of the Serra da Piedade, even predicting the export of iron ore to the whole world in the future.

“Leaving the village of Caeté it is worthwhile to climb the neighbouring Serra da Piedade, which’s main ridge is about one league long in E-W direction towards the Rio das Velhas and joining with the Serra de São João [das Cambotas] and Serra

da Lapa at its base to the East. Crossing the small villages of Mondéos and N.S. da Penha without stop, one reaches the heights of the Serra after an one hour trip, where one will find the small Piedade Chapel. Near the bridge over the Sabará River and Mondéos until Arraial da Penha the dominant rock is gneiss, which layers have direction in the 12th hour [Az 180°]. The gneiss is of very coarse grained, showing very altered feldspar and silvery mica on its surface. Under this primitive rock the clayish schist extends reddish, upon which, here and there, wrenched from the highest parts of the mountain range, are scattered blocks of different varieties of itabirite iron ore. The argillaceous schist continues up to the highest and steepest spots of the “serra” and beneath there is itacolumite, presenting however such a quick passage to the specular iron, specularite schist and magnetic iron ore (itabirite formation), that the itacolumite disappears soon, being followed by pure iron ore in vertical layers following the 3rd hour [Az 45°]. The layers of

this ore are often laminated with quartz in stripes and the quartz presents itself sometimes as very compact and intimately associated with the iron ore, sometimes occurs as isolated grains, which disaggregate on the rock surface, lending them an corroded aspect. The slopes of the serra also show sometimes the tapanboacanga, forming a crust upon the iron rocks. The total thickness of the iron ore until its greatest height, at 5460 English feet, is not less than ca. 1000 feet, according to my calculations, a thickness never measured in the world elsewhere. The magnetic proprieties of these iron ore masses have the same behavior of those found at the Pico de Itabira. However, even not having rained here for about a month and without clouds or mist hanging over the mountain, clear water dropped continually from the upper rocks, disappearing on its base, but showing up again 100 steps below as a copious spring which offers the most delicious water to the inhabitants of the hospice and the pilgrims who visit the chapel.”

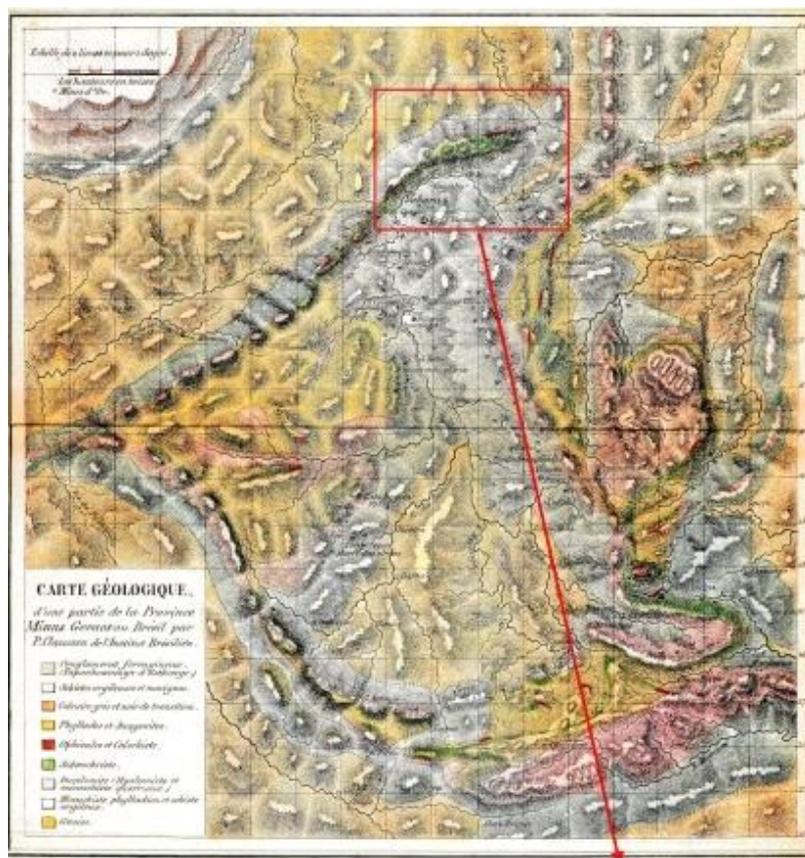


Figure 8 - Geological map of Iron Quadrangle (Quadrilátero Ferrífero) by P. Claussen (1841), in detail the Serra da Piedade, green is the so-called “siderochriste”(iron formation).

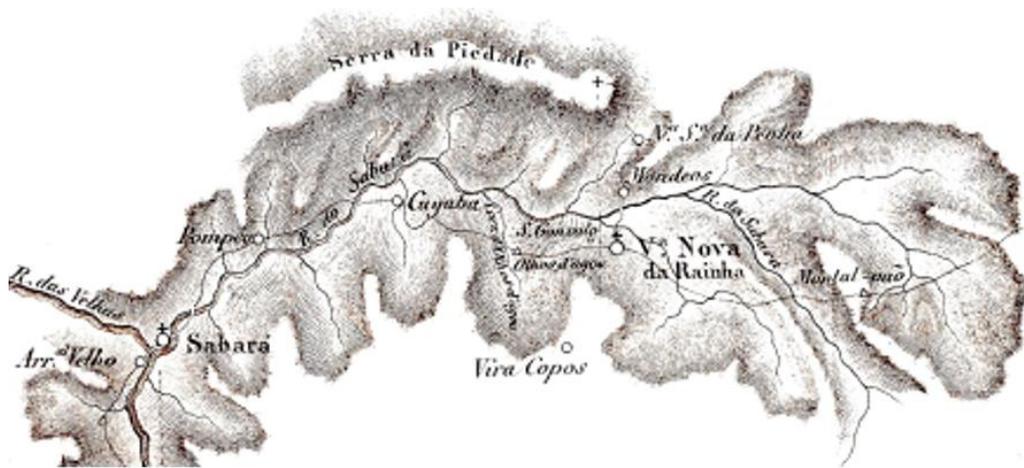


Figure 9 - Topographic map of the valley of the Sabará River and the Serra da Piedade. Source: Eschwege, 1832.

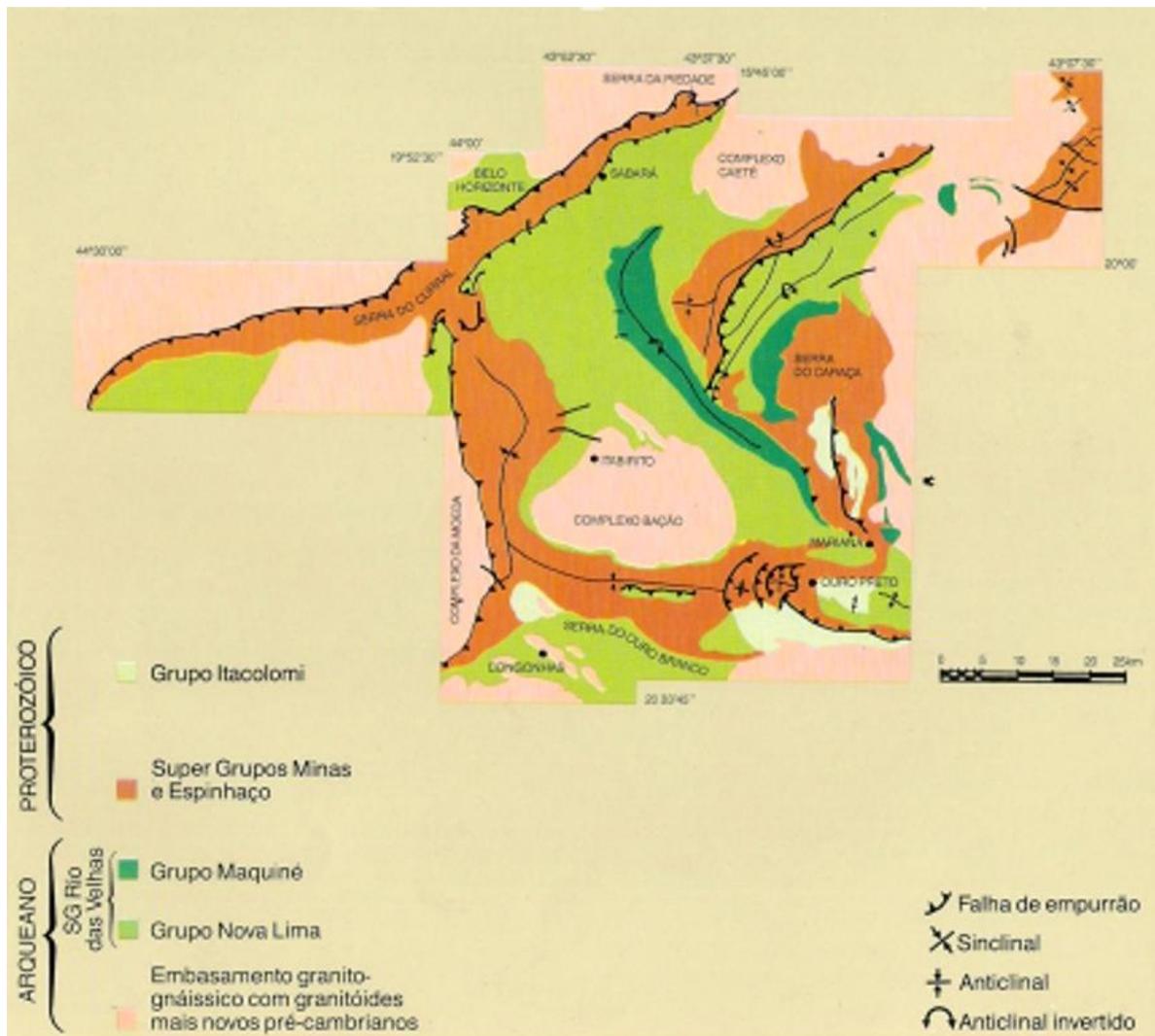


Figure 10 - Simplified geological map of the Quadrilátero Ferrífero, modified after Dorr (1969). Source: Scliar, 1992

The Iron Quadrangle was mapped by an agreement between the DNPM and the US Geological Survey during the years 1949 through 1969, with special attention to the iron ore deposits (Fig. 10). The geological map of the quadrangle (scale

1:25.000) Serra de Piedade was executed by Benedito Paula Alves and published in 1969 (in Dorr, 1969).

The biological aspects of the Serra da Piedade region are also considered of great importance since it encloses rare botanical species threatened of extinction. The physical characteristics of the Serra

provide the development of various types of vegetation, which are still well preserved. As one climbs, vegetation grows smaller in height. On the flanks one will find a dense forest, remainder of the tropical rain forest; from that level on, vegetation becomes more open and smaller. On top, the areas covered by the “canga” (clayish iron ore) show a rupestrian plant cover, typical of the iron formations of the Iron Quadrangle. Shrubs and grass grow upon a soil formed by very hard fragments (nodulous canga) or upon rocks with cracks where roots can penetrate (Fig. 11).



Figure 11 - Northern flank of the Serra da Piedade, showing the change of vegetation from tropical forest (in the foreground) to shrubbery and sparse grass vegetation on top of the mountain. Note also the headward migrating erosion cutting the canga capping. Photo: M.M.M.Machado.

RELIGIOUS AND TOURISTIC IMPORTANCE

For long the Serra da Piedade has been a religious reference for many people who make pilgrimages there every year. Its mystic appeal begun with a legend. According to Santos Pires (1902) the “Mute of the Penha” was a girl, daughter of a devout family and dumb since birth; when she had a vision of the Holy Virgin with the Jesus child in her lap on top of the Serra da Piedade, she started to talk immediately.

The legend of the Virgin’s appearance motivated Antônio da Silva Bracarena, a political persecuted in Portugal by the Marques de Pombal, to begin building a chapel in 1767. The image of Nossa Senhora da Piedade (Our Lady of Pity) was brought later on from Portugal (Fig. 12).

Bracarena was eager to facilitate the access of many people to the top and wished the chapel to be a reference for the remorsefull travelers who looked for a proper place to pray and become nearer to God. According to Duarte (1992), Bracarena’s history was re-established after de discovery of some documents, including a hand written letter by himself. It seems

like Barcarena came to Brazil in order to get rich and return to his homeland, but he gave up his original plan after hearing the story about the vision of the Our Lady of Pity.



Figure 12 – Wooden sculpture of Our Lady of Pity (Portuguese school, 18th century). Photo M.M.M.Machado.



Figure 13 - Field mass attended by pilgrims on top of the Serra da Piedade. Source: Duarte, 1992

Other events determined the religious history of the Serra da Piedade, nourishing its sacred identity. One remarkable role played sister Germana, according to Duarte (1992), a poor mulatto girl without any schooling, who lived between 1782 and 1856 and

grew up near the Serra. She suffered from convulsions since the age of 24 and lived in constant meditation presenting accesses of ecstasy every dawn from Thursdays to Fridays, when arms and feet hardened forming a cross.

The religious importance of the mountain made pope John XXIII consecrate the image of the sanctuary of Our Lady of Pity in 1958 as patroness of the state of Minas Gerais. Each year, from August 15th to September 7th is celebrated the jubilee in her honor gathering thousands of followers on top of the Serra da Piedade (Fig. 13).

PROTECTION MEASURES

The "Architectural and Landscape Complex of the Nossa Senhora da Piedade Sanctuary" was declared as historical heritage by the IPHAN on September 9th, 1956. According to Scliar (1992) this event led father Rosário Joffily, responsible for the sanctuary, to write to the director of the National Historical Heritage, asking for the desactivation of the iron ore mining.

"... since I became responsible for the Serra da Piedade, I put all my efforts to zeal over this jewel in the mountains of Minas. It wasn't possible to accept in good conscience that this unique peak, 600 km from the shore with an historical past which leads to Gandavo, which one century later was aim to the expedition of Fernão Dias, was background to the "Bandeiras", linked to the Emboabas war etc. besides being, in its humbleness, the oldest sanctuary of the region, should be damaged."

The DNPM (Federal Mining Department) accepted the request of the National Historical Inheritance by a letter dated July 15th, 1957 to father Rosário, announcing that:

"... concerning the register of land pertaining to this sanctuary in the roll of heritage and the damages that the mining activities ... are doing to the referred property, I inform you that the mentioned concessionaire was summoned to stop immediately all mining activities..."

In 2005 the IEPHA-MG (Minas Gerais State Institute of Historical and Artistic Heritage) augmented the territory of preservation of the Serra da Piedade as a natural, archeological, ethnographic and landscape heritage to about 2000 ha (10,000 acres). Besides the sanctuary, this area includes the astronomic observatory of the Federal University of Minas Gerais (UFMG) and the Cindacta radars, which control the regional airspace. The delimitation of the natural heritage encloses more than 80 springs, which guarantee the water supply for the population of the towns of Sabará, Caeté and Morro Vermelho.

CONCLUSION

The Serra da Piedade is an important and magnificent testimony of the Earth's evolution and of the mining history in Brazil. Legends involving its past fascinated visitors over centuries, besides being a reference of the regional landscape.

Although the declaration as historical and natural heritage led to the cessation and prohibition of mining activities in the area, the Serra still faces the lack of environmental education for visitors who often collect decorative species or throw garbage, not to speak of the intentional or accidental fires.

Therefore we believe that protective measures should include programs of environmental and geological interpretation for tourists and of environmental education for the neighboring communities. For the tourist we suggest that the heritage of the Serra, together with geological, biological, religious aspects, among others, should be presented in an interpretative form so that, understanding the scientific and historical value of this site, the visitors are able to appreciate it and contribute effectively for its preservation.

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