ATLAS GEOLOGICAL AND MINING OF CEARÁ 2022

CEARÁ STATE GOVERNMENT
Maria Izolda Cela de Arruda Coelho - Governor

SECRETARIAT OF ECONOMIC DEVELOPMENT AND LABOR - SEDET
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Roseane Oliveira de Medeiros - Executive Secretary of Industry

DEVELOPMENT AGENCY OF THE STATE OF CEARÁ - ADECE
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Luís Eduardo Fontenelle Barros - Director of Development
Maria Inês Cavalcante Studart Menezes - Financial Planning and Analysis Director
Silvana Maria Parente Neiva Santos - Director of Solidarity Economy
Ricardo Pereira Sales - Business Support Director

ATLAS PROJECT GEOLOGICAL AND MINING OF CEARÁ
Francisco Paula Pessoa de Andrade - Coordinator
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ÓRGÃOS COLABORADORES
National Mining Agency - ANM
Geological Survey of Brazil - CPRM
Secretariat of Water Resources - SRH
Water Resources Management Company - COGERH
Department of Geology - UFC

LOCALIZATION MAP

BRAZIL

CEARÁ

NORTHEAST

ATLANTIC OCEAN

Brazilian Continental Shelf Platform

PIAUÍ

SERRA DA IBIAPABA

RIO GRANDE DO NORTE

CHAPADA DO APODI

PARAÍBA

CHAPADA DO ARARIPE

PERNAMBUCO

SCALE

0 7,5 15 30 45 km

REFERENCE SYSTEM - SIRGAS2000
Projection: UTM 24 S - 39º

Geological Survey of Brazil
GEOLOGICAL MAPPINGS
1:100.000

Source: CPRM, 2022 <http://geosgb.cprm.gov.br>

PLANNING REGIONS AND CONSERVATION UNITS

Legend
Regions Planning
GeoPark Araripe
Conservation Unit
Federal
State
Categories
Full protection
Sustainable use
Unclassified

Source: IPECE, MMA, SNUC, SEMACE, URCA

UNDERGROUND WATERS

COASTAL REGION
SERRA GRANDE
CRYSTALLINE
POTIGUAR BASIN
ARARIPE REGION

Reservatórios Reservatórios

Hydraulic Characterization of Hydrostratigraphic Units
Granular unit (Gr) high productivity - from 100 to 50 m³/h
Granular unit (Gr) of the low medium - from 50 to 10 m³/h
Granular unit (Gr) very low productivity - between 10 to 01 m³/h
Carstic unit (K) high productivity - from 120 to 50 m³/h
Carstic unit (K) from very low to non-productive productivity - <1 m³/h
Fractured unit (Fr) generally low to very low productivity - <10 m³/h

Source: Hydrogeological Map of Brazil. Esc 1: 1,000,000. CPRM, 2014.

Availability Annual Water Surface = 5,1 Billion m³ (2.7% of 186 billion m³). Source: COGERH, 2022

EXPLANATORY NOTE

The Government of the State of Ceará, decided by the Economic Development Secretariat (SEDET) and the Economic Ceará Development Agency (ADECE), give attention especially the mineral sector, given the importance of the sector for the development of the state, especially in relation to the construction industry, agribusiness and manufacturing industry, which depends on various mineral commodities, including surface and groundwater. The geological knowledge is of fundamental importance for the development of urban planning and also for the development of executive projects of infrastructure works.

According to the Mineral Yearbook - 2019, from the State of Ceará, released by the National Mining Agency (ANM); in 2018, the mineral Ceara sector accounted for a production of 27.18 million tons, between 25 minerals such as iron ore, sand, industrial sand, quartz, common clays, limestone, magnesite, gypsum, crushed rocks / gravel, ornamental rocks (granite, gneiss, marble, limestone and quartzite), clay and phyllite. Addition of mineral water with a production of 658.87 million liters / year. The value of mineral production for the year 2018 was 685.43 million reais (Brazilian currency), providing civil construction, agribusiness and manufacturing a solid development of profitable and essential activities for the Ceara's economy.

The geological map and geophysical surveys basically prepared by the Geological Survey of Brazil (CPRM) show promising prospects to be implemented mineral exploration work for the characterization of new deposits and are deployed more mines, and can generate new opportunities for jobs and wealth in Ceará.

In Fortaleza are based federal agencies National Mining Agency (ANM), Geological Survey of Brazil (CPRM), National Nuclear Energy Commission (CNEN), Nuclear Industries of Brazil (INB), Department of Geology of the Federal University of Ceará (DEGEO / UFC); state agencies such as the State of Ceará Technology Center Foundation (NUTEC), State Environmental Superintendency (SEMACE), State University of Vale do Acaraú (UVA) and Regional University of Cariri (URCA); such as private universities.

Running this in Ceará we have approximately 100 geologists and about 10 mining engineers.

The motivation for mining companies and others to invest in mineral production activity in Ceará is already encouraged by the wide distribution of many mineral occurrences, deposits and mines in geological environments.

The existence of large deposits and mines listed in this Atlas of Geology and Mining of Ceará and the data of production explains the various fields already characterized with highlights for limestone for ciment manufacturing, soil correctives, dyes and oxides. We have, safely, billionaires reserves limestone's and other minerals essential goods, as groundwater; aggregates for construction, ornamental rocks, phosphate, Uranium and many others located throughout Ceará.

The National Araripe GeoPark is a result of geological knowledge, paleontological, highlighting the million reais (Brazilian currency), providing civil construction, agribusiness and manufacturing a solid development of profitable and essential activities for the Ceara's economy.

The main objective of this Atlas is to improve the mineral sector, such as new researches and business units. This Atlas was prepared for the main assignments of the geographic maps - CPRM, specifically of the Fortaleza Residence, as well as the data provided, thanks to the collaboration of Mineral Economy and Development, by the National Mining Agency-ANM and with the collaboration of Fortaleza from the Secretariat of Resources (SRH) and Water Resources Management Company (COGERH) for providing data on Ceará's water infrastructure and for organizing and positioning all georeferenced cartographic information.

Francisco Paula Pessoa de Andrade
Mining engineer

LEGEND	GEOLOGICAL UNITS	AGE (millions of years)
	Cenozoic Coverages	Presente - 66
	Mesozoic Sedimentary Basins	66 - 201
	Paleozoic Sedimentary Basins	419 - 443
	Cambro-Ordovician Sedimentary Basins	443 - 541
	Neoproterozoic and Cambro-Ordovician Magmatism	443 - 635
	Neoproterozoic Supracrustal Rocks	541 - 1000
	Neoproterozoic Migmatites	
	Meso-Neoproterozoic Supracrustals Rocks	640 - 1300
	Paleoproterozoic Basement	1600 - 2500
	Archean Terrains	2500 - 3200

LIST OF ACRONYMS

ADECE	Development Agency of the State of Ceará
ANM	National Mining Agency
CPRM	Fabricate Campanhia over Mineral Exploration
CNEN	Brazilian National Nuclear Energy Commission
ENEL	Ceará Energy Company
COGERH	Ceará Water Resources Management Company
CPRM	Geological Survey of Brazil
DER	State Department of Highways
IBGE	Brazilian Institute of Geography and Statistics
INB	Nuclear Industries of Brazil
IPECE	Institute of Economic Research and Strategy of Ceará
MI	Ministry of Home of Integration
NUTEC	Ceará Foundation
NUTEC	Center for Industrial Technology Foundation of Ceará
PISF	São Francisco River Integration Project
SEDET	Secretariat of Economic Development and Labor
SEINFRA	Secretariat of Infrastructure
SEMACE	State Superintendence for the Environment
SNUC	National System of Conservation Units
SRH	Secretariat of Water Resources
SRTM	Shuttle Radar Topography Mission
UECE	State University of Ceará
UFC	Federal University of Ceará
UFCA	Federal University of Cariri
URCA	Regional University of Cariri
UVA	State University Vale of Acaraú

MINERAL PROPERTY RESERVES

Source: ANM, 2020.

PERMITS FOR MINERAL PROPERTY

TOTAL: 5.399

Source: ANM, 2022.

MINERAL PRODUCTION SOLD

Source: ANM, 2020.

TABLE EVOLVING - CFEM IN CEARÁ

Source: ANM, 2022.

CONVENTIONS CARTOGRAPHIC

Capital
City
State limit
Highway
Railroad
Constructed
Planned
Lake
River
Dam
Adductor
Channel
Airport
Port
Transmission line of energy

LEGEND

Water infrastructure
Constructed
Under construction
Planned
Dam
Adductor
Channel
Eixo Norte
Cinturão das Águas
Ramais PISF
Transmission line of energy
CHESF 500 kV
CHESF 230 kV
COELCE 69 kV
Brazilian Legal Continental Shelf

Active mining processes
Mining Concession
Licensing

Source: Geographical Mining Information System (SIGMINE), July/2022

Mineral Resources
- Mineral occurrence

Mineral Substances

A - Sand; Ag - Siver; Amí - asbesto; Amt - Amethyst; Arg - Clay; Au - Gold; Brl - Crushed stone; Brt - Baryta; Cca - Limestone; Cl - Kaolin; Cs - Celestine; Cr - Chrome; Cu - Copper; Di - Diatomite; EGP – Platinum-Group Elements; Fe - Iron; Fp - Pyrobetuminous Shale; Gip - Gypsum; Gr - Graphite; Mgs - Magnesite; Mm - Marble; Mn - Manganese; Nb - Niobium; Ni - Nickel; Opa – Opal; P – Phosphorus; Pb - Lead; Peg - Pegmatite; Pta - Cut-stone; Qtz - Quartz; Ro - Ornamental rock; Rt - Rutile; Sal - Grit; Sch - Scheelite; Sn - Tin; Ta - Tantalum; Tf – peat; Tlc - Talc; Tur - Tourmaline; U - Uranium; Vm - Vermiculite; W - Tungsten; Zn - Zinc

Source: Data compiled from the Geo60SB database of the Geological Survey of Brazil - CPRM

SOURCE:
Geology - Coord State Geological Map.
Esc 1:500.000. CPRM, 2020. Adapted ADECE)
Mining processes - ANM
Water Infrastructure - SRH
Political division - IPECE/IBGE
Planning region - IPECE
Highway - DER
Railroad - TCSA
Transmission line - ENEL e CHESF
São Francisco River Integration Project - MDR
Conservation Unit - MMA, SNUC, SEMACE
Relief - SRTM
PCSB - UFC Postsch. Geology department.

LAYOUT:
University of Urban Recovery (PMCR)
Water Infrastructure Coordination
Coordinator: Alberto Sarmento

Realization: ADECE

Support: SGB Serviço Geológico do Brasil; ANM Agência Nacional de Mineração; Ceará Governo do Estado