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GEOLOGICAL RELIEF MAP OF SOUTH AMERICA

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Jorge GÓMEZ TAPIAS **Carlos SCHOBBENHAUS**

Compiled by

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Note: The 3D models were carried out by the Forest engineer, **Hengki PURWONEGORO** with the software Blender 3D.

Map prepared with the technical and financial support of:

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CPRM Serviço Geológico do Brasil
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Geological Survey of Brazil

With the cooperation of

ASGMI Asociación de Servicios de Geología y Minería Iberoamericanos

Association of Iberoamerican Geological and Mining Surveys

Scale 1:5 000 000

Coordinate System: World Polyconic
Projection: Polyconic
Datum: WGS 1984
Central Meridian: -59,0000

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https://doi.org/10.14682/2022GRMSA

Geological Map of South America at a scale of 1:5M

Abstract

A new edition of the Geological Map of South America (GMSA) at a scale of 1:5 M was developed by the Subcommission for South America of the Commission for the Geological Map of the World (CGMW), approved by the CGMW General Assembly held in Oslo (Norway), during the 33rd International Geological Congress.

This third version has been prepared with the cooperation of the Ibero–American Association of Geology and Mining Surveys (ASGMI), the geological surveys of Argentina, Brazil, Chile, Colombia, Ecuador, Peru, and Uruguay; and several additional universities and research institutes that are mentioned in the collaborators information.

The subcommission followed a methodology for integrating the geological information from each country as follows; first, a new code was generated for each chronostratigraphic unit according to the proposed legend, by using digital layers provided by the geological survey of each country; second, symbology and colors were created with patterns representative of rock type and colors depicting the ages; and third, a map with coded units was prepared at a scale of 1:5M.

With the objective of generalization and linking units by hand, the GMSA was printed at a scale of 1:3 M with the new codification. Next, the GMSA was scanned and georeferenced in order to generalize the geological units, faults and folds at a scale of 1:5 M. Once this was done, and despite the small–scale of the GMSA, the chronostratigraphic units, faults and folds on the map were adjusted with the aid of shaded relief images (STRM from NASA) in order to improve the matching between relief and the mapped geological units. Finally, the geology between countries was harmonized. It is worth noting that the updating of the GMSA was done through consultation of internationally indexed published papers.

The map is based on a Polyconic Projection (Latitude × Longitude), centered on Meridian –59°, WGS–1984 datum; data for offshore areas were taken from the Tectonic Map of South America at scale 1:5 M (Cordani et al., 2016); the Sea Floor Topography from GEBCO 08 Grid, version 20100927; and the Crustal Age Grid: NCEI/NOAA.

Collaborators:

The GIS map/database was developed by Nohora Emma MONTES RAMÍREZ and Helena Soares ZANETTI EYBEN. The shaded relief images and the style were prepared by Fernando Alirio ALCARCEL GUTIÉRREZ.

Data were supplied, or critically evaluated, in collaboration with the following, listed in alphabetical order by country:

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Venezuela: Franco URBANI from the Central University of Venezuela and Funvisis.

Support

The production of the Geological Map of South America was possible thanks to the technical and financial support of the Colombian Geological Survey and the Geological Survey of Brazil (CPRM).

Citation of the map:

Gómez, J., Schobbenhaus, C. & Montes, N.E., compilers. 2019. Geological Map of South America 2018. Scale 1:5 000 000. Commission for the Geological Map of the World (CGMW), Colombian Geological Survey and Geological Survey of Brazil. Paris.

Data Sources

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Offshore

Cordani, U.G., Ramos, V.A., Fraga, L.M., Cegarra, M., Delgado, I., de Souza, K.G., Gomes, F.E.M. & Schobbenhaus, C. 2016. Tectonic Map of South America at 1:5 9 M. CGMW, CPRM & SEGEMAR.

Conventions

Tectonic features

- Fault defined / inferred / concealed
- Strike–slip fault, right–lateral offset defined / concealed
- Strike–slip fault, left–lateral offset defined / concealed
- Thrust fault defined / inferred / concealed
- Normal fault defined / concealed
- Lineament
- Magnetic lineament
- Anticline
- Plunging anticline
- Doubly plunging anticline
- Overturned anticline
- Syncline
- Plunging syncline
- Doubly plunging syncline

Geological features

- Cretaceous basaltic dike
- Jurassic basaltic dike
- Cambrian basaltic dike
- Ediacaran basaltic dike
- Statherian basaltic dike
- Kimberlite cluster and related rocks
- Kimberlite and related rocks
- Impact crater
- Volcano
- High pressure metamorphic rocks (retro–eclogite)
- Paleogene alkaline volcanic
- Cretaceous alkaline intrusion / carbonatite
- Jurassic alkaline intrusion / carbonatite
- Triassic alkaline intrusion / carbonatite
- Edacaran alkaline intrusion / carbonatite
- Cryogenian alkaline intrusion / carbonatite
- Stenian alkaline intrusion / carbonatite
- Ectasian alkaline intrusion / carbonatite
- Statherian alkaline intrusion / carbonatite
- Orosirian alkaline intrusion / carbonatite
- 380 — Number to identify the basaltic dikes on the map and legend
- 200 — Number to identify the alkaline intrusion / volcanic on the map and legend

Oceanic crustal age

- Pleistocene
- Pliocene
- Miocene
- Oligocene
- Eocene
- Paleocene
- Upper Cretaceous
- Lower Cretaceous
- Undefined age (seamounts, oceanic plateaus, LIPS, volcanic ridges and interpreted lavas from Seaward Dipping Reflectors–SDRs)

Oceanic features

- Fracture zone
- Axis of ancient oceanic accretionary ridge
- Plate boundary by axis of active subduction zone
- Plate boundary by axis of active oceanic accretionary ridge
- Plate boundary by transform fault
- Plate boundary by thrust fault
- Lineament
- Continent–ocean boundary

The drawing, on this map, between the coastal boundary and oceanic crust (bluish tones) represent the bathymetry. It has no legal force in the framework of the agreements that establish the limits of the territorial sea.

Cartographic features

- National capital
- City
- River
- Coast line
- Salt lake
- Lake, lagoon or dam
- Glacier

Bathymetry (depth in meters)

- 0–200
- 200–2000
- 2000–4000
- 4000–6000
- 6000–8000

Legend

Ages taken from:
Cohen, K.M., Harper, D.A.T., Gibbard, P.L. 2018. ICS International Chronostratigraphic Chart 2018/08. International Commission on Stratigraphy. IUGS. www.stratigraphy.org (visited 2018/09/10).

- Sedimentary Rocks and Unconsolidated Deposits: s1: Siliciclastic; s2: Carbonatic; s3: Evaporitic; s4: Undifferentiated
- Volcanic Rocks: θ: Andesitic and related; β: Basaltic; α: Rhyolitic; δ: Alkaline; σ: Volcano–sedimentary; ω: Undifferentiated
- Plutonic Rocks: γ: Granitic; μ: Gabbroic and Ultramafic; λ: Alkaline
- Metamorphic Rocks: m1: Low to medium grade; m2: Medium to high grade; m3: Undifferentiated

Eon	Era	Period	Ma	s1	s2	s3	s4	θ	β	α	δ	σ	ω	γ	μ	λ	m1	m2	m3
Phanerozoic	Cenozoic	Quaternary	2.58	292	291	290	289	288	287	286	285	285							
		Neogene	23.03	279, 270, 268		283	282	278	282, 277	281, 279	275	274, 273		272	271				
		Paleogene	66.0	281	252			280	251, 259	258	265, 257	264, 256	250, 254	263, 269	253	★ 302	262		
	Mesozoic	Cretaceous	145.0	240	247		246	243	244	307, 245	242	241, 239	236	240, 238	268	237	★ 301	235	234
		Jurassic	201.3	229, 215	233, 216			232	229, 231	308, 230	228	230	226, 229	227	239	212	★ 300	227, 217	
		Triassic	252.2	210				209	208, 210		208		207, 209	218	211	★ 299	201		
	Paleozoic	Permian	298.9	195	204		194, 196	193		203		192	191	193		192	191	190	189
		Carboniferous	358.9	184	182	175	188, 181	180	186		180	185	178, 179	186, 183		182	177	176, 178	185
		Devonian	419.2	170	174, 167		169						173, 169	163			172, 171		
		Silurian	443.8	164	163	160	162						158	159			166	147, 158	165
		Ordovician	485.4	150, 146		145		149		151		144	148	150		149	152	160, 161	157
		Cambrian	541.0	140	134					138, 205			136	137		139	136	135	
Proterozoic	Neoproterozoic	Ediacaran	635	133	132		131			130, 304		129	128	127		126	125	124	
		Cryogenian	720	130, 124	108		119, 123			118		107, 117	116, 115	106	114	108, 113	112	111, 106	103
		Tonian	1000	100, 54	102		99, 103					98					96	95	
	Mesoproterozoic	Stenian	1200	90	73		89		80			87	88	86	85	84	89	80	79, 85
		Ectasian	1400	81, 69			72						78	71	83	82	77	75, 71	70
		Calymmian	1600						68				67			66	65	66	31
	Paleoproterozoic	Statherian	1800	62			61		60	59, 303		58	57	56		55, 294	56	54	53
		Orosirian	2050	49			41			48		47	46	45	44	43, 293	43	42	
		Rhyacian	2300	38								37	36, 35	40		34	33	32, 39	30
		Siderian	2500	27, 28			26						25			24	23	22	
Archean	Neoarchean		2800	19								18	17	16		15	14	13	12
	Mesoarchean		3200									10	9	8			11	6	5, 7
	Paleoarchean		3600									3					4	2	1