

Foto: Dielson Mendonça in Wikipedia

## Limestone mining in Chapada do Araripe (CE) affects paleontological site

### DATE

09/12/2014

### DISTRICT

CE - Barbalha  
CE - Crato  
CE - Nova Olinda  
CE - Santana do Cariri

### LATITUDE

-

### LONGITUDE

-

### SUMMARY

*Until recently, laminated limestone - popularly known as Cariri Stone - was exploited in artisanal and small-scale ways in the cities of Nova Olinda and Santana do Cariri, Ceará, in the Araripe Basin. Such activity is considered responsible for many environmental impacts in the region, including the accumulation of tons of tailings on the banks of streams and in mining fronts.*

## CASE DESCRIPTION

With 9,000 km<sup>2</sup>, the Araripe Basin extends over the states of Piauí, Pernambuco and Ceará. An ecological reserve, rich in natural sources, caves and paleontological sites (ROTEIRO CEARÁ, 2011), the region is known worldwide for the presence of fossil deposits from the Cretaceous period, the Museum of Paleontology of Santana do Cariri (CE) and the Araripe National Forest (Flona), the first in Brazil (FUNDAÇÃO ARARIPE, 2008).

The sedimentary rocks of the Santana Formation [which is named after the city of Santana do Cariri and is divided into three Members: Crato, Ipubi and Romualdo], in the Araripe Basin, are one of the country's major fossil beds. In the region, countless species of fish and reptiles are found in addition to invertebrates and plants (KELLNER, 2002). However, mining activities and illegal fossil collecting are generating not only the destruction of the paleontological heritage but also the degradation of the local landscape, with silting of streams and increased areas of erosion (VIANA; NEUMANN, 1999).

The best outcrops containing fossils are located in the areas of gypsum mines, which are concentrated in the state of Pernambuco. In order to achieve the evaporite-bearing layers, mining companies remove large sections of rocks from the

Romualdo Member. As a result, most fossil portions are exposed, containing hundreds of calcareous nodules. However, most of the fossils from the Santana Formation are found in Ceará, where illegal fossil collection is also intense. In Piauí, there is no mining activity, and calcareous nodules are found in smaller quantities (KELLNER, 2002).

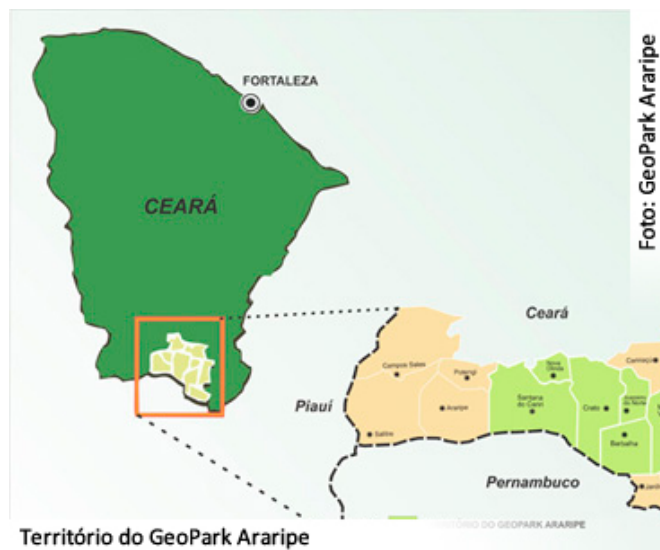


Foto: GeoPark Araripe

The main mineral deposits of laminated limestone - popularly called Cariri Stone - are located in the municipalities of Nova Olinda and Santana do Cariri, Ceará (VIDAL; PADILHA, 2003). Other important extractive areas are the quarries of the Batateiras River, in the locality known as Cachoeira, Lameiro District, city of Crato, and the Santa Rita and Caldas quarries, which are close to the municipality of Barbalha (VIANA; NEUMANN, 1999).

Limestone began to be mined in the region in the 1940s, from gypsum exploitation. From 1970 on, its commercial exploitation began effectively (CASTRO; MELLO; VIDAL, 2009). From 1980 to 1990 there was an increase in production, accompanied by the growth of the ornamental rocks sector (PADILHA et al., 2008 apud CASTRO; MELLO;

VIDAL, 2009). Until recently, however, all steps of the production chain had been held precariously. Extraction was fairly rudimentary, without using proper techniques, which resulted in the accumulation of piles of tailings and various impacts, not to mention wasted material (VIDAL; PADILHA; OLIVEIRA, 2005).



Foto: GeoPark Araripe

Antiga área de mineração de calcário próxima ao acesso de Santana do Cariri

With 284,399 km<sup>2</sup> and 14,256 inhabitants (IBGE, 2010a), the municipality of Nova Olinda lives basically on the extraction of laminated limestone. The mining activity is also the basis of the economy in Santana do Cariri, a municipality with 855,558 km<sup>2</sup> and 17,170 inhabitants (IBGE, 2010b). According to the National Department of Mineral Production (DNPM), in 2003 there were about 200 mining fronts in the cities and their surroundings, some of them were paralyzed due to technical extracting problems (VIDAL; PADILHA, 2003).

In 2003, in an attempt to diagnose the problems of the productive chain of laminated limestone in the region and seeking to propose solutions, a technical team from the Center for Mineral Technology (Cetem) and the Company for Development of the State of Ceará (Codece) visited the local quarries. Among the problems found, the following may be mentioned: illegalized mining areas; lack of environmental licensing; lack of information on the possibilities for industrial use of the ore and waste tailings; mining performed without adequate security and techniques, with low recovery; high losses during beneficiation; fossil occurrences within the unit where limestone was mined; abandoned mine fronts; low diversification and quality of the final product; low product price due to lack of refining during beneficiation; lack of infrastructure (water, electricity, access roads, etc.); little interactivity among miners, hindering the formation of cooperatives (SDLR-CE, 2011).

At the time, it was estimated that the loss in mining through manual operation amounted to 90% whereas through semi-mechanized operation, with a cutting machine, accounted for 60% (VIDAL; PADILHA, 2003). The tailings generated were employed solely in landfills, in improving local roads and in the manufacture of cement by company Indústria Barbalhense de Cimento Portland (Ibicip) (VIDAL; PADILHA; OLIVEIRA, 2005), holder of the Santa Rita and Caldas mining quarries

(VIANA; NEUMANN, 1999).

The main products resulting from the beneficiation were: the slab itself, with varying size and thickness; cracked slab; cushion slab without squareness and rough squared tile. The most demanded product by the market was the 50x50cm tile. The main consumer markets were: Crato, Juazeiro do Norte, Barbalha and Fortaleza, in Ceará, and the states of Pernambuco, Piauí, Maranhão, Bahia and Minas Gerais. Producers had neither an organized commercialization nor a Strategic Plan for Cariri Stone Development in Southern Ceará (VIDAL; PADILHA, 2003).

In order to pass on the problems detected, the possible solutions and leverage mining, CETEM technicians held meetings with the miners and representatives of public and private organizations. These meetings gave rise to a proposal for the creation of a cooperation network with local, state and federal partners to provide technical support, seeking to form a Local Production Arrangement (LPA) (VIDAL; PADILHA, 2003).

The Cariri Stone LPA was implemented between 2005 and 2009, with investments of about R\$ 1.5 million from the Ministry of Mines and Energy (MME), the Ministry of Science, Technology and Innovation (MCTI), the Ministry of National Integration (MI) and Banco do Nordeste (BNB - the Northeastern Bank). The team work included researchers, technicians and several professionals from twelve institutions, coordinated by CETEM (VIDAL, 2009).



Foto: GeoPark Araripe

Pedra Cariri

Project activities sought to facilitate regional development through the mining and beneficiation of limestone, mainly as an ornamental stone. The actions aimed at: increasing the number of direct and indirect jobs in the local mining activity; reducing occupational accidents and damage to workers' health; reducing areas degraded by mining; increasing the selling price of production, adding more value to products (VIDAL, 2009).

The team responsible for creating the LPA encountered some difficulties to put the project into practice, such as: problems of coordination between state and federal governments, causing project delay due to lack of funding release; bureaucratic



delays by foundations managing the resources; difficulty to absorb a cooperativist culture; lack of managerial training regarding producers' fiscal responsibilities; and lack of investment and support from local governments (VIDAL, 2009).

Nevertheless, the LPA achieved its main goals, namely: formalization of the workers; development of technology to add value to the product; indication for industrial use of tailings from mining and beneficiation; project to install the beneficiation equipment in the existing shed; preparation of a central marketing; community awareness on the importance of protecting the environment and the paleontological heritage; and support to the implementation of the Geopark, by the state government of Ceará (VIDAL, 2009).

The APL produces about 80,000 m<sup>2</sup> of Cariri Stones, generating around 1,500 direct jobs (VIDAL; FERNANDES apud CASTRO; MELLO; VIDAL, 2009). By 2004, 70% of the companies had moved their production system from manual to semi-mechanized mining (AMARAL FILHO; CAMPOS, 2006 apud CASTRO; MELLO; VIDAL, 2009).

The LPA also prepared and sent to the Ministry of Tourism a Scientific and Cultural Tourist Project focused on the mining activity at Chapada do Araripe, which should be integrated into the Araripe Geopark. The project's main objectives are the preservation and dissemination of the region's paleontological heritage (VIDAL, 2009).

In 2011, the Araripe Geopark received the green certification, the highest in the evaluation scale of the United Nations Educational, Scientific and Cultural Organization (UNESCO) at the European Geoparks Conference in Norway. Ceará is the only area in Brazil to have the 'Global Network of Geoparks' seal. Its main actions seek to preserve the region's natural features, to develop geo-tourism and geo-education, and to achieve the sustainable development of the territory (BRASIL MINERAL, 2011).

## GEOGRAPHIC LOCATION

## BIBLIOGRAPHIC REFERENCES

BRASIL MINERAL. Ceará. Geopark recebe certificação verde. In: Brasil Mineral Online, n. 520 – 21 set. 2011.

Disponível em:

<http://www.brasilmineral.com.br/BM/default.asp?COD=5753&busca=&numero=520>. Acesso em: 07 dez. 2011.

CASTRO, Nuria Fernández; MELLO, Edson Farias; VIDAL, Francisco Wilson Hollanda. O APL calcário do Cariri no contexto do ordenamento do território. VII Simpósio de Rochas Ornamentais do Nordeste. Fortaleza, 12 e 13 de nov. 2009.

Disponível em:

<http://pt.scribd.com/doc/42219669/VIIISRONE-Nuria>. Acesso em: 07 dez. 2011.

FUNDAÇÃO ARARIPE. Economia e Sociedade.

Disponível em:

[http://www.fundacaoararipe.org.br/content/viewContent.php?IDcontent=oAraripe\\_economiaSociedade&IDmenuDir=oAraripe&IDtopo=2](http://www.fundacaoararipe.org.br/content/viewContent.php?IDcontent=oAraripe_economiaSociedade&IDmenuDir=oAraripe&IDtopo=2). Acesso em: 07 dez. 2011.

IBGE, Instituto Brasileiro de Geografia e Estatística. Nova Olinda (CE). In: IBGE Cidades, 2010a.

Disponível em:

<http://www.ibge.gov.br/cidadesat/xtras/perfil.php?codmun=230920&r=2>. Acesso em: 07 dez. 2011.

\_\_\_\_\_. Santana do Cariri (CE). In: IBGE Cidades, 2010b.

Disponível em:

<http://www.ibge.gov.br/cidadesat/xtras/perfil.php?codmun=231210&r=2>. Acesso em: 07 dez. 2011.

KELLNER, Alexander Wilhelm Armin. Um dos mais importantes depósitos fossilíferos do Cretáceo brasileiro. In: Schobbenhaus, C.; Campos, D.A.; Queiroz, E. T.; Winge, M.; Berbert-Born, M. L. C. (Edits.) Sítios Geológicos e Paleontológicos do Brasil. 1. ed. Brasília: DNPM/CPRM - Comissão Brasileira de Sítios Geológicos e Paleobiológicos (SIGEP), 2002. v. 01: 121-130. CE.

Disponível em:

<http://sigep.cprm.gov.br/sitio006/sitio006.pdf>. Acesso em: 07 dez. 2011.

ROTEIRO CEARÁ. Chapada do Araripe.

Disponível em:

<http://roteiroceara.uol.com.br/roteiro/serras/chapada-do-araripe/>. Acesso em: 06 dez. 2011.

SDLR-CE, Secretaria do Desenvolvimento Local e Regional do Estado do Ceará. Arranjo produtivo local de pedras ornamentais em Nova Olinda e Santana do Cariri.

Disponível em:

[http://conteudo.ceara.gov.br/content/aplicacao/sdlr/\\_includes/PDFs/APL%20-%20Cariri%20-%20Pedras.pdf](http://conteudo.ceara.gov.br/content/aplicacao/sdlr/_includes/PDFs/APL%20-%20Cariri%20-%20Pedras.pdf). Acesso em: 07 dez. 2011.

VIANA, Maria Somália Sales; NEUMANN, Virgínio Henrique Lopes. O Membro Crato da Formação Santana, CE. In: Schobbenhaus, C.; Campos, D. A.; Queiroz, E. T.; Winge, M.; Berbert-Born, M. (Edit.) Sítios Geológicos e Paleontológicos do Brasil., 1999.

Disponível em:

<http://vsites.unb.br/ig/sigep/sitio005/sitio005.pdf>. Acesso em: 06 dez. 2011.

VIDAL, Francisco Wilson Hollanda. Cetem encerra parte das atividades no APL do Calcário do Cariri – CE. Brasília, 22 out. 2009.

Disponível em:

<http://www.redeaplmineral.org.br/noticias/cetem-encerra-parte-das-atividades-no-apl-do-calcario-do-cariri-2013-ce/>. Acesso em: 08 dez. 2011.

VIDAL, Francisco Wilson Hollanda; PADILHA, Manoel William Montenegro. A indústria extrativa da pedra cariri no estado do Ceará: problemas x soluções. Livro IV Simpósio de Rochas Ornamentais do Nordeste, 16 - 19 nov. 2003, Fortaleza (CE), p. 199 - 210.

Disponível em:

[http://www.redeaplmineral.org.br/biblioteca/rochas-ornamentais/APLCariri\\_problemas\\_solucoes.pdf](http://www.redeaplmineral.org.br/biblioteca/rochas-ornamentais/APLCariri_problemas_solucoes.pdf). Acesso em: 07 dez. 2011.

VIDAL, Francisco Wilson Hollanda; PADILHA, Manoel William Montenegro; OLIVEIRA, Raimundo Roncy de. Aspectos do aproveitamento dos rejeitos da Pedra Cariri, 2005.

Disponível em:

[http://www.redeaplmineral.org.br/biblioteca/rochas-ornamentais/005Manoel\\_William.pdf](http://www.redeaplmineral.org.br/biblioteca/rochas-ornamentais/005Manoel_William.pdf). Acesso em: 07 dez. 2011