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The Macururé Complex (Sergipano Belt, NE Brazil) in southern Alagoas state: Geology and geochronology

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Abstract

The Sergipano Belt is part of the Southern Subprovince of the Borborema Province (NE Brazil) and separates the Pernambuco-Alagoas Domain from the São Francisco Craton. The Macururé Domain is the largest unit of the Sergipano Belt and comprises a basement of Paleoproterozoic age (Jirau do Ponciano Dome) and a supracrustal succession (Macururé Complex). Here we present the results of field, petrographic and structural work and of geochronological dating conducted in an area in the southern part of Alagoas state, northeast of the city of São Brás. The lithological associations of the Macururé Complex include quartzite, schist and banded metasedimentary rocks (metarhythmites). The main foliation shows a gentle dip to the southwest and is associated with a SW-plunging mineral lineation. The mineral assemblage muscovite+biotite+garnet±kyanite±staurolite in schist and metarhythmite indicates medium pressure and temperature conditions (amphibolite facies) typical of Barrovian metamorphism. U-Pb dating of detrital zircon grains from a quartzite sample yielded dominantly Tonian ages, showing a large age peak at c. 985 Ma. These zircon grains are thus derived from sources related to the Cariris Velhos event. The youngest grain has a $^{206}Pb/^{238}U$ age of 939±36 Ma (2σ), which is considered as the maximum age of deposition. Two smaller age populations of c. 2.0 Ga and 1.1 Ga are also present. The most probable provenance of c. 2.0 Ga zircon grains is the nearby Jirau do Ponciano Dome. The other age group is more enigmatic and could be related to erosion of A-type rocks formed during local extensional events preceding the Cariris Velhos event.

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1. Introduction

The Borborema Province of northeastern Brazil is one of the several Brasiliano/Pan-African belts formed during the assemblage of West Gondwana (Van Schmus et al. 2008; Neves 2015 and references therein). The province is divided in three subprovinces by the Patos and Pernambuco dextral shear zone systems (Fig. 1a). The Southern Subprovince is further subdivided in the Pernambuco-Alagoas (PEAL) Domain and the Sergipano and Riacho do Pontal belts. The Sergipano Belt has a triangular shape and is limited by the PEAL Domain in the north and by the São Francisco Craton in the south, being separated in western and eastern sectors by the Tucano-Jatobá rift system (Fig. 1a). The Sergipano Belt has been divided in several lithostratigraphic domains (Davison and Santos 1989; D'el-Rey Silva 1999; Oliveira et al. 2006, 2010) (Fig. 1b). The Macururé Domain is the largest unit and has been the subject of several studies in recent years. However, most of them have been conducted in the state of Sergipe (Bueno et al. 2009; Oliveira et al. 2010, 2015a, 2015b, Conceição et al. 2016; Lisboa et al. 2019). In this paper, we report the results of geological mapping, petrographic and structural studies and geochronological dating of an area in the middle portion of the Macururé Domain in the state of Alagoas (Figs. 1b and 1c). With this data, we discuss the structural style, metamorphic grade, the age of deposition and the provenance of the metasedimentary rocks in order to contribute to the understanding of the geological evolution of the Sergipano Belt.

2. Geological setting

2.1. Sergipano Belt

The Sergipano Belt is dominated by supracrustal sequences, which have been divided in five lithostratigraphic domains mainly based on increasing metamorphic grade from south to north (Davison and Santos 1989; D'el-Rey Silva 1999; Oliveira et al. 2006, 2010): Estância, Vaza Barris, Macururé, Poço Redondo-Marancó and Canindé. The southernmost Estância and Vaza Barris domains are composed of (meta) sedimentary rocks deformed under subgreenschist (Estância)

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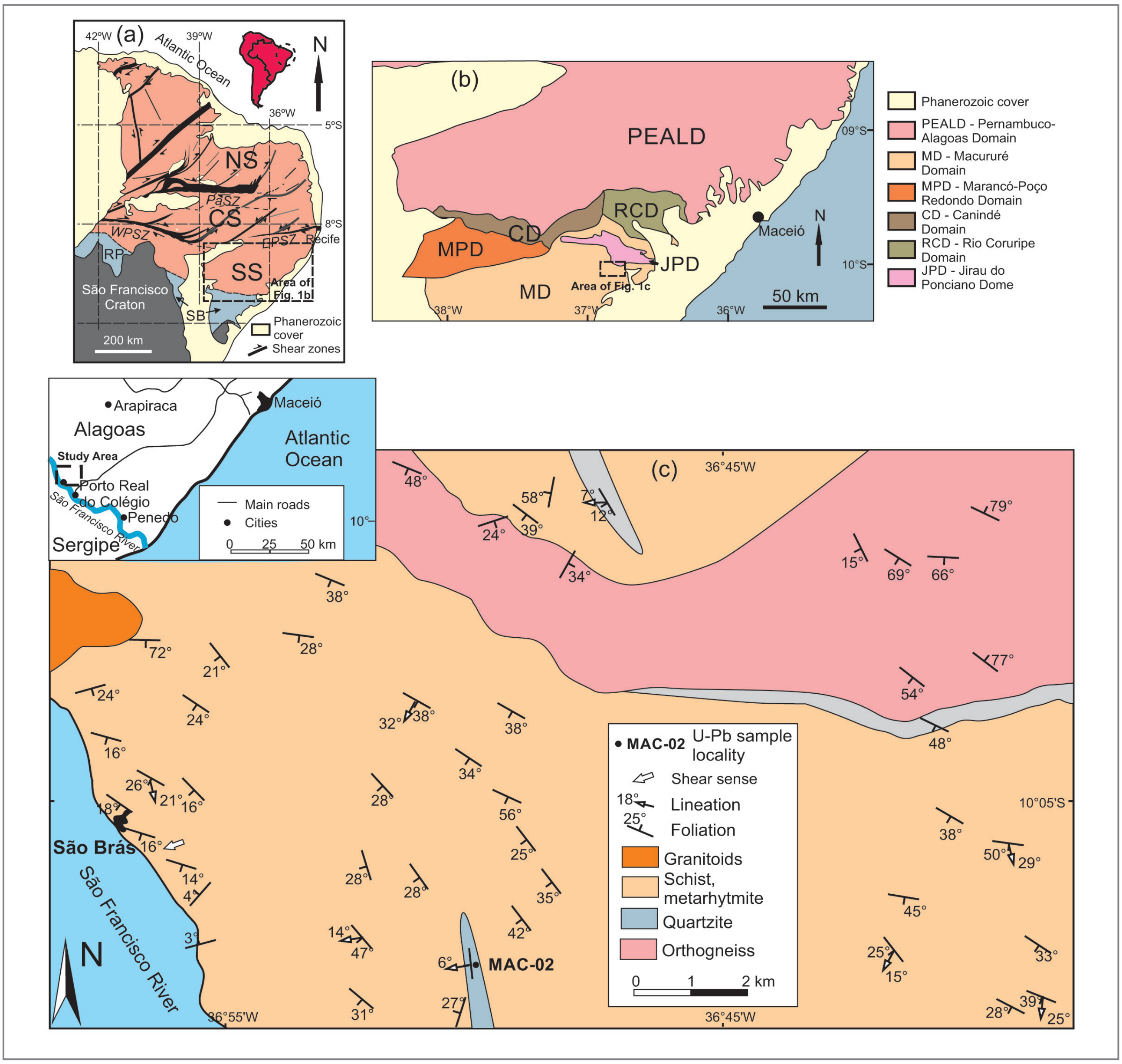

FIGURE 1 – Geotectonic setting and geographic location of the study area. (a) Sketch showing the subdivision of the Borborema Province in Northern (NS), Central (CS) and Southern (SS) subprovinces, highlighting the Sergipano (SB) and Riacho do Pontal (RP) belts bordering the São Francisco Craton. Shear zone systems: PaSZ, Patos; EPSZ, East Pernambuco; WPSZ, West Pernambuco. (b) Simplified geological map of the area outlined in (a) showing the subdivision of the eastern portion of the Southern Subprovince according to Mendes et al. (2009). Rectangle shows location of the study area. (c) Geological map of the study area. Inset shows its location in the State of Alagoas.

to greenschist (Vaza Barris) facies conditions (D'el-Rey Silva 1999), and, in contrast with the other domains, are not intruded by granitic plutons.

The Poço Redondo-Marancó and Canindé domains are located in the northwestern portion of the Sergipano Belt (Fig. 1b), the latter being separated from the PEAL Domain by the Jacaré dos Homens contractional shear zone (Mendes et al. 2009, 2012). Another domain, named Rio Coruripe, was proposed for the northeastern portion of the Sergipano Belt (Silva Filho and Torres 2002; Mendes et al. 2009, 2012) but it is debated if it represents the high-grade counterpart of the Macururé Domain (Oliveira et al. 2006) or the eastward continuation of the Canindé Domain (Neves et al. 2016). The Poço Redondo-Marancó Domain consists of migmatitic orthogneisses and augen gneisses and of a supracrustal sequence comprising metasedimentary rocks interlayered with amphibolites, meta-andesites, metadacites, metarhyolites and serpentinites (Davison and Santos 1989; Carvalho 2005; Silva Filho 2006). The Canindé Domain comprises metavolcano-sedimentary sequences and variably deformed and metamorphosed peridotitic, gabbroic, dioritic and granitic rocks (Davison and Santos 1989; Mendes et al. 2009; Oliveira et al. 2010). The mesosome of migmatites from the Poço Redondo-Marancó Domain yielded crystallization ages ranging from 980 to 960 Ma and the largest augen gneiss body has crystallization age of 952 ± 2 Ma (Carvalho 2005). The detrital zircon population in the metasedimentary rocks from the Canindé Domain is dominated by Neoproterozoic grains, amongst which the youngest have ages ranging from 708 to 663 Ma (Nascimento 2005; Oliveira et al. 2015a).

The Macururé domain constitutes most of the central and northern parts of the Sergipano Belt. It consists of metasedimentary rocks of the Macururé Complex, which surrounds basement rocks of the Jirau do Ponciano Dome (Fig. 1b). The Jirau do Ponciano Dome consists of tonalitic to granodioritic high-grade orthogneisses (Jirau do Ponciano Complex) interleaved with metavolcano-sedimentary rocks of the Nicolau-Campo Grande Complex (Mendes et al. 2009, 2012). The Macururé Complex include quartzites, metapelites and metarhythmites. This complex was metamorphosed dominantly under amphibolite facies conditions (Silva et al. 1995), and intruded by several granitic stocks (Bueno et al. 2009; Oliveira et al. 2015b; Conceição et al. 2016; Lisboa et al. 2019) during the Brasiliano Orogeny. Zircon U-Pb dating of orthogneiss samples of the Jirau do Ponciano Complex yielded dominant crystallization ages in the interval 2.04-2.06 Ga (Spalletta and Oliveira 2017). These ages are similar to crystallization ages of amphibolite and metarhyolite samples from the Nicolau-Campo Grande Complex (2.05-2.07 Ga; Lima et al. 2019). U-Pb dating of detrital zircon grains from metasedimentary rocks of the Macururé Complex showed age clusters mainly in the intervals 1050-930 Ma and 2100-1900 Ma (Oliveira et al. 2006, 2010, 2015a). The granitoids emplaced into the Macururé Complex yielded crystallization ages ranging from 630 to 570 Ma (Bueno et al. 2009; Oliveira et al. 2015b; Conceição et al. 2016; Lisboa et al. 2019).

2.2. Study area

The study area is situated in the eastern portion of the Sergipano Belt, northeastward of the city of São Brás, State of Alagoas (Fig. 1c). Orthogneisses belonging to the Jirau do Ponciano Dome occur in its northern portion. They are represented by muscovite-bearing granitic gneisses, with local intercalation of amphibolite lenses, and by migmatized orthogneisses with amphibole-bearing mesosome. The lithological associations of the Macururé Complex include muscovite quartzite (Fig. 2a), banded metasedimentary rocks (metarhythmites; Fig. 2b) and mica schist (Fig. 2c). Quartzite occurs at the southern contact of the orthogneissic basement with the Macururé Complex, forming the base of the metasedimentary cover, and as map-scale (Fig. 1c) to thin lenses intercalated with the banded metasedimentary rocks. Pelitic-psammitic metasedimentary rocks are the most abundant lithologies. The pelitic bands are composed of quartz, biotite, muscovite and garnet whereas the psammitic layers are dominated by quartz ± feldspar. The banded appearance gives place to a more homogeneous texture in fine-to medium-grained pelitic schists, which show the same mineral assemblage of the pelitic bands of the metarhythmites. Calc-silicate rocks composed of quartz, plagioclase, amphibole, epidote and quartz may occur as thin, centimeter- to decimeter-thick bands in these rocks (Fig. 2d). A small body of porphyritic granite intrudes the metasedimentary sequence in the west part of the area.

3. Structure and metamorphism

In the study area, the Macururé Complex shows a relatively simple geological structure. The centimetric to decimetric alternating layers of metapelites and metapsammites in the metarhythmites represent the original bedding (S_0) and can be related to the Tc-Td-Te or Td-Te intervals of classic Bouma turbidites (Silva et al. 1995). The main foliation is usually parallel to the bedding and shows low to moderate dip to

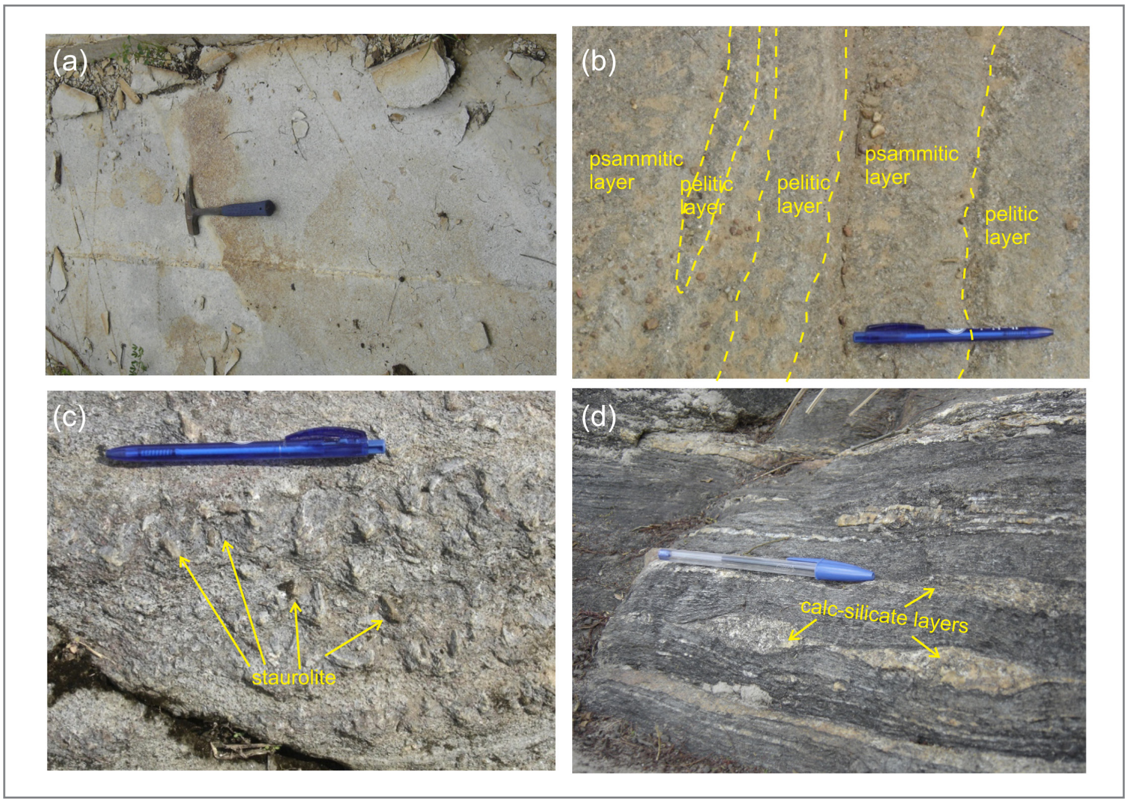

FIGURE 2 – Lithotypes in the study area. (a) Muscovite quartzite with horizontal foliation. (b) Metarhythmite showing alternating pelitic-rich and psammitic-rich bands. (c) Muscovite biotite schist with porphyroblasts of staurolite. (d) Boudinage layers of calc-silicate rock in pelitic schist.

the southwest (Fig. 3a). This foliation is interpreted to be of second generation (S_2) because intrafolial, tight to isoclinal folds defined by micas, so indicating existence of a previous metamorphic foliation (S_1), are locally observed (Fig. 3b). In places where S_2 is oblique to S_0, its dip is always steeper (Fig. 3c). Mineral lineations, sometimes defined by kyanite, plunge mainly to the southwest (Figs. 1c, 3a and 3d). Stretching lineations are only rarely observed and kinematic shear criteria were only found near the city of São Brás (Fig. 1c). There, the foliation dips to the northeast and en-echelon quartz veins (Fig. 3e) and C'-type shear bands (Fig. 3f) indicate top-to-the-southwest tectonic transport. Poles to S_2 define a broad girdle whose axis plunges 23° to S72°W (Fig. 3a), which coincides with the orientation of hinge lines of crenulations formed in a later deformation phase.

In schists and metarhythmites, garnet is ubiquitous as an accessory mineral phase (Fig. 4a) and centimetric porphyroblasts of staurolite and kyanite (Figs. 2c and 3d), sometimes together (Fig. 4b), are common. Syntectonic growth of kyanite during development of S_2 is attested by its orientation parallel to L_2, with no sign of superposition of a previous foliation (Figs. 3d and 4c). Garnet may show an internal foliation oblique to the external foliation, indicating early-S_2 growth. Staurolite usually occurs as elongate poikiloblasts with internal foliation continuous with S_2 (Fig. 4d), but in places the internal foliation is slightly curved, indicating early-S_2 growth.

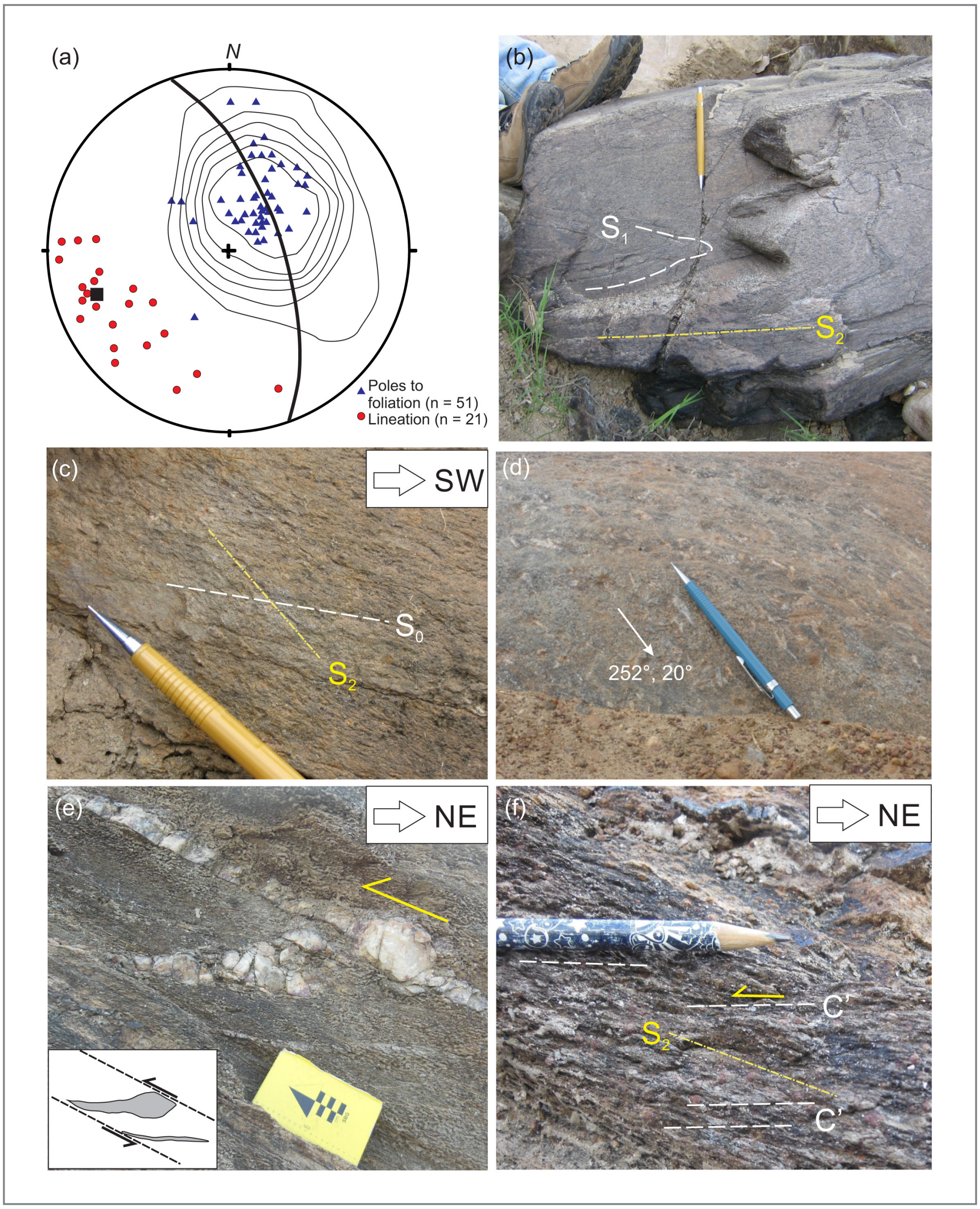

FIGURE 3 – Structural aspects of the study area. (a) Poles to the main foliation (S2) and their Kamb contours (2 sigma intervals), and mineral lineations plotted on equal-area (lower hemisphere) projections. The great circle is fitted to the distribution of the foliation poles and the square indicates its pole (251°, 23°). (b) Intrafolial isoclinal folds. (c) Mica foliation oblique to bedding. (d) Porphyroblasts of kyanite defining a mineral lineation. (e, f) Kinematic shear criteria. (e) En-echelon quartz veins. (f) C'-type shear bands.

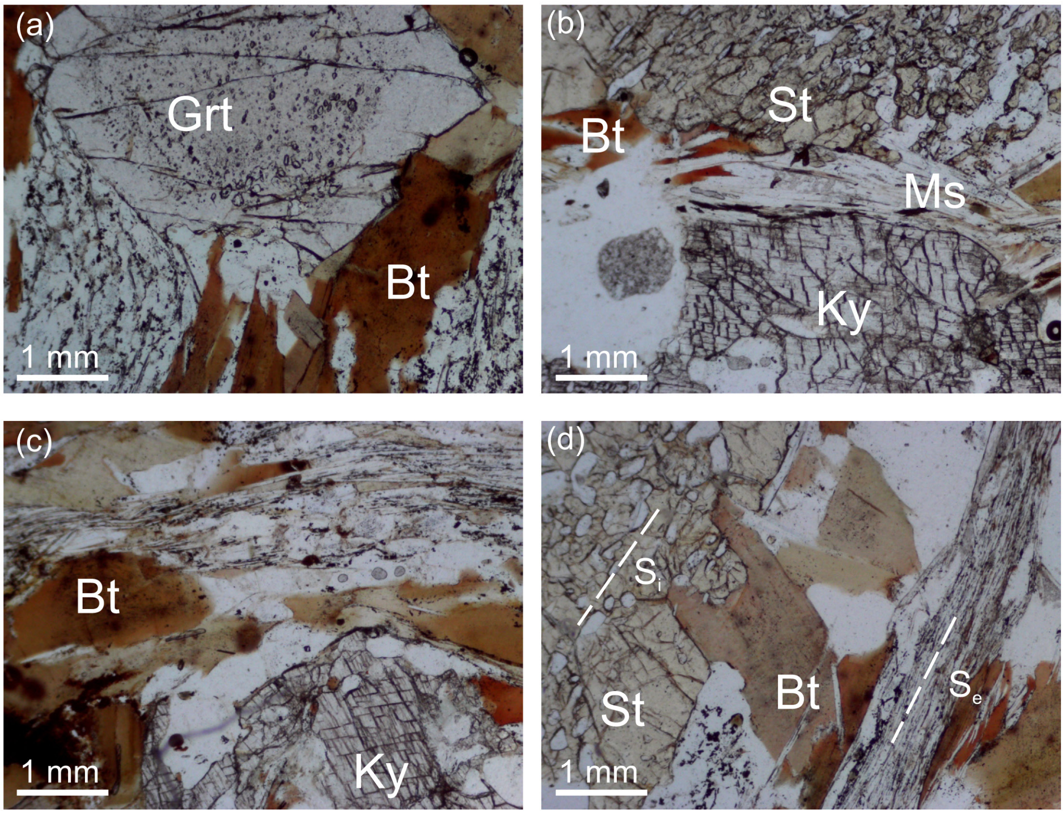

FIGURE 4 – Metamorphic aspects of the study area. a) Zoned garnet (Grt) porphyroblast. (b) Metamorphic assemblage biotite (Bt)-muscovite (Ms)-kyanite (Ky)-staurolite (St). (c) Elongate porphyroblast of kyanite parallel to the foliation defined by biotite. (d) Elongate poikiloblast of staurolite with internal foliation (Si) parallel to the external foliation S2 (Se).

4. U-Pb geochronology

Two samples were chosen for the geochronological study, one from a kyanite-bearing garnet biotite muscovite schist and one from a muscovite quartzite, but the first did not yield zircon grains. The analyzed sample (MAC-02) is from a quartzite collected at coordinates 10°06'52.7"S; 36°49'23.8"W (Fig. 1c). Zircon grains were separated using conventional techniques. U-Pb zircon ages were obtained by laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) at the Université de Montpellier, France, following the procedure detailed in Neves et al. (2016).

The U-Pb results are shown in Table 1 and in Fig. 5. Forty-one grains were analyzed, all of which show oscillatory zoning and high Th/U ratios (mostly above 0.5) suggestive of derivation of igneous (or metaigneous) sources (e.g., Kirkland et al. 2015). Of these, 25 grains yielded discordance < 5% and are the only discussed. The concordant data define three age groups. The three populations of zircon grains have similar morphologies, being dominated by elongate grains with rounded corners (Fig. 5). The oldest group comprises five analyses with $^{207}Pb/^{206}Pb$ ages ranging from 1954±28 Ma (2σ) to 2046±38 Ma (2σ). The second group comprises four analyses that yielded Late Mesoproterozoic ages around 1100 Ma. The remaining 16 analyses are of latest Mesoproterozoic to earliest Neoproterozoic age, showing a large age peak at c. 985 Ma. The youngest grain has a $^{206}Pb/^{238}U$ age of 939±36 Ma (2σ), which is considered as the maximum age for deposition.

5. Discussion

The dominant flat-lying foliation in the study area suggests development associated with thrust tectonics. The absence of mylonitic belts and the rarity of stretching lineations indicates distributed non-coaxial deformation, without strain localization. The local presence of shear criteria indicating top-to-the-southwest tectonic transport (Figs. 3e, f) agrees with the he overall vergence of the Sergipano Belt towards the São Francisco Craton (Brito Neves et al. 1977; Jardim de Sá et al. 1992; D'el-Rey Silva 1999; Oliveira et al. 2010). In this context, the southwestward dip of the main foliation in the study area is attributed to later folding. In places where S_2 is oblique to S_0, its dip is always steeper (Fig. 3c), indicating that the study area may be located in the normal limb of an inverted macroscopic fold with northeastern vergence. This inference is consistent with location of the study area south of the Jirau do Ponciano Dome, which is shown on regional maps as an inverted antiform (Mendes et al. 2009, 2012; Lima et al. 2019).

Oliveira et al. (2010) proposed a time gap between S_1 and S_2 based on observations in the central portion of the Macururé Domain. In contrast, S_1 and S_2 are here interpreted as resulting from progressive deformation, giving the absence of any metamorphic discontinuity, as previously discussed by Silva et al. (1995). The mineral assemblage muscovite+biotite+garnet±kyanite±staurolite (Fig. 4b) indicates medium pressure and temperature conditions (amphibolite facies) typical of Barrovian metamorphism.

Table 1. U-Pb LA-ICP-MS analyses of zircon grains from muscovite quartzite (sample MAC-02) of the Macururé Complex.

Analysis	Pb* (ppm)	Th (ppm)	U (ppm)	Th/ U	208Pb/ 206Pb	207Pb/ 206Pb	± (1s)	207Pb/ 235U	± (1s)	206Pb/ 238U	± (1s)	Rho	Apparent 206Pb/ 238U	± (1s)	ages (Ma) 207Pb/ 206Pb	± (1s)	Err R8 %	Err 7/6 %	Conc.(%)
#1	16.6	113.0	90.3	1.25	0.323	0.0893	0.0009	1.8104	0.0240	0.1470	0.0013	0.66	884	7	1411	19	0.9	1.0	62.6
#2	25.4	113.1	150.3	0.75	0.211	0.0763	0.0008	1.5783	0.0222	0.1499	0.0013	0.62	901	7	1104	22	0.9	1.1	81.6
#3	62.5	300.7	328.8	0.91	0.275	0.0719	0.0007	1.5740	0.0237	0.1588	0.0017	0.73	950	10	983	21	1.1	1.0	96.7
#4	52.4	129.8	162.9	0.80	0.150	0.1239	0.0010	5.0565	0.0557	0.2959	0.0023	0.70	1671	11	2014	14	0.8	0.8	83.0
#5	84.7	136.7	223.6	0.61	0.174	0.1198	0.0010	5.6611	0.0612	0.3426	0.0025	0.66	1899	12	1954	14	0.7	0.8	97.2
#6	23.2	106.5	112.9	0.94	0.298	0.0724	0.0006	1.6832	0.0242	0.1686	0.0019	0.78	1005	10	997	18	1.1	0.9	100.8
#7	68.8	192.7	398.3	0.48	0.157	0.0749	0.0007	1.6400	0.0197	0.1588	0.0012	0.62	950	7	1066	19	0.7	0.9	89.2
#8	96.2	196.3	246.6	0.80	0.227	0.1214	0.0009	5.7955	0.0918	0.3461	0.0048	0.87	1916	23	1977	14	1.4	0.8	96.9
#9	33.4	138.5	151.8	0.91	0.316	0.0730	0.0008	1.7246	0.0343	0.1714	0.0028	0.82	1020	15	1013	23	1.6	1.1	100.7
#10	82.6	372.0	445.2	0.84	0.256	0.0724	0.0006	1.5974	0.0233	0.1600	0.0020	0.85	957	11	997	16	1.2	0.8	96.0
#11	4.0	15.0	20.2	0.74	0.245	0.0738	0.0014	1.7337	0.0427	0.1703	0.0028	0.66	1014	15	1037	37	1.6	1.8	97.8
#12	45.4	106.1	116.4	0.91	0.223	0.1219	0.0010	5.8060	0.0688	0.3453	0.0028	0.70	1912	14	1985	15	0.8	0.9	96.3
#13	33.5	101.4	182.1	0.56	0.174	0.0722	0.0007	1.6785	0.0186	0.1686	0.0010	0.54	1005	6	991	19	0.6	0.9	101.4
#14	117.3	189.3	533.3	0.35	0.164	0.1274	0.0010	3.3639	0.0540	0.1915	0.0026	0.86	1130	14	2062	14	1.4	0.8	54.8
#15	27.5	134.0	162.3	0.83	0.248	0.0769	0.0006	1.5948	0.0140	0.1504	0.0004	0.30	903	2	1119	17	0.3	0.8	80.7
#16	81.5	260.2	467.0	0.56	0.176	0.0745	0.0007	1.6524	0.0159	0.1609	0.0006	0.39	962	3	1055	18	0.4	0.9	91.2
#17	21.0	153.1	144.7	1.06	0.196	0.0816	0.0008	1.4504	0.0260	0.1290	0.0019	0.83	782	11	1235	20	1.5	1.0	63.3
#18	101.4	148.4	429.0	0.35	0.119	0.1291	0.0017	4.9529	0.1664	0.2782	0.0086	0.92	1582	43	2086	23	3.1	1.3	75.8
#19	74.6	516.1	435.0	1.19	0.299	0.0787	0.0006	1.5492	0.0159	0.1428	0.0009	0.64	861	5	1164	15	0.7	0.8	73.9
#20	7.1	25.3	37.1	0.68	0.222	0.0720	0.0006	1.6954	0.0210	0.1707	0.0016	0.76	1016	9	986	16	0.9	0.8	103.0
#21	292.7	552.6	1130.6	0.49	0.166	0.1239	0.0013	3.9726	0.0607	0.2326	0.0027	0.75	1348	14	2013	18	1.1	1.0	67.0
#22	72.3	415.9	411.3	1.01	0.309	0.0736	0.0006	1.6045	0.0206	0.1580	0.0015	0.75	946	8	1032	17	1.0	0.9	91.7
#23	13.5	51.4	71.6	0.72	0.226	0.0723	0.0009	1.6831	0.0281	0.1690	0.0018	0.65	1006	10	993	26	1.1	1.3	101.3
#24	23.8	120.9	140.6	0.86	0.228	0.0764	0.0009	1.6467	0.0198	0.1562	0.0007	0.37	936	4	1107	22	0.4	1.1	84.6
#25	36.6	55.2	101.6	0.54	0.170	0.1262	0.0013	6.3442	0.0937	0.3645	0.0038	0.70	2003	18	2046	19	1.0	1.1	97.9
#26	24.0	83.6	146.6	0.57	0.193	0.0709	0.0008	1.5332	0.0356	0.1569	0.0032	0.89	939	18	954	22	2.1	1.1	98.5
#27	52.2	338.7	206.0	1.64	0.171	0.1267	0.0011	4.0633	0.0526	0.2326	0.0022	0.73	1348	11	2052	16	0.9	0.9	65.7
#28	12.7	15.7	65.8	0.24	0.074	0.0756	0.0008	1.9580	0.0328	0.1878	0.0024	0.78	1109	13	1085	21	1.3	1.1	102.2
#29	63.3	139.7	166.3	0.84	0.241	0.1233	0.0010	5.8421	0.0634	0.3435	0.0025	0.67	1904	12	2005	14	0.7	0.8	94.9
#30	102.3	98.4	276.5	0.36	0.136	0.1261	0.0010	6.2642	0.0674	0.3602	0.0026	0.68	1983	12	2045	14	0.7	0.8	97.0
#31	124.5	185.4	343.5	0.54	0.156	0.1209	0.0010	5.6242	0.0642	0.3374	0.0026	0.68	1874	13	1969	15	0.8	0.8	95.2
#32	100.8	585.6	422.4	1.39	0.411	0.0782	0.0006	2.0017	0.0217	0.1857	0.0014	0.69	1098	8	1151	15	0.8	0.8	95.4
#33	45.4	305.2	227.7	1.34	0.411	0.0715	0.0006	1.5559	0.0244	0.1579	0.0020	0.82	945	11	971	18	1.3	0.9	97.4
#34	85.9	238.3	497.0	0.48	0.152	0.0734	0.0013	1.6599	0.0337	0.1641	0.0016	0.49	979	9	1024	35	1.0	1.8	95.6
#35	53.5	374.1	242.9	1.54	0.464	0.0714	0.0007	1.6556	0.0223	0.1683	0.0016	0.72	1003	9	968	19	1.0	0.9	103.6
#36	16.3	50.3	91.1	0.55	0.172	0.0725	0.0007	1.6892	0.0257	0.1689	0.0019	0.74	1006	10	1001	21	1.1	1.0	100.5
#37	102.3	661.4	561.6	1.18	0.371	0.0737	0.0008	1.6828	0.0275	0.1657	0.0021	0.76	988	11	1032	21	1.2	1.1	95.8
#38	116.5	605.0	642.9	0.94	0.285	0.0722	0.0006	1.6050	0.0230	0.1611	0.0019	0.83	963	11	993	16	1.2	0.8	97.0
#39	121.9	102.1	345.2	0.30	0.108	0.1273	0.0011	6.0172	0.0704	0.3427	0.0026	0.66	1900	13	2062	15	0.8	0.9	92.2
#40	15.6	41.5	75.3	0.55	0.169	0.0770	0.0009	2.0234	0.0297	0.1906	0.0018	0.65	1125	10	1121	22	1.0	1.1	100.3
#41	16.2	42.8	78.0	0.55	0.167	0.0761	0.0008	1.9662	0.0295	0.1875	0.0021	0.74	1108	11	1097	20	1.1	1.0	101.0

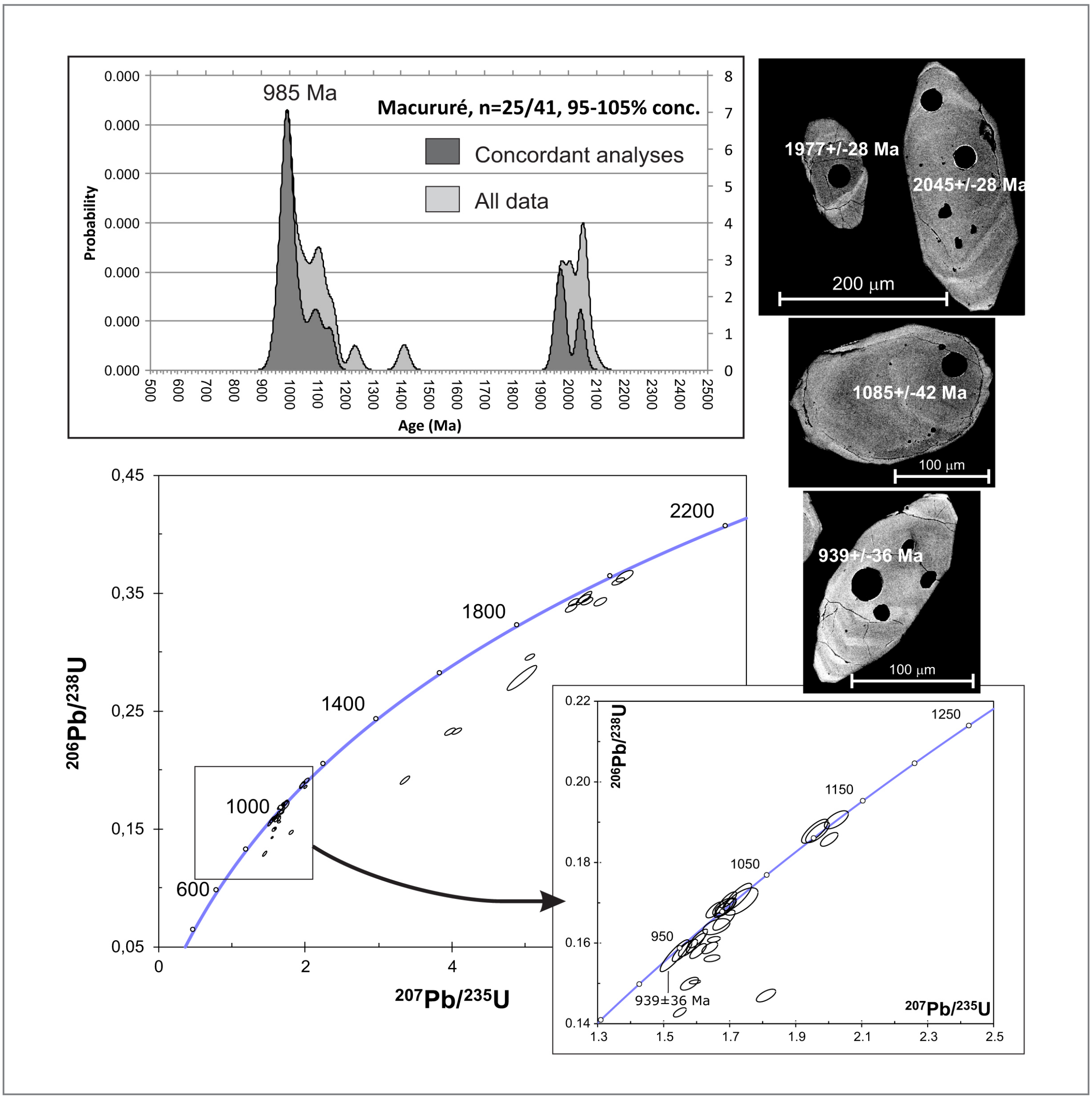

FIGURE 5 – Probability and Concordia plots for LA-ICP-MS zircon analyses from sample MAC-02 and representative backscattered electron (BSE) images of analyzed grains.

The detrital zircon ages of sample MAC-02 (Fig. 5) are similar to other dated samples from the Macururé Complex (Van Schmus et al. 2011; Oliveira et al. 2006, 2010, 2015a), which revealed no post-Tonian zircon grains (Fig. 6). The dominant latest Mesoproterozoic to early Neoproterozoic ages show that the main sources of the detritus were formed during the Cariris Velhos event (Brito Neves et al. 1995). This event was first documented in the Alto Pajeú Domain of the Central Subprovince (Brito Neves et al. 1996; Santos et al. 2010; Van Schmus et al. 2011; Guimarães et al. 2012) but was later recognized in the PEAL Domain (Brito et al. 2008; Cruz et al. 2014; Da Silva Filho et al. 2014), Marancó-Poço Redondo Domain (Carvalho 2005; Oliveira et al. 2010), and Riacho do Pontal Belt (Caxito et al. 2014). Although the nature of the Cariris Velhos event (if orogenic or extensional) is still debated, the dominance of bimodal metavolcanic rocks and of metagranitoids with A-type signature favors an intraplate origin for the magmatism (Neves 2003; Guimarães et al. 2011, 2012, 2016). Given the wide distribution of the Cariris Velhos-related rocks, it is not possible to ascertain if zircon grains of the dominant age group were sourced from proximal rocks (Marancó-Poço Redondo Domain) or had more distal provenance. The absence of zircon grains younger than c. 900 Ma in our and in previously analyzed samples could indicate that deposition of the Macururé Complex occurred at the end or shortly afterward the Cariris Velhos event. Alternatively, it may simply be that younger sources were either not available for erosion at the time of deposition or were not present along the drainage system.

The most obvious source for zircon grains in the age interval 1.95-2.05 Ga is the Jirau do Ponciano Dome, which shows a similar age range (Spalletta and Oliveira

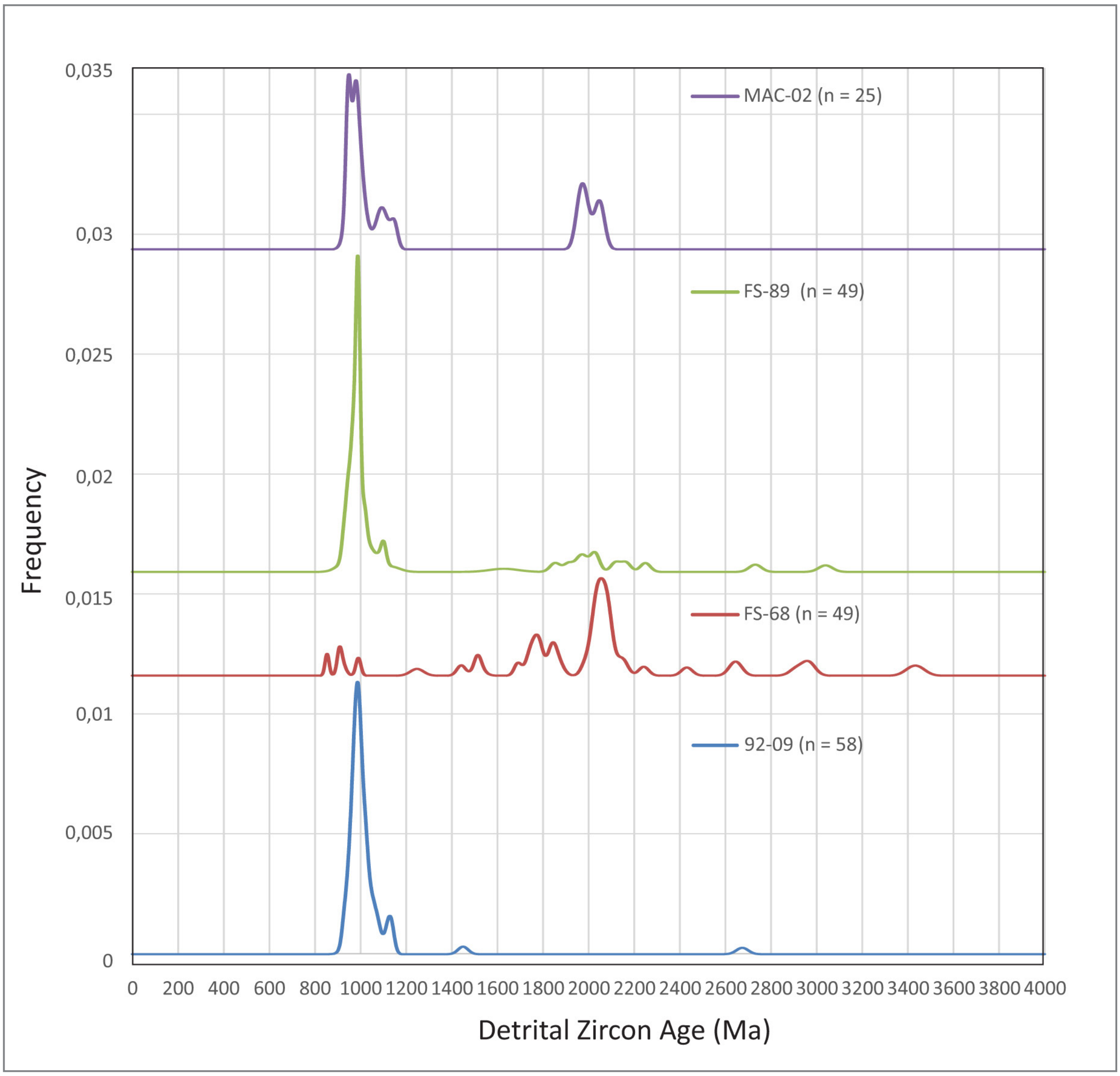

FIGURE 6 – Cumulative probability density distribution diagram of U-Pb detrital zircon ages from metasedimentary rocks of the Macururé Complex. Sources of data: MAC-02, this study; FS-89 and FS-68, Oliveira et al. (2015); 92-09, Van Schmus et al. (2011).

2017; Lima et al. 2019), although it is somewhat surprising the comparatively small number of analyses in this age range given the proximity of available source rocks. The provenance of zircon grains with ages around 1.1 Ga (Fig. 5) is more enigmatic. The age of 1091±13 Ma recorded in a metavolcanic rock from the Riacho Gravatá Complex of the Alto Pajeú Domain (Guimarães et al. 2012) is so far the only one documented in central and southern Borborema Province. Guimarães et al. (2012) interpreted this age as related to an early stage of rifting preceding the Cariris Velhos event. Similarly, detrital zircon grains from the Sopa-Brumadinho Formation of the Espinhaço Supergroup falls within the interval between 1080±16 and 1240±20 Ma (Chemale Jr. et al. 2012). They are tentatively interpreted as resulting from erosion of A-type source rocks during the initial rifting stage corresponding to deposition of the basal units of the Upper Espinhaço Group (Chemale Jr. et al. 2012). Therefore, it is possible that the c. 1.1 Ga zircon population records localized extensional events at the late Mesoproterozoic in the Borborema Province and/or São Francisco Craton.

6. Conclusion

The Macururé Domain in southern Alagoas state is constituted by Paleoproterozoic orthogneisses that outcrop in the northern part of the study area and by quartzite, metarhythmite and micaschist, which are the dominant lithotypes. The southwestern dipping flat-lying foliation was developed under amphibolite facies conditions, with the paragenesis muscovite+biotite+garnet±kyanite±staurolite indicating medium P-T (Barrovian) metamorphism. U-Pb analyses of detrital zircon grains point to the dominance of early Tonian rocks (1.0 to 0.94 Ga) as the main sources of the sediments, with a smaller contribution of Paleoproterozoic (c. 2.0 Ga) and Late Mesoproterozoic (c. 1.1 Ga) sources.

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