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The provenance of the Caminaberg Quartzite constrained by U-Pb LA-ICP-MS ages of detrital zircons (Görlitz Schist Belt, Saxo-Thuringian Zone)

Provenienz des Caminaberg-Quarzits auf der Basis von U-Pb-LA-ICP-MS-Altern detritischer Zirkone (Görlitzer Schiefergebirge, Saxothuringische Zone)

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Abstract

U-Pb LA ICP-MS ages of detrital zircons from the Devonian Caminaberg Quartzite (Caminaberg-Quarzit) in the Görlitz Schist Belt (Görlitzer Schiefergebirge) point to a provenance from the West African Craton and/or the Sub-Saharan Metacraton. The facies of the Caminaberg Quartzite is unique for a Devonian deposit in the Saxo-Thuringian Zone and has an exotic character. The quartzite body is a large olistolithe in the Lower Carboniferous wildflysch matrix of the Görlitz Schist Belt. The zircon population pattern itself and analogues in southern Turkey demonstrate that the occurrence of a facies with thick deposits of high mature sandstones and quartzites is possible along the peri-Gondwanan margin in Devonian times.

Kurzfassung

U-Pb-LA-ICP-MS-Alter detritischer Zirkone des devonischen Caminaberg-Quarzits im Görlitzer Schiefergebirge sprechen für eine Herkunft der Sedimente vom Westafrikanischen Kraton und/oder vom Sub-Sahara-Metakraton. Die Fazies des Caminaberg-Quarzits ist unter den Ablagerungen des Devons im Saxothuringikum einzigartig und hat einen exotischen Charakter. Der Quarzitkörper ist ein großer Olistolith, welcher in die unterkarbone Wildflyschmatrix des Görlitzer Schiefergebirges eingeformt ist. Das Muster der U-Pb-Alter der Zirkonpopulationen und die Analogie zu altersgleichen Sedimentabfolgen in der Südtürkei zeigen, dass die Verbreitung einer Fazies mit mächtigen siliziklastischen Ablagerungen (sehr reife Sandsteine und Quarzite) entlang des Nordrandes von peri-Gondwana im Devon möglich ist.

1. Introduction and geological setting

In this paper we present U-Pb LA ICP-MS ages of detrital zircon grains from the unique and exotic Caminaberg Quartzite (Caminaberg-Quarzit) which is Devonian in age and situated in the Görlitz Schist Belt (Görlitzer Schiefergebirge). The latter one is a rock complex bordering to the northeast to the Lausitz Block (Fig. 1). It is charac-

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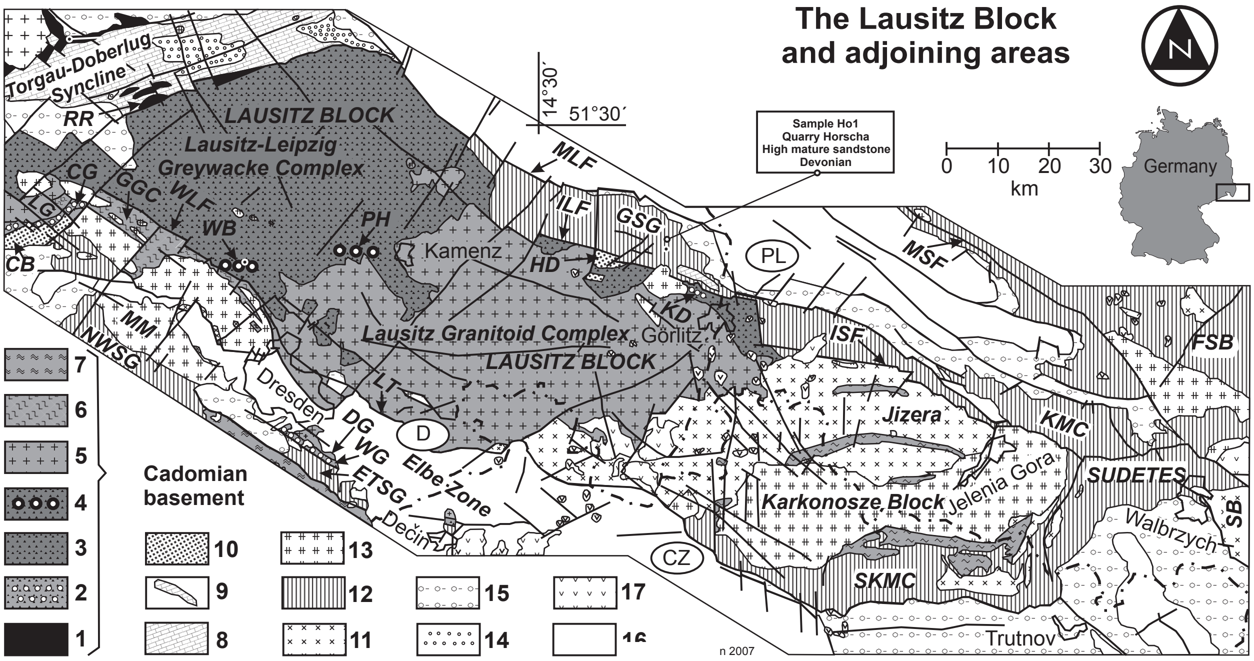

Fig. 1. Geological map of the Lausitz Block (Saxo-Thuringian Zone) including deposits of the Lausitz-Leipzig Greywacke Complex (Lausitz-Leipziger Grauwackenkomplex, latest Ediacaran to Early Cambrian age), Early Cambrian intrusions of the Lausitz Granitoid Complex (Lausitzer Granodioritkomplex), and geological units of adjoining areas (after Linnemann et al. 2008, Kozdrój et al. 2001, Linnemann & Schauer 1999, Linnemann et al. 2010a, b). Geochronological ages are taken from: * Buschmann et al. 2001 (SHRIMP U-Pb), ** Linnemann et al. 2007 (U-Pb on single zircons by LA-ICP-MS), *** Linnemann et al. 2000 (Pb-Pb evaporation age on single zircons), **** Linnemann, McNaughton, Drost, Gehmlich, Tonk – unpublished data (SHRIMP U-Pb).

1, Rothstein Formation (Ediacaran, c. 566 Ma) with sedimentary deposits, black cherts, and volcanic rocks from a Cadomian back-arc basin in the Torgau-Doberlug Syncline; **2**, Diamictites intercalated with Ediacaran passive margin deposits (greywackes, quartzites, quartz shists, shales) of the Weesenstein Group (Elbe Zone) and the Clanzschwitz Group (North Saxon Anticline); at Kunnersdorf near Görlitz, there is a small diamictite occurrence in the Lausitz Block; **3**, Lausitz Group, consisting of monotonous greywacke-schist turbidites that formed in the setting of a retro-arc or foreland basin, respectively (latest Ediacaran to earliest Cambrian); **4**, Microconglomerate intercalated into the Lausitz Group and mainly composed of fragments of black chert; **5**, Early Cambrian intrusions of granodiorites, granites, diorites, and tonalites of the Lausitz Granitoid Complex and adjoining areas (c. 540 – 530 Ma); **6**, Late Ediacaran sedimentary rocks and Early Cambian granitoid intrusions often strongly sheared and metamorphosed under upper greenshist to amphibolite facies conditions; **7**, Late Ediacaran sedimentary rocks strongly sheared and metamorphosed under upper greenshist to amphibolite facies conditions (units of the Erzgebirge Block bordering on the Elbe Zone); **8**, Lower to Middle Cambrian deposits; **9**, A few gigantic Lower Cambrian blocks in a Lower Carboniferous wildflysch deposit; **10**, Lower Ordovician high mature conglomerates, sandstones, and shales (Tremadoc); **11**, Lower Ordovician granitoids (c. 490 – 480 Ma); **12**, Cambro-Ordovician, Silurian, and Lower Carboniferous sedimentary rocks and volcano-sedimentary complexes affected by the Variscan Orogeny (undifferentiated); **13**, Variscan granitoid intrusions (c. 335 – 300 Ma); **14**, Variscan early molasse in Upper Viséan units of the Torgau-Doberlug Syncline; **15**, Molasse deposits and volcanic rocks in Upper Carboniferous and Lower Permian basins; **16**, Meso- and Cenozoic cover rocks; **17**, Tertiary basalts.

CG, Clanzschwitz Group (Ediacaran); **LG**, Laas Granodiorite (Early Cambrian); **WG**, Weesenstein Group (Ediacaran); **DG**, Dohna Granodiorite (Early Cambrian); **GGC**, Großenhain Gneiss Complex originated from Cadomian basement rocks containing Ediacaran pararocks and orthogneisses of Early Cambrian age; **RR**, Rothstein Rock (type area of the Rothstein Formation, Ediacaran); **KD**, Roadcut near the village of Kunnersdorf (occurrence of a diamictite, Lausitz Group, Ediacaran); **WB**, Wetterberg Mountain with a quarry near the village of Ebersbach (occurrence of a microconglomerate containing black cherts, Lausitz Group, Ediacaran); **PH**, village of Petershain (occurrence of a microconglomerate containing black cherts, Lausitz Group, Ediacaran); **CB**, Collmberg Mountain (type area of the Collmberg Formation, Tremadoc); **HD**, Area of the Hohe Dubrau (type area of the Dubrau Formation, Tremadoc); **NWSG**, Nossen-Wilsdruff Schist Belt (Variscan schist belt, part of the complex dextral shear-zone system of the Elbe Zone); **ETSG**, Elbtal Schist Belt (Variscan schist belt, part of the complex dextral shear-zone system of the Elbe Zone); **GSG**, Görlitz Schist Belt (Variscan wildflysch complex bordering to the north of the Lausitz Block); **SKMC**, South Karkonosze Metamorphic Complex; **KMC**, Kaczawa Metamorphic Complex; **FSB**, Fore Sudetic Block; **SB**, Sowie Mountains Block; **MM**, Meissen Massif (Variscan complex of granitoids, c. 335 – 330 Ma); **WLF**, West Lausitz Fault; **LT**, Lausitz Thrust; **MLF**, Main Lausitz Fault; **ILF**, Intra Lausitz Fault; **ISF**, Intra Sudetic Fault; **MSF**, Marginal Sudetic Fault.

Abb. 1. Geologische Karte des Lausitz-Blocks (Saxothuringische Zone).

terized by Lower Carboniferous wildflysch deposits of greywacke-mudstone turbidites, debris flows, and conglomerates with abundant olistoliths of Palaeozoic rock units (Fig. 2; Linnemann & Schauer 1999, Göthel 2001). With the exception of a number of quarries, the area is poorly exposed ("Terra Incognita" of Stille 1951) and mostly known from drill cores (Brause 1969). Some olistoliths are compatible with the Thuringian Facies. This is

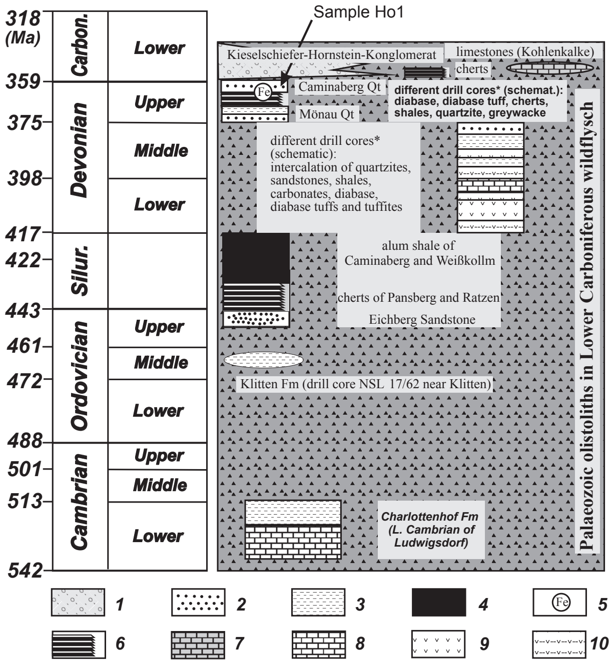

Fig. 2. Schematic lithologic column for the Görlitz Schist Belt showing elements of both, the Thuringian and the Bavarian Facies (modified after Linnemann et al. 2010a). Except for the Lower Carboniferous chert-bearing conglomerate, all Palaeozoic rock bodies are interpreted as olistoliths in a Lower Carboniferous wildflysch matrix (grey coloured triangle-pattern; modified after Brause 1969, Linnemann & Schauer 1999, Göthel 2001). * important drill cores for Devonian strata: NSL 16/62 (Friedersdorf), NSL 11/61 (Litschen), NSL 7/62 (Kreba 1), NSL 15/62 (Halbendorf), NSL 19/63 (Lippen 1), NSL 32/63 (Reichwalde), SP 38 (Spremberg), NSL Uhyst, NSL 6/61 (Neudorf). For details see Brause (1969) and Berger et al. (2008). **1**, Conglomerate (Kieselschiefer-Hornstein-Konglomerat); **2**, Quartzites and sandstones; **3**, Shales and schists; **4**, Alumn shales with graptolithes; **5**, Chamositic sedimentary iron ore underlying the Caminaberg Quartzite; **6**, Bedded cherts; **7**, Dark grey carbon-rich limestone (Kohlenkalk); **8**, Carbonates; **9**, Diabases; **10**, Diabase tuffs and tuffites.

Abb. 2. Schematisches Säulenprofil zur Darstellung der lithologischen Einheiten des Görlitzer Schiefergebirges.

especially the case for the Lower Cambrian units of Ludwigsdorf and the Lower Silurian cherts and alum shales (Fig. 2). The Upper Silurian limestone (Ockerkalk) does not exist and is replaced by alum shales (Fig. 2). Typical elements of the Bavarian Facies are the chert-bearing conglomerate (Kieselschiefer-Hornstein-Konglomerat), Lower Carboniferous black limestones (Kohlenkalk), Upper Devonian cherts, and the Upper Ordovician Eichberg Sandstone (Eichberg-Sandstein), which could be an equivalent to the Döbra Sandstone (Döbra-Sandstein) of the Bavarian Facies (Fig. 2). Several Palaeozoic rock units in the Görlitz Schist Belt are exotic and not known from other parts of the Saxo-Thuringian Zone. These are the Upper Devonian shallow-marine to terrestrial quartzites (Mönau-Quarzit, Caminaberg-Quarzit) and sedimentary iron ores (Fig. 2). Göthel (2001) suggested the formation of an accretionary prism north of the Lausitz Block during the Early Carboniferous to explain the situation. The Görlitz Schist Belt continues to the Sudetes (Bober-Katzbach-Gebirge; Fig. 1).

2. Analytical techniques

2.1. Zircon separation

Zircon concentrates were separated at the Senckenberg Naturhistorische Sammlungen Dresden, Museum für Mineralogie und Geologie. 1 kg samples of unweathered sandstone were crushed and sieved and then a heavy mineral separate was concentrated by use of a heavy liquid (lithium heteropolytungstate in water). A final concentration was made by magnetic separation in a Frantz isodynamic separator. Selection of the zircon grains for U-Pb dating was achieved by hand-picking under a binocular microscope. Zircon grains of all grain sizes and morphological types were selected for single grain analyses by LA-ICP-MS. Zircon crystals were set in synthetic resin mounts, polished to approximately half their thickness, and cleaned in a warm, dilute nitric acid (HNO_3) ultrasonic bath followed by rinsing in de-ionised water.

2.2. LA-ICP-MS U-Pb dating

U-Pb age of single grains was determined by LA-ICP-MS at the Natural History Museum (London) using a New-Wave UP213 frequency quintupled solid-state Nd : YAG-laser (λ = 213 nm) coupled to a PlasmaQuad 3 quadrupole ICP-MS. Samples and standard were placed in an airtight chamber which was flushed by helium (He) gas carrying the ablated material to the ICP-MS, mixed with argon (Ar) prior to injection to the plasma torch. U-Pb and Pb-Pb ratios of the unknowns were determined relative to that of the 91.500 zircon standard with certified ID-TIMS ages of 1062.4 ± 0.4 Ma for $^{206}Pb/^{238}U$ and 1065.4 ± 0.3 Ma for $^{207}Pb/^{206}Pb$. Collection of data spanned up to 180 s per analysis and includes a gas background taken during the initial c. 60 s. To reduce the extent of inter-element laser induced fractionation, the sample was moved relatively to the laser beam along a line. The nominal diameter of the laser beam was 60 µm for the standard and 30 µm or 45 µm for the unknowns. Pulse energy of the laser was 0.03 – 0.06 mJ per pulse for the unknowns and 0.09 mJ per pulse for the standard with an energy density of 3.5 J/cm^2 and a repetition rate of 20 Hz. Further discussion of the analytical protocols used in this study can be found in Fernández-Suárez et al. (2002). Raw data reduction was performed using LAMTRACE, a macro based spreadsheet written by Simon Jackson

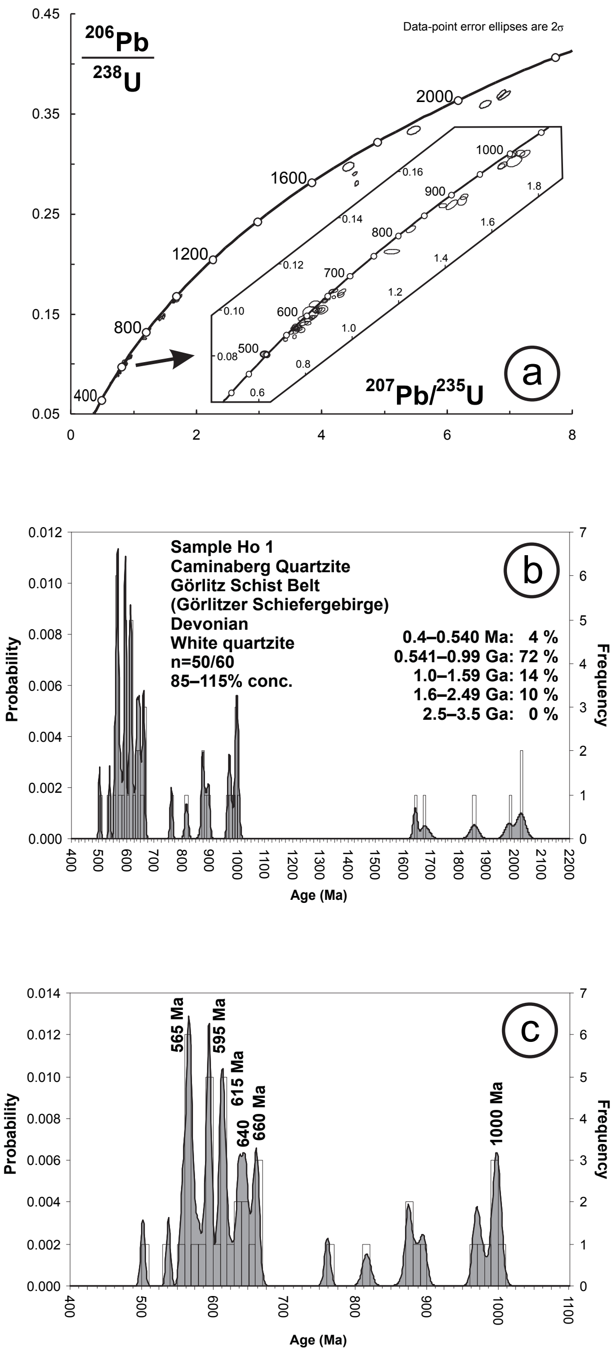

Fig. 3. U-Pb ages of detrital zircon grains from sample Ho1 (Caminaberg Quartzite, Devonian, Görlitz Schist Belt, Saxo-Thuringian Zone): **a**, Concordia diagram; **b**, Combined binned frequency and probability density distribution plots of detrital zircon grains in the range of 400 – 2200 Ma; **c**, Combined binned frequency and probability density distribution plots of detrital zircon grains in the range of 400 – 1100 Ma.

Abb. 3. U-Pb-Alter detritischer Zirkone der Probe Ho1 (Caminaberg-Quarzit).

(Macquarie University, Australia). Calculations and plotting of concordia diagrams were achieved using Isoplot/Ex rev. 2.49 (Ludwig 2001), probability density plots and histograms were prepared by AgeDisplay (Sircombe 2004).

3. Results

60 detrital zircon grains were analyzed from sample Ho1 of the white and high mature Caminaberg Quartzite. For the coordinates of the sample location, see the heading of Tab. 1. U-Pb data are shown in Tab. 1 and Fig. 3. Of 60 measured grains, 50 grains were concordant (in the range of 85 – 115%; Fig. 3). The youngest concordant grain is 502 ± 6 Ma old. The oldest zircon has an age of 2158 ± 19 Ma. The sample yields two Cambrian zircons (502 ± 6 Ma and 538 ± 6 Ma). 72% of all zircons in the sample are Neoproterozoic in age ranging from ~546 – 896 Ma (Fig. 3, Tab. 1). 14% of all grains show Mesoproterozoic ages (~1022 – 1050 Ma). 10% of all zircons in the sample are Palaeoproterozoic in age in the range of ~1920 – 2158 Ma (Fig. 3, Tab. 1). No Archaean grains occur. The probability plot shows distinct peaks at ~565 Ma, 595 Ma, 615 Ma, 640 Ma, 660 Ma, and ~1000 Ma (Fig. 3).

4. Discussion and conclusion

On the base of the U-Pb dating of the detrital zircon grains from the Caminaberg Quartzite a derivation of the clastic debris from the West African Craton or from the Sub-Saharan Metacraton is concluded in this paper. Typical for the provenance from the West African Craton in the pattern of detrital zircon spectra is a magmatic gap in the range of c. 1.0 – 1.6 Ga, peaks at c. 2.0 Ga and c. 2.5 Ga, and a few Archean ages (e.g,. Linnemann et al. 2011, Drost et al. 2010). Observations of zircon patterns derived from the Sub-Saharan Metacraton show distict peaks at ~0.9 – 1.2 Ga, 1.6 – 2.2 Ga, 2.3 – 2.7 Ga, and 3.0 – 3.4 Ga (Altumi et al. 2013). All other continents, which are principal candidates for sediment supply during Ordovician times (Baltica, Avalonia, Amazonia) show a very strong portion of Mesoproterozoic zircon grains (Nance & Murphy 1994, Keppie et al. 2003, Gerdes & Zeh 2006, Linnemann et al. 2011). The relative lack of Mesoproterozoic zircons in the Caminaberg Quartzite completely rules out Baltica, Avalonia, and Amazonia as sources for the siliciclastic sediments of the Caminaberg Quartzite. Instead, the age patterns of detrital zircons from the Caminaberg Quartzite clearly indicate the fingerprint of the West African Craton and/or the Sub-Saharan Metacraton. The Devonian sediments of the investigated quartzite were accumulated at the Gondwanan margin of NW Africa. The zircons derived from the cratonic hinterland are mixed with Neoproterozoic ones derived from the Cadomian basement and/or the Pan-African fold belts. Such grains typically dominate zircon assemblages of northwestern

Table 1. U-Pb LA-ICP-MS detrital zircon data of sample Ho1, n = 50/60, concordant in the range of 80–120%, high mature quartzite (Caminaberg Quartzite), age of sedimentation is Devonian, quarry near Horscha, Görlitz Schist Belt, Saxo-Thuringian Zone, Germany, coordinates: 51°18′7.76″ N, 14°44′49.16″ E.

Tabelle 1. U-Pb-LA-ICP-MS detritischer Zirkone der Probe Ho1.

Spot	Grain	206/238	2 σ	207/235	2 σ	207/206	2 σ	Age 206/238	2 σ	Age 207/235	2 σ	Age 207/206	2 σ	conc%
mr09c07	HO27	0.081	0.0005	0.6261	0.0049	0.0561	0.0004	502	6	494	8	454	7	111
mr09c14	HO34	0.0871	0.0005	0.7155	0.0062	0.0596	0.0006	538	6	548	9	586	11	92
mr09b15	HO23	0.0884	0.0006	0.7542	0.0048	0.0619	0.0006	546	7	571	7	670	13	81
mr09d11	HO43	0.0902	0.0005	0.7407	0.0059	0.0596	0.0005	557	7	563	9	586	11	95
mr09a12	HO8	0.0908	0.0007	0.7596	0.0077	0.0607	0.0007	560	8	574	12	626	14	89
mr09b11	HO19	0.0914	0.0008	0.7828	0.0103	0.0621	0.0010	564	10	587	15	676	21	83
mr09a06	HO2	0.0917	0.0007	0.7641	0.0076	0.0604	0.0007	566	9	576	11	618	14	92
mr09a08	HO4	0.0918	0.0006	0.7507	0.0059	0.0593	0.0005	566	7	569	9	576	10	98
mr09b07	HO15	0.092	0.0008	0.7680	0.0127	0.0605	0.0011	567	10	579	19	622	23	91
mr09c12	HO32	0.0919	0.0005	0.7603	0.0062	0.0600	0.0006	567	7	574	9	602	11	94
mr09d09	HO41	0.0923	0.0007	0.7540	0.0101	0.0593	0.0007	569	8	571	15	576	14	99
mr09b16	HO24	0.0927	0.0008	0.7640	0.0130	0.0598	0.0011	572	10	576	20	594	23	96
mr09b12	HO20	0.0941	0.0006	0.7949	0.0126	0.0612	0.0008	580	8	594	19	646	16	90
mr09c08	HO28	0.0942	0.0005	0.8115	0.0088	0.0624	0.0008	581	6	603	13	688	18	84
mr09e14	HO58	0.0959	0.0006	0.8133	0.0116	0.0615	0.0009	590	8	604	17	656	18	90
mr09b14	HO22	0.0964	0.0007	0.7891	0.0136	0.0594	0.0009	593	8	591	20	580	18	102
mr09a16	HO12	0.0966	0.0003	0.8095	0.0096	0.0608	0.0006	594	4	602	14	630	13	94
mr09a15	HO11	0.0967	0.0006	0.8297	0.0079	0.0622	0.0007	595	7	613	12	680	14	88
mr09c06	HO26	0.097	0.0004	0.8381	0.0070	0.0627	0.0007	597	5	618	10	696	14	86
mr09d13	HO45	0.0988	0.0018	0.8233	0.0221	0.0604	0.0020	607	22	610	33	618	41	98
mr09b05	HO13	0.0997	0.0007	0.8561	0.0111	0.0622	0.0006	613	9	628	16	682	13	90
mr09c10	HO30	0.0998	0.0006	0.8432	0.0085	0.0613	0.0007	613	7	621	13	648	15	95
mr09a11	HO7	0.0999	0.0007	0.8683	0.0109	0.0630	0.0007	614	9	635	16	708	16	87
mr09d12	HO44	0.1	0.0007	0.8477	0.0097	0.0615	0.0007	615	9	623	14	654	15	94
mr09e11	HO55	0.1001	0.0012	0.8715	0.0168	0.0631	0.0016	615	15	636	25	710	36	87
mr09d05	HO37	0.1025	0.0009	0.8400	0.0150	0.0595	0.0010	629	12	619	22	582	20	108
mr09c11	HO31	0.1037	0.0005	0.8834	0.0076	0.0618	0.0005	636	6	643	11	666	11	95
mr09d07	HO39	0.1043	0.0005	0.8847	0.0079	0.0615	0.0006	639	6	644	11	656	12	97
mr09a10	HO6	0.1049	0.0004	0.8959	0.0074	0.0619	0.0006	643	5	650	11	670	12	96
mr09e16	HO60	0.1055	0.0004	0.9229	0.0049	0.0634	0.0004	647	5	664	7	722	9	90
mr09a05	HO1	0.1065	0.0007	0.9527	0.0093	0.0649	0.0006	652	9	680	13	768	14	85
mr09a07	HO3	0.1077	0.0010	0.9564	0.0120	0.0644	0.0006	660	12	681	17	752	13	88
mr09c16	HO36	0.108	0.0006	0.9125	0.0075	0.0613	0.0004	661	8	658	11	648	9	102
mr09b06	HO14	0.1082	0.0006	0.9211	0.0126	0.0618	0.0007	662	7	663	18	664	16	100
mr09e12	HO56	0.1253	0.0007	1.1714	0.0219	0.0678	0.0013	761	8	787	29	862	32	88
mr09c09	HO29	0.135	0.0010	1.2536	0.0137	0.0674	0.0006	816	12	825	18	848	15	96
mr09b10	HO18	0.1452	0.0006	1.3906	0.0107	0.0694	0.0006	874	8	885	14	910	15	96

Table 1 continued.

Spot	Grain	206/238	2 σ	207/235	2 σ	207/206	2 σ	Age 206/238	2 σ	Age 207/235	2 σ	Age 207/206	2 σ	conc%
mr09c05	H025	0.1456	0.0014	1.4289	0.0163	0.0711	0.0006	877	17	901	21	960	15	91
mr09c15	H035	0.1472	0.0012	1.4732	0.0128	0.0726	0.0007	885	15	919	16	1000	20	89
mr09e07	H051	0.1491	0.0008	1.4817	0.0107	0.0721	0.0005	896	9	923	13	986	13	91
mr09e13	H057	0.1622	0.0008	1.6408	0.0098	0.0733	0.0004	969	10	986	12	1022	11	95
mr09a13	H09	0.1627	0.0010	1.6471	0.0130	0.0734	0.0005	972	11	988	16	1024	14	95
mr09d08	H040	0.1645	0.0016	1.6964	0.0219	0.0748	0.0009	982	19	1007	26	1062	26	92
mr09b08	H016	0.167	0.0008	1.6847	0.0110	0.0731	0.0005	996	10	1003	13	1016	13	98
mr09c13	H033	0.1676	0.0011	1.7421	0.0146	0.0754	0.0005	999	13	1024	17	1078	14	93
mr09e09	H053	0.1677	0.0009	1.6955	0.0086	0.0733	0.0005	999	11	1007	10	1022	14	98
mr09b13	H021	0.1679	0.0009	1.7222	0.0131	0.0744	0.0006	1001	11	1017	15	1050	18	95
mr09e05	H049	0.2809	0.0018	4.5565	0.0187	0.1176	0.0007	1596	20	1741	14	1920	22	83
mr09b09	H017	0.2903	0.0012	4.5277	0.0222	0.1131	0.0005	1643	14	1736	17	1848	15	89
mr09d06	H038	0.2974	0.0029	4.4232	0.0593	0.1079	0.0014	1678	32	1717	46	1762	45	95
mr09e08	H052	0.3337	0.0027	5.4659	0.0672	0.1188	0.0013	1857	30	1895	47	1936	42	96
mr09e06	H050	0.3598	0.0026	6.6090	0.0595	0.1332	0.0010	1981	28	2061	37	2140	32	93
mr09e15	H059	0.3684	0.0030	6.9100	0.0650	0.1360	0.0006	2022	33	2100	39	2176	20	93
mr09a09	H05	0.3699	0.0027	6.8660	0.0467	0.1346	0.0006	2029	30	2094	28	2158	19	94

peri-Gondwanan siliciclastics of Neoproterozoic to Palaeozoic age.

The Caminaberg Quartzite is unique for a Devonian deposit in the Saxo-Thuringian Zone and has an exotic character. Usually, Devonian sediments of the Thuringian Facies are characterized by fine-grained siliciclastics, carbonates, and volcanics. The Devonian of the Bavarian Facies is represented by cherts. The Caminaberg Quartzite is a large olistolithe in the Lower Carboniferous wildflysch matrix of the Görlitz Schist Belt (Linnemann et al. 2010a). A similar Devonian facies of thick high mature sandstones to our knowledge only occurs in southern Turkey (Wehrmann et al. 2010). That has no meaning concerning the provenance of the Caminaberg Quartzite, but it demonstrates that the development of a facies consisting of thick deposits of high mature sandstones and quartzites is possible along the peri-Gondwanan margin in Devonian times.

5. References

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