Petrography and geochronology of the Furquim Quartzite, an eastern extension of the Itacolomi Group (Quadrilátero Ferrífero, Minas Gerais)

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Abstract

This paper presents the results of a petrographic and geochronological investigation of the Furquim Quartzite (FQ) to establish its stratigraphic correlation to quartzitic units of the Quadrilátero Ferrífero (QF) province. The Quartzite comprises a ca. 20km long and 1-6km wide ridge overlying discordantly the Archean to Paleoproterozoic gneissic basement and rocks of the Archean Rio das Velhas Supergroup between the city Mariana and the town Furquim, southeast of the QF. Despite the discordant contacts, previous field-based stratigraphic studies considered the Furquim Quartzite as part of the Archean Maquiné Group – top unit of the Rio das Velhas Supergroup. U-Pb zircon geochronology via LA-ICP-MS identified several detrital populations ranging from Paleoproterozoic to Archean age. The youngest population of 2087±19 Ma defines the maximum age for the sedimentation of the precursor sandstone. This age can be correlated to be the age of the youngest zircon population of the Itacolomi Group quartzites in the QF. Thus, in contrast to previous studies, the results indicate that the FQ is an eastern extension of the Itacolomi Group, the youngest unit of the Paleoproterozoic Minas Supergroup.

Keywords: Furquim Quartzite, Quadrilátero Ferrífero, U/Pb Geochronology, LA-ICP-MS, Paleoproterozoic.

1. Introduction

The Furquim Quartzite is exposed along a *ca*. 20 km long and 1 to 6 km wide ridge some 10 to 20 km southeast of the Quadrilátero Ferrífero (Fig. 1a). In the investigated area (Fig. 1b) the Furquim Quartzite trends NE-SW and inflects to a NNE-trend in the region of the town of Furquim. According to the geological map of Baltazar *et al*. (1993), the quartzite ridge separates the western Archean Santa Bárbara Complex from the eastern Proterozoic Mantiqueira Complex (Fig.1a). Baltazar *et al*. (1993) correlated this quartzite unit to the Maquiné Group of the Archean Rio das Velhas Supergroup. However, the postulated correlation with the Rio das Velhas quartzite is not corroborated by the mode of occurrence, since in a great part of the area, the quartzite ridge overlies discordantly the Rio das Velhas schists and the Santa Bárbara gneisses, thus suggesting an allochtonous origin. This paper presents the results of the petrographic and geochronological investigation of the Furquim Quartzite in order to enable the discussion of its stratigraphic correlation to quartzite units of the well-known Maquiné, Moeda and Itacolomi quartzites in the Quadrilátero Ferrífero.

2. Geological context

The main quartzitic units in the region of the Quadrilátero Ferrífero belong to the Archean Rio das Velhas Supergroup and to the Paleoproterozoic Minas Supergroup.

The Rio das Velhas Supergroup is subdivided into Nova Lima and Maquiné groups (Dorr, 1969). The Nova Lima Group is composed mostly of metaultramafic, metamafic and metasedimentary pelitic to ruditic rocks. Felsic volcanic rocks mark the final deposition of the Nova Lima Group *at ca*. 2.75 Ga (Machado *et al*., 1992, 1996; Noce *et al*., 2005). The overlying Maquiné Group is a clastic unit comprised of mainly quartzites. U-Pb age determinations of detrital zircons indicate 3.2 to 2.9 Ga for the main sources of the Maquiné sediments (Machado *et al.,* 1996).

The Minas Supergroup overlies the Rio das Velhas Supergroup and surrounding TTG-gneiss terrains. From bottom to top, it is subdivided into the Tamanduá, Caraça, Itabira, Piracicaba, Sabará, and Itacolomi Groups (Dorr, 1969). Zircon U–Pb detrital age data suggest that the maximum age of deposition of the sediments of the Caraça quartzite is *ca*. 2.6 Ga (Machado *et al*., 1996; Hartmann *et al*., 2006). The Sabará and Itacolomi groups are the youngest units of the Minas Supergroup. The Sabará Group comprises metassedimentary rocks such as metadiamictites and metatuffs and metaturbidites. The Itacolomi Group comprises quartzites derived from sediments with a maximum deposition age of around 2.1 Ga (Machado *et al*., 1996, Hartmann *et al*., 2006). Similar ages were also obtained for the deposition of the Sabará sediments (Machado *et al*., 1996). Table 1 presents the ages of the youngest zircons found in the main quartzitic units of the Quadrilátero Ferrífero. These ages correspond to the maximum age for the deposition of the sediments.

Two other geological units that would be potential sources for the detrital zircons of the Furquim Quartzite are the TTG-gneiss complexes, including the Santa Bárbara and the Mantiqueira complexes (Fig. 1b). The Santa Bárbara Complex corresponds to an Archean TTG gneiss terrain considered to be the basement of the Rio das Velhas Supergroup in the eastern portion of the Quadrilátero Ferrífero. Geochronological U-Pb SHRIMP and LA-ICP-MS dating by Lana *et al*. (2013) indicate crystallization ages of 3.2 Ga. The Mantiqueira Complex is composed of TTG ortogneisses thrusted over the southern margin of the São Francisco Craton during the 2.1 Ga Transamazonian event (Silva *et al*., 2002, Noce *et al*., 2007). U-Pb zircon age determinations by SHRIMP (Silva *et al*., 2002; Noce *et al*., 2007) resulted in paleoproterozoic crystallization ages of around 2180-2041 Ma for ortogneisses of the Mantiqueira Complex and two metamorphic events at 2100 Ma and 560 Ma.

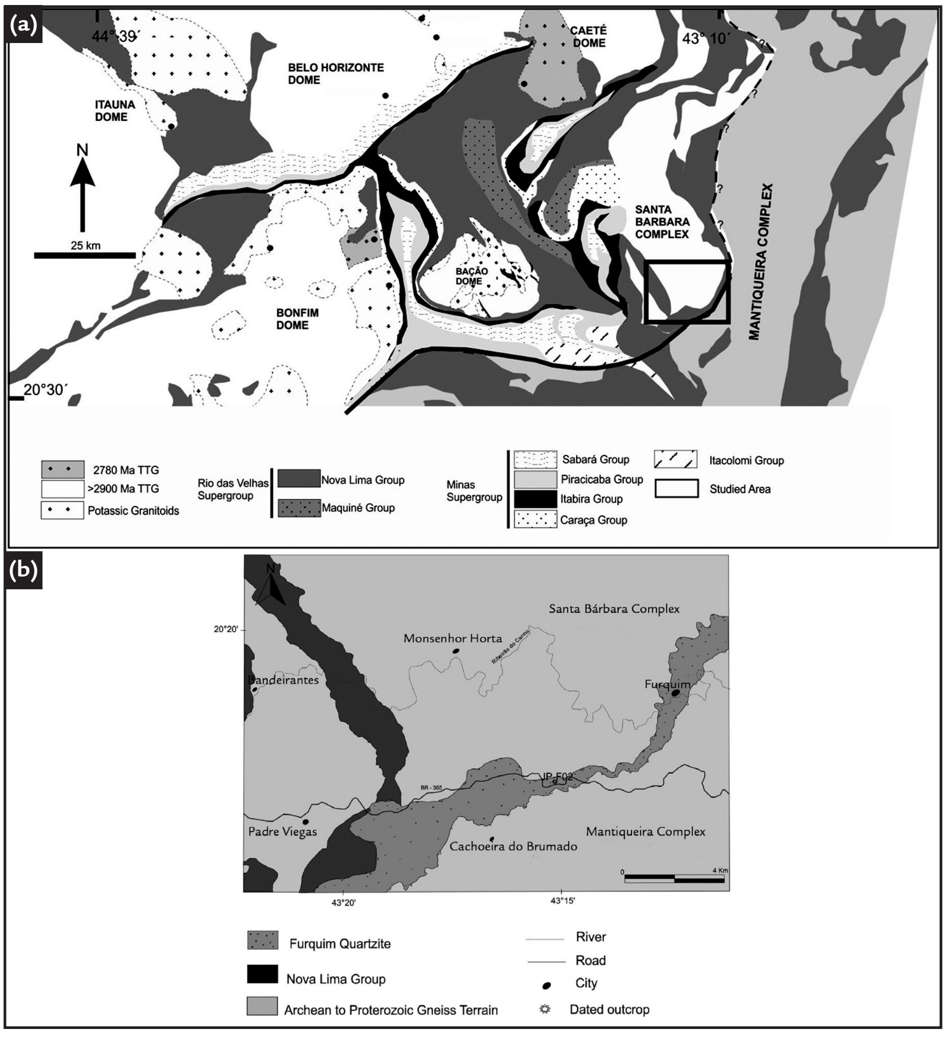

Figure 1
a) Geological map of the Quadrilátero Ferrífero (modified from Lana *et al*., 2013). Rectangle: location of the study area;
b) Geological map of the study area of the Furquim Quartzite (modified from Jordt-Evangelista, 1984) and location of dated sample JP-F02.

Quartzitic unit	Age (Ma)	
	Hartmann *et al*., 2006	Machado *et al*., 1996
Itacolomi Group	2143±16	2059±58
Sabará Formation	2668±20	2125±4
Moeda Formation (Caraça Group)	2649±11	2651±33; 2606±47
Maquiné Group	-	2877±3
Nova Lima Group	2749±07	2996±38

Table 1
Youngest zircon grains in the Quadrilátero Ferrífero quartzites corresponding to the maximum ages for the deposition.

3. Material and methods

Thin sections of representative hand samples collected in the vicinity of the town of Furquim and on the highway BR-356 were described on a Leica DM EP microscope at the Departamento de Geologia (DEGEO), Universidade Federal de Ouro Preto.

One sample (sample JP-F02, UTM: 0682390/7746163, sample locality on Fig. 1b) weighing *ca.* 5kg was collected for LA-ICP-MS U-Pb geochronology. Zircons were concentrated making use of a conventional jaw crusher, milling, manual panning and heavy liquids separation. The zircons were hand-picked under a binocular microscope. Approximately 123 zircon crystals were selected and mounted on a 2.5 cm-diameter epoxy mount. The mount was polished and imaged under SEM-cathodoluminescence to accentuate internal growth zoning.

The laser ablation-ICP-MS (LA-ICPMS) analyses were performed using a single collector Agilent 7700 Quadrupole(Q)-ICP-MS and a 213 nm New Wave laser at the isotope/geochemistry laboratory of Department of Geology, Universidade Federal de Ouro Preto. Acquisitions consisted of a 20 s measurement of the gas blank, followed by a 40 s measurement of U, Th and Pb signals during ablation, and a 30 s washout. All ratios were obtained after averaging the background-subtracted signal (See Romano *et al.*, 2013 and Takenaka *et al.*, 2015, for details on the instrumentation and methodology). Two standards were used during runs: the primary standard GJ-1 zircon (608±1 Ma) and the secondary standard Plesovice zircon (338±1 Ma). The relevant isotopic ratios have been calculated using Glitter data reduction software (van Achterbergh *et al.*, 2001). The U-Pb diagrams were produced using Isoplot 4 software (Ludwig, 2012). The results of the analyses, including data for the primary and secondary standards can be found in Table 2.

4. Results

4.1 Petrography

The main rock type is a strongly folded (Fig.2a) and sheared muscovite quartzite. Disrupted quartz veins along fold hinges may be confused with pebbles or cobbles of conglomerates (Fig. 2b). Quartz reaches 70 to 90 vol%, muscovite 5 to 20%, while the accessory minerals hematite, magnetite, kyanite, feldspars, garnet, zircon, and tourmaline seldom sum 5% (Fig. 2c to 2f, all samples from outcrop in the town of Furquim).

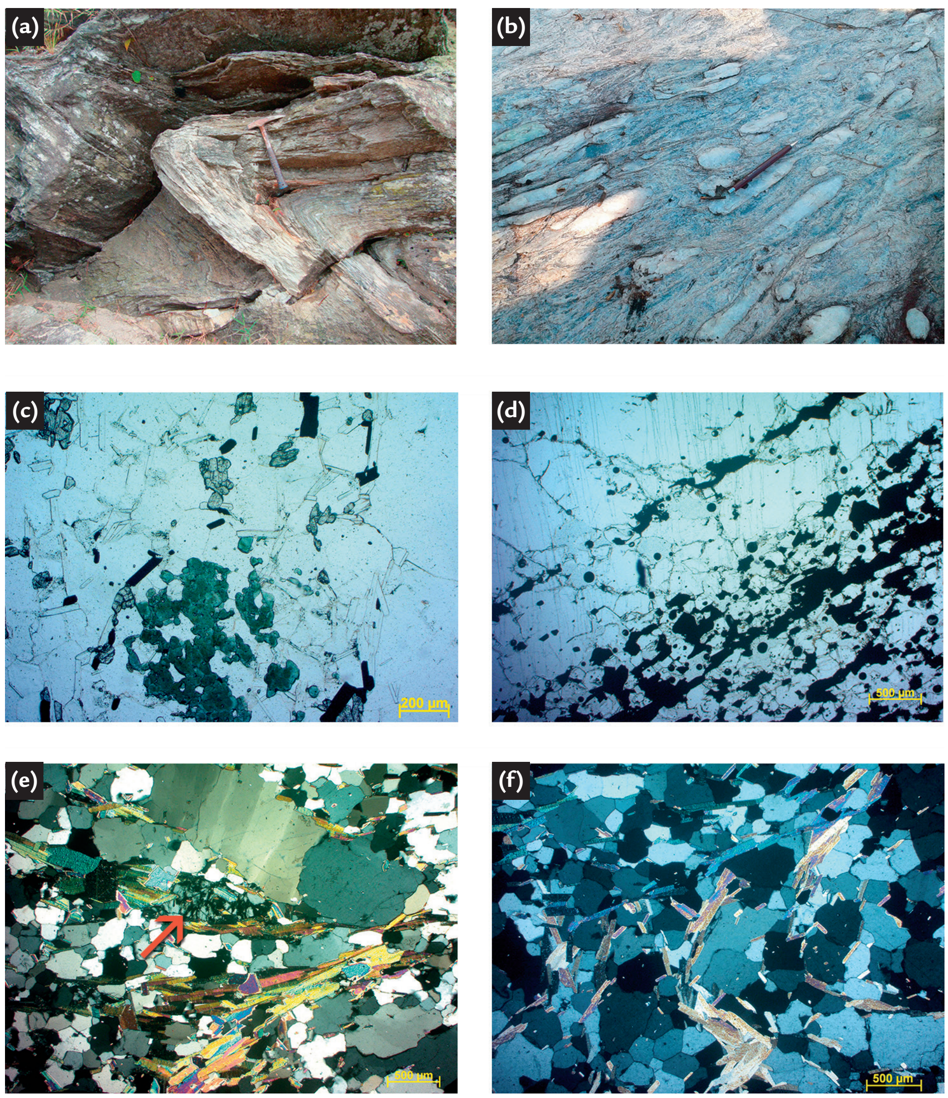

Figure 2
(a) - Outcrop of the dated folded quartzite (Point JP-F02 on Fig. 1b), view to SSW. See hammer in the center of photo for scale.
(b)- Disrupted quartz veins, outcrop in the town of Furquim. See pencil in the center of photo for scale.
(c) - Photomicrograph of muscovite quartzite with tourmaline (greenish), kyanite (gray, strong relief) and hematite (black), N//.
(d) - Photomicrograph of hematite-rich portion in quartzite, N//.
(e) - Photomicrograph showing subgrains in deformed quartz vein in muscovite quartzite. Strongly altered feldspar is seen in the center of figure (arrow), NX.
(f) - Photomicrograph of folded muscovite quartzite, NX. Samples of Fig. 2c to e collected in Furquim. (Photomicrographs from Alvarenga, 2013).

4.2 Geochronology

The extracted zircons from sample JP-F02 measure ca. 100-200 µm, are yellow to brown, slightly rounded and often fractured. Cathodoluminescence images show that most grains present well-defined oscillatory zoning with some broad zones of intense alteration and radiation damage and no discernible core–rim relationships (Fig. 3). Of the 123 grains mounted on the epoxy disc, 119 LA-ICP-MS analyses were performed on center and rims of 47 translucent to partly translucent grains. The complete geochronological data set can be found in Table 2.

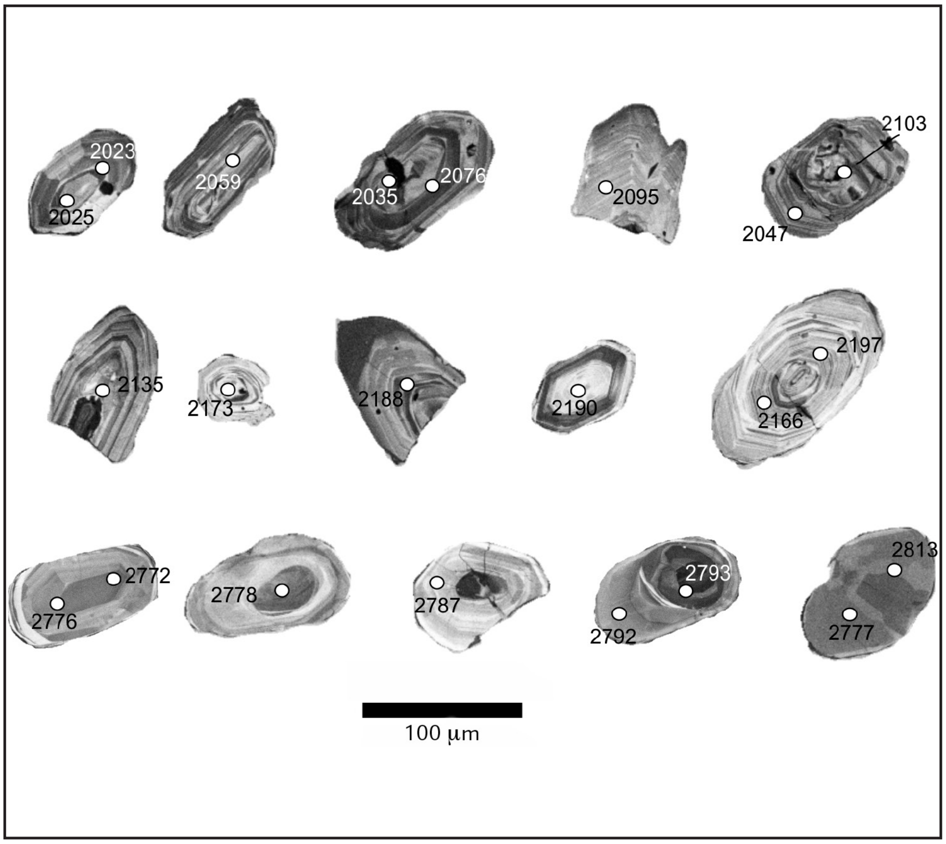

Figure 3
Cathodoluminescence images of analyzed zircons, ages in million years (Ma).

Figure 4 shows concordant to sub-concordant points (63 analyses > 3% concordant) plotted on the frequency histogram and on the concordia. Several Paleoproterozoic populations ranging between 2.0 and 2.5 Ga (n=31) are distributed along the concordia. The youngest one of 2087±19 Ma old (n=10) defines the maximum age of sedimentation for the precursor sandstones. An Archean component is represented by ages in the 2.5-3.0 Ga (n=32) range.

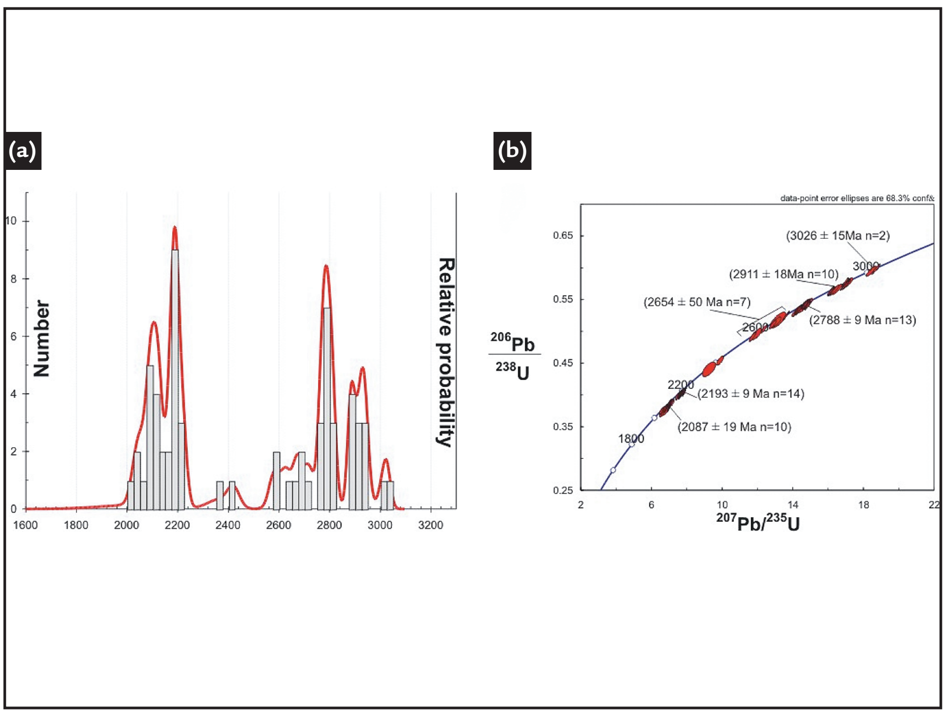

Figure 4
(a) Frequency histogram where two main detrital zircon populations of the Furquim Quartzite can be identified: a Paleoproterozoic population of about 2.2 Ga and an Archean population around 2.8 Ga.
(b) U-Pb Concordia diagram of LA-ICP-MS analyses of zircons (see Fig. 1b for sample locality).

Table 2 - part I
Results of U-Pb LA-ICP-MS analyses for the Furquim Quartzite.

#	Pb204 CPS	Pb207 CPS	U238 CPS	Pb PPM	Th/U	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s
TEST59	5	12458	68193	135,86	0,4	0,22634	0,00207	0,5991	0,00525	18,69597	0,15659	3026	15	3026	21	3026	8
TEST134	12	30193	166480	506,81	0,1	0,2242	0,00253	0,59525	0,00554	18,40183	0,19287	3011	18	3011	22	3011	10
TEST147	6	23869	138821	481,17	1,6	0,21466	0,00257	0,57695	0,00537	17,07292	0,18815	2941	19	2936	22	2939	11
TEST78	0	24771	153987	289,01	0,1	0,21459	0,00191	0,57542	0,0051	17,02778	0,14236	2941	14	2930	21	2936	8
TEST61	19	30489	191037	347,33	0,1	0,21435	0,00199	0,57347	0,00517	16,94893	0,14766	2939	15	2922	21	2932	8
TEST96	25	17852	109475	228,52	0,4	0,21241	0,00188	0,57789	0,00501	16,92506	0,13829	2924	14	2940	20	2931	8
TEST47	0	30099	193279	322,53	0,4	0,21227	0,00224	0,57449	0,00591	16,90682	0,17404	2923	17	2926	24	2930	10
TEST60	10	28008	172878	452,05	0,3	0,21077	0,00253	0,56699	0,00547	16,47079	0,18333	2912	19	2895	22	2905	11
TEST97	0	24143	151799	306,66	0,2	0,20908	0,00231	0,56557	0,00528	16,30547	0,16759	2898	18	2890	22	2895	10
TEST64	0	41155	265534	538,11	0,5	0,208	0,00187	0,5635	0,00491	16,16016	0,1347	2890	15	2881	20	2886	8
TEST42	0	20108	130132	239,08	0,3	0,20699	0,00173	0,56417	0,00482	16,10169	0,12402	2882	14	2884	20	2883	7
TEST63	19	34692	225430	387,14	0,4	0,2069	0,00168	0,56472	0,00479	16,11156	0,1213	2881	13	2886	20	2883	7
TEST91	11	53454	377969	587,7	0,5	0,19843	0,00159	0,54126	0,00461	14,81488	0,11075	2881	13	2789	19	2803	7
TEST15	11	35654	243356	462,8	0,2	0,19762	0,00223	0,54529	0,00505	14,85681	0,1549	2807	18	2806	21	2806	10
TEST124	0	17950	128303	241,14	0,9	0,19737	0,00176	0,54226	0,00475	14,76002	0,12304	2805	15	2793	20	2800	8
TEST56	14	8685	59685	134,83	1,6	0,1967	0,00211	0,54407	0,00512	14,75528	0,14582	2799	17	2801	21	2800	9
TEST142	11	26807	191417	384,83	0,4	0,19584	0,0017	0,54273	0,00466	14,6573	0,11861	2792	14	2795	19	2793	8
TEST148	11	16256	110851	711,29	0,5	0,19561	0,00277	0,53821	0,00546	14,50999	0,19098	2790	23	2776	23	2784	13
TEST71	0	21837	151704	298	0,5	0,1953	0,00179	0,54397	0,00467	14,648	0,12264	2787	15	2800	20	2793	8
TEST88	19	57241	431414	613,96	0,5	0,19402	0,00168	0,53385	0,0049	14,315	0,1204	2777	14	2758	21	2771	8
TEST144	6	24184	176238	336,77	0,3	0,19395	0,00172	0,53354	0,00456	14,2684	0,11729	2776	14	2756	19	2768	8
TEST145	18	30062	225827	379,34	0,4	0,19347	0,00221	0,53449	0,00505	14,25559	0,15473	2772	19	2760	21	2767	10
TEST123	10	44114	334786	566,06	0,1	0,19297	0,0017	0,53423	0,00477	14,22443	0,11973	2768	14	2759	20	2765	8
TEST23	321	15553	112330	232,3	0,1	0,19287	0,00244	0,53226	0,00552	14,15013	0,16764	2767	21	2751	23	2760	11
TEST57	0	11921	89833	150,89	0,9	0,18739	0,0018	0,52577	0,00464	13,58394	0,11932	2767	16	2724	20	2721	8
TEST95	2	11196	93699	840,29	1,2	0,18345	0,00419	0,51872	0,00843	13,12547	0,2873	2684	37	2694	36	2689	21
TEST113	9	10203	79564	309,02	1,1	0,18319	0,00252	0,51581	0,00532	13,02832	0,16684	2682	23	2681	23	2682	12
TEST106	19	11053	88146	157,22	0,6	0,18186	0,00203	0,51149	0,00478	12,82578	0,13263	2670	18	2663	20	2667	10
TEST120	23	23212	188784	389,73	0,5	0,17721	0,00187	0,50457	0,00436	12,32715	0,11809	2627	17	2633	19	2630	9
TEST107	3	5219	44607	101,43	1,8	0,17414	0,00273	0,49675	0,00592	11,92847	0,17767	2598	26	2600	25	2599	14
TEST86	5	17113	159932	207,8	1,0	0,17205	0,00198	0,49248	0,00486	11,68761	0,12798	2578	19	2581	21	2580	10
TEST102	0	16349	177936	330,75	0,7	0,15665	0,0022	0,45503	0,00476	9,82572	0,13019	2420	24	2418	21	2419	12
TEST132	12	13145	177074	234,38	0,3	0,13973	0,00123	0,4039	0,0035	7,78406	0,06399	2224	15	2187	16	2206	7
TEST100	34	18850	244903	462,41	0,2	0,13939	0,00133	0,40673	0,00347	7,81681	0,06795	2220	16	2200	16	2210	8
TEST109	44	13861	182198	351,12	0,4	0,13827	0,00148	0,40511	0,00363	7,72381	0,07657	2206	19	2193	17	2199	9
TEST69	15	17895	249047	293,84	0,4	0,1376	0,00116	0,40048	0,00345	7,59984	0,05986	2197	15	2171	16	2185	7
TEST43	4	8628	115909	161,64	0,4	0,13699	0,0013	0,40254	0,00347	7,60299	0,06596	2190	16	2181	16	2185	8
TEST141	1	11403	152897	245,74	0,5	0,13697	0,00136	0,40222	0,00345	7,59578	0,06886	2189	17	2179	16	2184	8
TEST58	12	4025	53927	72,92	0,5	0,13692	0,00184	0,40315	0,00404	7,61089	0,09486	2189	23	2184	19	2186	11
TEST99	0	13354	177547	313,16	0,5	0,1369	0,00154	0,40011	0,00356	7,55164	0,07773	2188	19	2170	16	2179	9
TEST55	16	10500	146390	170,2	0,4	0,1368	0,00127	0,40506	0,00361	7,64155	0,06672	2187	16	2192	17	2190	8
TEST41	8	10809	149151	185,61	0,5	0,13678	0,00119	0,40249	0,00346	7,59125	0,0609	2187	15	2181	16	2184	7
TEST40	0	12370	170150	209,53	0,6	0,13674	0,00117	0,40413	0,00346	7,6201	0,06032	2186	15	2188	16	2187	7
TEST115	0	11425	152623	242,55	0,9	0,13628	0,0015	0,40371	0,00364	7,58543	0,07743	2180	19	2186	17	2183	9
TEST22	15	12164	163732	227,34	0,5	0,13571	0,00137	0,40235	0,0035	7,52765	0,06941	2173	17	2180	16	2176	8
TEST68	9	10348	140439	324,21	0,4	0,13514	0,00167	0,39864	0,00379	7,42691	0,08471	2166	21	2163	17	2164	10
TEST126	25	11753	165634	310,2	0,2	0,13274	0,00154	0,38838	0,00347	7,10781	0,07546	2135	20	2115	16	2125	9
TEST74	4	13152	191179	289,97	0,3	0,13203	0,00121	0,3902	0,00335	7,10321	0,05994	2125	16	2124	16	2124	8
TEST75	18	33103	512914	517,61	0,2	0,13184	0,0011	0,381	0,00337	6,93341	0,05555	2123	15	2081	16	2103	7
TEST65	0	13957	221720	219,62	0,5	0,1315	0,00136	0,38196	0,00371	6,94466	0,06965	2118	18	2085	17	2104	9
TEST77	6	15053	233157	246,54	0,5	0,13067	0,00127	0,38947	0,00357	7,01913	0,06517	2107	17	2120	17	2114	8
TEST53	0	16807	242970	405,22	0,6	0,13036	0,00146	0,3871	0,00347	6,95687	0,07161	2103	19	2109	16	2106	9
TEST62	15	13624	208269	333,27	0,2	0,13008	0,00127	0,37755	0,00331	6,77107	0,061	2099	17	2065	15	2082	8
TEST119	9	9302	139419	181,54	0,3	0,12981	0,0012	0,38863	0,00336	6,95624	0,05945	2095	16	2117	16	2106	8
TEST26	37	19904	317607	334,66	0,7	0,1293	0,00111	0,37979	0,0034	6,7776	0,05579	2089	15	2075	16	2083	7
TEST25	10	14963	236762	250,64	0,6	0,12906	0,00112	0,38171	0,00339	6,79639	0,05606	2085	15	2084	16	2085	7
TEST82	0	16946	252378	523,12	0,5	0,12837	0,00154	0,38054	0,00347	6,73491	0,07428	2076	21	2079	16	2077	10
TEST66	12	9598	151998	269,91	0,3	0,12715	0,00196	0,37275	0,00406	6,53453	0,09472	2059	27	2042	19	2051	13
TEST54	0	16320	255854	381,37	0,5	0,12628	0,00154	0,37615	0,00357	6,54949	0,07429	2047	21	2058	17	2053	10
TEST83	0	17281	266608	446,02	0,4	0,12544	0,00147	0,37545	0,00335	6,49301	0,06998	2035	21	2055	16	2045	9
discarded																	
TEST130	17	15357	129023	225,22	0,7	0,19306	0,00271	0,50014	0,00549	13,32666	0,17847	2768	23	2614	24	2703	13
TEST118	31	10243	161478	182,01	0,3	0,13374	0,00152	0,35748	0,0033	6,59162	0,06995	2148	20	1970	16	2058	9
TEST108	41	18697	304161	413,56	0,2	0,13642	0,00172	0,35007	0,0034	6,58276	0,07795	2182	22	1935	16	2057	10
TEST111	34	47354	368607	802,99	0,3	0,20141	0,00233	0,48547	0,00455	13,47917	0,14646	2838	19	2551	20	2714	10
TEST87	40	36494	410381	500,25	0,6	0,16782	0,00166	0,41844	0,00384	9,68496	0,09097	2536	16	2253	17	2405	9
TEST67	12	18871	355823	325,34	0,6	0,12595	0,0014	0,31879	0,0029	5,53479	0,05708	2042	19	1784	14	1906	9
TEST149	0	13638	128921	293,11	0,3	0,18797	0,00347	0,45129	0,00576	11,73511	0,20412	2725	30	2401	26	2584	16
TEST110	26	59826	479385	829,35	0,3	0,20462	0,00222	0,47839	0,00446	13,4977	0,13876	2863	18	2520	19	2715	10
TEST98	44	21787	368463	384,92	0,3	0,13773	0,00161	0,34297	0,00334	6,51599	0,07275	2199	20	1901	16	2048	10
TEST136	78	8950	123699	401,57	0,1	0,14742	0,00321	0,35945	0,00484	7,30428	0,1489	2316	37	1980	23	2149	18
TEST17	9	15152	301383	243,09	0,5	0,12993	0,00162	0,30903	0,00309	5,53955	0,06516	2097	22	1736	15	1907	10
TEST49	27	19382	444135	477,89	1,0	0,12211	0,00167	0,27984	0,00284	4,71249	0,06061	1987	24	1591	14	1770	11
TEST46	11	25409	192431	318,61	0,9	0,22134	0,00278	0,47063	0,00496	14,36315	0,16937	2990	20	2486	22	2774	11
TEST112	11	15780	186256	383,04	1,0	0,17393	0,00255	0,38878	0,0043	9,3291	0,12959	2596	24	2117	20	2371	13
TEST133	0	2555	45980	149,63	1,1	0,13946	0,00427	0,30907	0,00557	5,94005	0,16934	2221	52	1736	27	1967	25
TEST103	82	27048	593918	513,88	0,0	0,12827	0,00132	0,27673	0,00251	4,89441	0,04747	2074	18	1575	13	1801	8
TEST76	8	20373	490535	393,73	0,4	0,12608	0,00169	0,267	0,00271	4,64472	0,05932	2044	24	1526	14	1757	11
TEST18	102	24619	594065	450,82	0,4	0,12878	0,00161	0,26841	0,00281	4,78484	0,05796	2081	22	1533	14	1782	10
TEST73	54	4388	441634	143,21	0,0	0,07461	0,00073	0,10115	0,00087	1,04069	0,00949	1058	20	621	5	724	5
TEST19	236	23686	567270	499,65	0,4	0,129	0,00174	0,25613	0,00259	4,55683	0,05781	2084	24	1470	13	1741	11
TEST84	82	24308	670334	426,66	0,4	0,12203	0,00149	0,22929	0,00214	3,85654	0,04405	1986	22	1331	11	1605	9
TEST85	155	18926	318216	256,96	0,4	0,15459	0,00205	0,29563	0,00318	6,34208	0,0797	2397	22	1670	16	2024	11
TEST79	37	10260	132086	236,93	0,5	0,18605	0,00259	0,33947	0,00383	8,73385	0,11461	2708	23	1884	18	2311	12
TEST114	30	5434	161102	303,69	0,8	0,12197	0,00222	0,21857	0,00252	3,67711	0,06252	1985	32	1274	13	1566	14
TEST16	141	25020	615216	382,26	0,4	0,13482	0,00138	0,24367	0,00229	4,53339	0,04438	2162	18	1406	12	1737	8
TEST48	43	17192	446254	345,66	0,6	0,13098	0,00171	0,23277	0,00234	4,20479	0,05144	2111	23	1349	12	1675	10
TEST45	40	33979	834656	543,93	0,8	0,13261	0,00181	0,23349	0,00251	4,30875	0,05609	2133	24	1353	13	1695	11
TEST135	382	23881	368863	341,87	0,2	0,17283	0,002	0,28914	0,00269	6,88881	0,07464	2585	19	1637	13	2097	10
TEST101	363	26189	541990	414,73	0,4	0,15136	0,00162	0,25136	0,00234	5,24653	0,05315	2361	18	1446	12	1860	9
TEST70	57	14966	266113	314,25	0,9	0,16088	0,00138	0,26509	0,00226	5,88056	0,04643	2465	14	1516	12	1958	7
TEST131	73	22816	420695	457,73	0,2	0,16285	0,00185	0,25821	0,00241	5,79785	0,06171	2486	19	1481	12	1946	9
TEST128	205	20491	783682	466,36	1,0	0,12607	0,00161	0,16837	0,00169	2,93274	0,03593	2044	22	1003	9	1390	9
TEST50	248	27528	2024668	523,85	0,6	0,10564	0,00117	0,10551	0,00104	1,54221	0,01659	1725	20	647	6	947	7
TEST80	86	26113	529420	389,91	2,7	0,17829	0,00217	0,21908	0,00219	5,38691	0,0617	2637	20	1277	12	1883	10
TEST146	101	19092	365813	394,57	0,5	0,18052	0,00254	0,21857	0,00222	5,43959	0,07067	2658	23	1274	12	1891	11
TEST116	530	28001	1637503	490,5	0,4	0,11746	0,0016	0,11933	0,00121	1,93674	0,02524	1918	24	727	7	1094	9
TEST117	510	29881	1807361	529,95	0,5	0,11591	0,00137	0,11558	0,00113	1,85186	0,02101	1894	21	705	7	1064	7
TEST125	708	35996	860309	475,37	0,5	0,17064	0,00189	0,19859	0,00191	4,67876	0,04983	2564	18	1168	10	1763	9
TEST81	30	13418	361207	217,28	1,2	0,16259	0,00212	0,18323	0,00195	4,12558	0,05072	2483	22	1085	11	1659	10
TEST129	94	13772	511280	458,8	0,6	0,14761	0,00195	0,14783	0,00152	3,01488	0,03768	2318	22	889	9	1411	10
TEST127	1465	52008	1219086	618,95	0,5	0,18525	0,00189	0,18553	0,00174	4,74458	0,04663	2701	17	1097	9	1775	8
TEST29	806	34329	6762937	860,65	0,0	0,10809	0,00116	0,03757	0,00035	0,56035	0,00571	1767	20	238	2	452	4

Table 2 - part II
Results of U-Pb LA-ICP-MS analyses for the Furquim Quartzite.

#	Pb204 CPS	Pb207 CPS	U238 CPS	Pb PPM	Th/U	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s
Padrao Secundário																	
TEST156	6	2851	749890	133,36	0,06	0,05321	0,00061	0,05369	0,00047	0,39393	0,00422	337,6	25,61	337,2	2,85	337,2	3,07
TEST37	1	3190	851437	131,71	0,06	0,05329	0,00054	0,05371	0,00046	0,39472	0,00376	341	22,64	337,3	2,84	337,8	2,73
TEST152	14	2866	755710	128,88	0,06	0,05274	0,00062	0,05373	0,00046	0,39072	0,00426	317,5	26,28	337,4	2,84	334,9	3,11
TEST153	0	2904	757483	131,48	0,06	0,05364	0,00069	0,05374	0,00048	0,39746	0,00481	355,9	28,8	337,4	2,92	339,8	3,49
TEST157	11	2732	701698	129,82	0,06	0,05319	0,00067	0,05374	0,00047	0,39415	0,00464	336,9	28,3	337,5	2,85	337,4	3,38
TEST155	0	2869	759924	134,84	0,06	0,05287	0,00062	0,05378	0,00047	0,39206	0,0043	323,3	26,34	337,7	2,87	335,9	3,14
TEST5	25	2960	786528	127,97	0,06	0,0532	0,00055	0,05389	0,00047	0,39548	0,00385	337,2	23,12	338,4	2,87	338,4	2,8
TEST6	39	3149	854669	127,64	0,06	0,05309	0,0006	0,05392	0,00048	0,39502	0,00423	332,7	25,15	338,5	2,96	338	3,08
TEST8	4	2860	770014	126,45	0,06	0,05258	0,00055	0,05399	0,00047	0,39143	0,00387	310,7	23,67	338,9	2,85	335,4	2,82
TEST36	0	3177	843699	135,6	0,06	0,05324	0,00054	0,05402	0,00047	0,39656	0,00379	338,9	22,8	339,1	2,85	339,2	2,76
TEST158	34	3020	825601	130,26	0,06	0,05244	0,00073	0,05405	0,0005	0,39085	0,00515	304,6	31,19	339,3	3,08	335	3,76
TEST34	11	3173	836267	133,17	0,06	0,05328	0,00053	0,05405	0,00047	0,39722	0,00373	340,5	22,32	339,3	2,86	339,6	2,71
TEST154	25	2977	787230	138,27	0,06	0,05296	0,00058	0,05413	0,00047	0,39534	0,00408	327,2	24,68	339,8	2,88	338,3	2,97
TEST7	6	3018	808971	131,49	0,06	0,05272	0,00054	0,05414	0,00047	0,3937	0,00382	316,8	23,17	339,9	2,87	337,1	2,78
#	Pb204 CPS	Pb207 CPS	U238 CPS	Pb PPM	Th/U	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s	Pb207/Pb206	1s	Pb206/U238	1s	Pb207/U235	1s
Padrao Primário																	
TEST90	0	3450	443459	139	0,02	0,0604	0,0006	0,0978	0,0009	0,8145	0,0078	618	22	602	5	605	4
TEST9	9	3826	492675	135	0,02	0,0602	0,0006	0,0981	0,0008	0,8136	0,0076	610	21	603	5	605	4
TEST20	0	3706	473455	140	0,02	0,0606	0,0006	0,0981	0,0008	0,8195	0,0077	624	21	603	5	608	4
TEST39	0	3496	451285	142	0,02	0,0599	0,0006	0,0982	0,0008	0,8110	0,0077	599	22	604	5	603	4
TEST159	0	3026	390152	134	0,02	0,0598	0,0007	0,0984	0,0009	0,8112	0,0084	595	24	605	5	603	5
TEST4	9	3665	477484	135	0,02	0,0593	0,0006	0,0985	0,0009	0,8052	0,0076	577	22	606	5	600	4
TEST121	2	3015	401258	138	0,02	0,0579	0,0006	0,0986	0,0009	0,7868	0,0079	524	24	606	5	589	4
TEST3	1	3670	473661	133	0,02	0,0601	0,0006	0,0986	0,0009	0,8168	0,0076	606	21	606	5	606	4
TEST138	8	3042	391993	135	0,02	0,0597	0,0007	0,0987	0,0009	0,8125	0,0083	593	23	607	5	604	5
TEST31	0	3570	465714	140	0,02	0,0589	0,0006	0,0988	0,0009	0,8029	0,0076	565	22	607	5	599	4
TEST72	0	3376	430147	141	0,02	0,0603	0,0006	0,0988	0,0009	0,8221	0,0079	616	22	607	5	609	4
TEST137	0	3169	399681	135	0,02	0,0609	0,0007	0,0989	0,0009	0,8307	0,0084	636	23	608	5	614	5
TEST150	12	3064	391862	136	0,02	0,0599	0,0007	0,0990	0,0009	0,8183	0,0084	601	23	609	5	607	5
TEST21	13	3735	472705	140	0,02	0,0606	0,0006	0,0990	0,0009	0,8278	0,0077	626	21	609	5	612	4
TEST33	0	3633	466133	140	0,02	0,0597	0,0006	0,0992	0,0009	0,8165	0,0077	593	21	610	5	606	4
TEST38	0	3521	449359	142	0,02	0,0599	0,0006	0,0993	0,0009	0,8208	0,0078	601	22	610	5	609	4
TEST105	10	3131	403413	139	0,02	0,0593	0,0006	0,0994	0,0009	0,8121	0,0081	576	23	611	5	604	5
TEST32	0	3608	460841	140	0,02	0,0598	0,0006	0,0994	0,0009	0,8203	0,0077	598	22	611	5	608	4
TEST122	10	3080	394792	138	0,02	0,0595	0,0006	0,0995	0,0009	0,8168	0,0082	587	23	611	5	606	5
TEST160	11	3043	384716	137	0,02	0,0603	0,0007	0,0995	0,0009	0,8272	0,0085	613	24	612	5	612	5
TEST10	0	3739	478524	137	0,02	0,0596	0,0006	0,0996	0,0009	0,8188	0,0077	590	22	612	5	607	4

5. Discussion

The age pattern of 31 zircons reveals a high concentration of ages in the 2.0-2.5 Ga range, with a mode of around 2.2 Ga and an important Archean component. This pattern is similar to that obtained for the Itacolomi Group by Machado *et al*. (1996), thus suggesting that the Furquim Quartzite detrital sequence belongs to this Group. This interpretation is also supported by the obtained minimum age of 2087±19 Ma that is identical to the minimum ages of 2059±58 Ma obtained by Machado *et al*. (1996) and that of 2143±16 obtained by Hartmann *et al*. (2006) for the Itacolomi samples.

The large number of zircon grains of Paleoproteozoic age indicates that the main sediment sources for the Furquim Quartzite are terrains generated during the Transamazonian Orogeny. The Archean ages indicate contribution of the gneissic and greenstone terrains.

The youngest Paleoproterozoic population dated at 2087±19 Ma defines the maximum age of deposition of the precursor sandstones of the Furquim Quartzite.

Quartzite ridges belonging to the Itacolomi Group are more widespread than supposed so far. Besides the locus tipicus near the city of Ouro Preto, the huge mass of quartzite, approximately 1400 m thick, occurring at Serra de Ouro Branco, southern Quadrilátero Ferrífero, previously correlated to the Tamanduá Group or to the Moeda Formation was dated by Machado *et al*.(1996) and correlated to the Itacolomi Group.

The occurrence of a ridge of quartzite belonging to the Itacolomi Group farther east from its locus tipicus near Ouro Preto is probably due to the action of a tectonic event as indicated by its allochtonous nature. Other studies concerning the structural complexity of Furquim Quartzite are necessary to elucidate its geological evolution.

6. Concluding remarks

The results of the geological, petrographic and geochronological investigation of the Furquim Quartzite allowed for a conclusion that the ridge located southeast of the Quadrilátero Ferrífero is possibly an allochtonous unit. The postulated correlation to the Archean Maquiné quartzite as presented in the regional geological map published by CPRM (Baltazar *et al*., 1993) is not supported by the results of U-Pb geochronology on zircon by LA-ICP-MS, which defined several detrital zircon populations ranging from Paleoproterozoic to Archean age. The youngest population dated 2087±19 Ma defines the maximum age for the sedimentation of the precursor sandstone. This age is similar to the age of the youngest zircon population of the Itacolomi Group in the Quadrilátero Ferrífero dated by Machado *et al*. (1996) and Hartmann *et al*. (2006). Therefore, it is possible to conclude that the Furquim Quartzite can be stratigraphically correlated to the quartzites of the Itacolomi Group.

7. Acknowlegments

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