

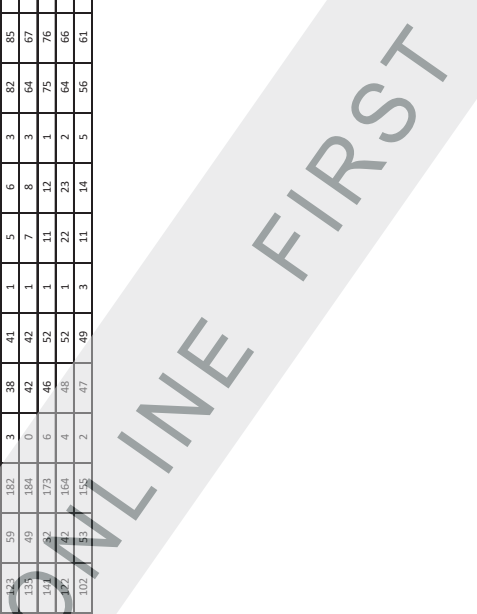
Supplement 1. Petrography

Sample	Interval (m)	Grain Size (µm)	Sorting	Roundness	Maturity	Qm	Qp	Q	Pt	K+P	F	Lex	Lp	Lv	Lcarb	Ls	TQM	Mp	Lm	M	HM	Misc	Sum	Sum-QPL	Q (%)	F (%)	L (%)	Qm (%)	Lt (%)	
S1 ¹	1572.05	130	well/moderately well sorted	angular to sub-rounded	matures-submature	123	46	169	3	41	44	0	14	14	1	96	37	32	6	38	18	15	1	396	362	46.7	12.1	41.2	34	53.9
S1 ²	2100.00	130	well/moderately well sorted	angular to sub-rounded	matures-submature	114	50	164	1	39	40	1	7	8	1	93	94	19	12	31	63	8	2	410	337	48.6	11.9	39.5	33.8	54.3
S2	1768.85	100	well/moderately well sorted	angular to sub-rounded	matures-submature	115	31	146	4	36	40	1	8	9	0	78	78	26	9	35	32	13	0	353	308	47.4	13	39.6	37.3	49.7
S3	2305.80	100	moderately well sorted	angular to sub-rounded	submature	130	40	170	2	39	41	0	6	6	0	82	82	19	8	27	92	8	1	407	306	55.6	13.4	31	42.5	44.1
S4 ¹	827.70	110	well/moderately well sorted	angular to sub-rounded	matures-submature	129	33	162	7	54	61	1	7	8	5	60	65	14	9	23	91	30	4	444	319	50.8	19.1	30.1	40.4	40.5
S4 ²	904.50	100	well/moderately well sorted	angular to sub-rounded	matures-submature	131	42	173	5	46	51	2	9	11	4	65	69	23	17	40	46	22	1	413	344	50.3	14.8	34.9	38.1	47.1
S5	1436.15	110	well/moderately well sorted	angular to sub-rounded	matures-submature	113	36	149	0	50	50	3	18	21	8	67	75	25	25	50	82	10	2	439	345	43.2	14.5	42.3	32.8	52.7
S6 ¹	2929.65	80	well/moderately well sorted	angular to sub-rounded	matures-submature	114	47	161	2	51	53	0	7	7	0	83	83	15	6	15	34	16	5	370	315	51.1	16.8	32.1	36.2	47
S6 ²	3068.75	90	moderately sorted	angular to sub-rounded	submature	123	52	175	0	45	45	0	7	7	0	83	83	15	6	21	64	12	2	409	331	52.9	13.6	33.5	37.2	49.2
D1	1992.25	100	well/moderately well sorted	angular to sub-rounded	matures-submature	107	60	167	1	43	44	1	11	12	3	79	82	19	15	34	81	12	2	434	339	49.3	13	37.7	31.6	55.4
D2	1987.70	130	well/moderately well sorted	angular to sub-rounded	matures-submature	101	40	141	3	36	39	0	5	5	4	87	91	23	6	29	66	11	3	385	305	46.2	12.8	41	33.1	54.1
D3	1098.95	140	well/moderately well sorted	angular to sub-rounded	matures-submature	140	42	182	2	37	39	1	9	10	0	68	68	18	5	23	46	6	5	379	322	56.5	12.1	31.4	43.5	44.4
D3 ¹	2127.25	150	well/moderately well sorted	angular to sub-rounded	matures-submature	126	63	189	2	25	27	1	6	7	0	75	75	26	12	38	63	8	0	407	336	56.3	8	35.7	37.5	54.5
D4 ¹	3331.20	120	well/moderately well sorted	angular to sub-rounded	matures-submature	143	59	182	3	38	41	1	5	6	3	82	85	12	6	18	32	15	4	383	332	54.8	12.4	32.8	37	50.6
D4 ²	3760.85	220	moderately well sorted	angular to sub-rounded	submature	135	49	184	0	42	42	1	7	8	3	64	67	9	9	18	35	7	4	365	319	57.7	13.2	29.1	42.3	44.5
D5 ¹	2818.95	150	well/moderately well sorted	angular to sub-rounded	matures-submature	141	82	173	6	46	52	1	11	12	1	75	76	25	14	39	48	9	1	410	352	49.1	14.8	36.1	40	45.2
D5 ²	4012.95	130	well/moderately well sorted	angular to sub-rounded	matures-submature	92	42	164	4	48	52	1	22	23	2	64	66	17	12	29	52	8	2	386	334	49.1	15.6	35.3	36.5	47.9
D6	1689.90	170	well/moderately well sorted	angular to sub-rounded	matures-submature	102	53	158	2	47	49	3	11	14	5	56	61	23	16	39	61	12	2	393	318	48.7	15.4	35.9	32.1	52.5

Table 1.1. Modal composition of the Upper Miocene sandstones from the Svba (S1-S6) and Drava (D1-D6) depressions.

Qm	monocrystalline quartz
Qp	polycrystalline quartz
Q	total quartz
Pt	twinned plagioclase feldspar
K+P	potassium (alkali) feldspar, non-twinned plagioclase feldspar, sericitized plagioclase feldspar, albitized potassium (alkali) feldspar, and other altered and partly dissolved plagioclase or potassium (alkali) feldspar
F	total feldspar
Lex	extrusive (volcanic) rock
Lp	intrusive (plutonic) rock
Lv	total magmatic (igneous) rock
Lcarb	clastic sediment
Lcarb	carbonatic sediment
Ls	total sedimentary rock
TQM	quartz-mica tectonite
Mp	polycrystalline mica
Lm	total metamorphic rock
M	phyllonite
HM	accessory heavy mineral and opaque mineral
Misc	miscellaneous and unidentified grain

Explanation of the abbreviations and symbols in Table 1.1.



Supplement 2. Heavy Minerals

Sample	Interval (m)	Fraction	HMC	opaque	mica	HM	Sum	Garnet	Apatite	Zircon	Tourmaline	Rutile	Brookite	Anatase	Epidote	Clinzoisite	Zoisite	Titanite	Chorhtoid	Chromite	Staurolite	Kyanite	X	Sum	
S1 ¹	1572.05	0.063 - 0.125	9.6	10	39	52	100	76	10	1	3	5	0	0	3	0	0	0	0	0	0	1	0	1	100
S1 ²	2100.00	0.063 - 0.125	6.5	3	82	15	100	79	11	1	5	3	0	0	0	0	0	0	0	0	0	0	0	1	100
S2	1768.85	0.063 - 0.125	5.1	2	81	17	100	66	18	2	8	3	0	0	1	0	0	0	0	0	0	0	0	1	100
S3	2305.80	0.063 - 0.125	3.1	4	78	18	100	67	14	1	8	10	0	0	0	0	0	0	0	0	0	0	0	1	100
S4 ¹	827.70	0.063 - 0.125	0.2	5	59	36	100	28	7	2	2	1	0	0	51	6	1	2	0	0	0	0	0	1	100
S4 ²	904.50	0.063 - 0.125	5.6	2	73	24	100	33	9	2	3	2	0	0	38	11	1	1	0	0	0	0	0	1	100
S5	1436.15	0.063 - 0.125	4.0	3	84	14	100	73	15	2	3	4	0	0	0	0	0	0	0	0	0	0	0	1	100
S6 ¹	2529.65	0.063 - 0.125	4.0	3	86	11	100	47	31	4	9	6	0	0	0	0	0	0	0	0	0	0	0	1	100
S6 ²	3068.75	0.063 - 0.125	5.5	3	81	15	100	59	21	1	10	7	0	0	0	0	0	0	0	0	0	0	0	1	100
D1	1992.25	0.063 - 0.125	4.7	2	83	15	100	45	29	3	12	8	0	0	0	0	0	0	0	0	0	0	0	1	100
D2	1398.70	0.063 - 0.125	9.1	6	50	44	100	84	8	1	2	4	0	0	0	0	0	0	0	0	0	0	0	1	100
D3 ¹	1098.95	0.063 - 0.125	6.8	2	68	30	100	72	15	1	5	5	0	0	0	0	0	0	0	0	0	0	0	1	100
D3 ²	2127.25	0.063 - 0.125	5.6	4	72	23	100	49	20	5	11	12	0	0	0	0	0	0	0	0	0	0	0	2	100
D4 ¹	3331.20	0.063 - 0.125	3.6	2	89	8	100	30	48	5	10	4	0	0	0	0	0	0	0	0	0	0	0	2	100
D4 ²	3760.85	0.063 - 0.125	5.6	4	87	9	100	38	35	4	15	11	0	0	0	0	0	0	0	0	0	0	0	1	100
D5 ¹	2818.95	0.063 - 0.125	4.0	3	71	26	100	70	17	2	5	3	0	0	0	0	0	0	0	0	0	0	0	1	100
D5 ²	4010.95	0.063 - 0.125	5.4	1	95	4	100	33	45	5	11	4	0	0	0	0	0	0	0	0	0	0	0	1	100
D6	1689.90	0.063 - 0.125	5.0	4	76	20	100	66	21	2	4	3	0	0	0	0	0	0	0	0	0	0	0	1	100

Table 2.1. Heavy mineral composition of the Upper Miocene sandstones from the Sava (S1-S6) and Drava (D1-D6) depressions.

Zircon	Rutile	Apatite	Tourmaline	Garnet	Balance	Interpretation
-1	-1	-1	-1	1	b1	Selective dissolution
-1	-1	1	1	0	b2	Selective sorting
0	0	-1	1	0	b3	Provenance indicator
-1	1	0	0	0	b4	Provenance indicator

Table 2.2. Sign matrix and interpretations of modelled balances. Minerals with 1 are in numerator, with -1 are in denominator, while those with 0 are not included in balance construction.

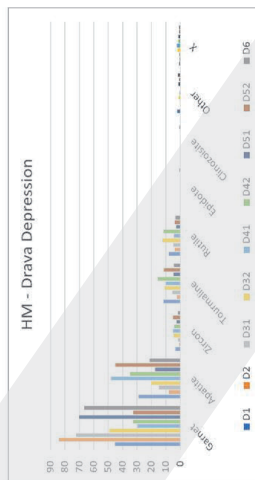
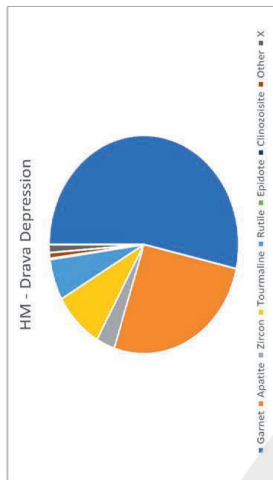
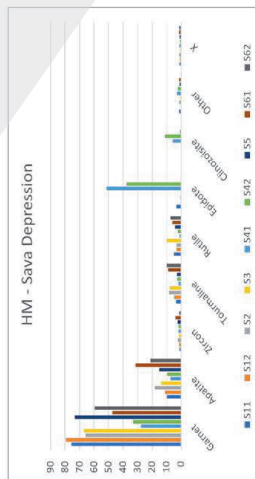
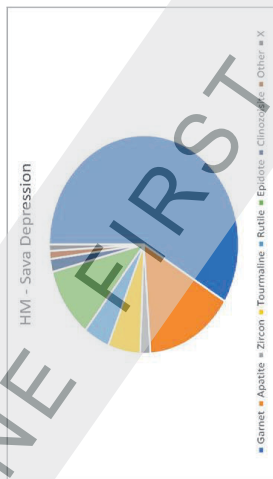


Figure 2.1. The proportion of heavy minerals in the Upper Miocene sandstones from the Sava and Drava depressions and the distribution of heavy minerals per sample.

Supplement 3. Raman Spectroscopy

Sample	No	Alm	Py	Sp	An	Gro	Peak 1 (210-245)	Peak 2 (340-368)	Peak 3 (369-380)	Peak 4 (515-560)	Peak 5 (800-870)	Peak 6 (870-920)
S1 ^a	GRANAT9.1	0.96	0.00	0.02	0.02	0.00	216.54	341.12	369.49	555.14	860.12	914.82
S1 ^a	GRANAT10.1	0.84	0.12	0.02	0.02	0.00	214.79	344.91	371.21	555.42	861.94	915.80
S1 ^a	GRANAT11.1	0.86	0.10	0.04	0.00	0.00	215.12	343.67	371.56	555.57	862.78	916.18
S1 ^a	GRANAT12.2	0.58	0.18	0.06	0.00	0.18		350.71	371.27	555.82	855.66	910.40
S1 ^a	GRANAT13.0	0.60	0.20	0.00	0.00	0.20		347.93	372.78	554.92	856.08	911.98
S1 ^a	GRANAT14.0	0.96	0.04	0.00	0.00	0.00		343.01	371.49	555.76	863.16	916.56
S1 ^a	GRANAT14.1	0.84	0.16	0.00	0.00	0.00		344.30	371.11	555.41	871.43	915.89
S1 ^a	GRANAT16.0	0.88	0.12	0.00	0.00	0.00		344.85	371.09	555.85	865.43	914.76
S1 ^a	GRANAT18.0	0.76	0.18	0.06	0.00	0.00		345.90	372.17	555.96	863.01	917.45
S1 ^a	GRANAT19.0	0.74	0.18	0.06	0.02	0.00		345.80	372.15	555.76	862.00	916.11
S1 ^a	GRANAT20.0	0.76	0.18	0.00	0.06	0.00		345.81	371.66	554.54	861.73	914.24
S1 ^a	GRANAT1.0	0.88	0.12	0.00	0.00	0.00	213.73	344.14	370.78	555.43	864.34	916.34
S1 ^a	GRANAT2.0	0.54	0.18	0.20	0.00	0.08		349.52	371.02	555.98	857.83	913.03
S1 ^a	GRANAT3.0	0.38	0.14	0.48	0.01	0.00	216.52	347.34	376.20	557.41	856.85	911.96
S1 ^a	GRANAT4.0	0.74	0.10	0.00	0.02	0.16		349.95	365.84	555.50	859.57	908.98
S1 ^a	GRANAT4.1	0.74	0.16	0.02	0.04	0.04		346.93	370.89	555.12	860.13	913.76
S1 ^a	GRANAT5.0	0.64	0.10	0.24	0.02	0.00	214.39	346.58	369.54	555.33	858.05	913.12
S1 ^a	GRANAT6.0	0.54	0.18	0.14	0.00	0.14		350.66	371.31	555.46	856.36	911.15
S1 ^a	GRANAT7.0	0.86	0.14	0.00	0.00	0.00		345.07	371.00	555.97	864.16	916.89
S1 ^a	GRANAT8.0	0.80	0.14	0.00	0.04	0.02		345.95	370.53	555.33	861.07	914.25
S1 ^a	GRANAT9.0	0.64	0.08	0.26	0.00	0.02		346.68	369.64	555.31	858.51	913.93
S1 ^a	granat10.0	0.48	0.02	0.50	0.00	0.00		346.17	371.17	555.13	855.82	911.67
S1 ^a	granat11.0	0.74	0.22	0.00	0.04	0.00		346.81	372.16	555.92	862.81	915.45
S1 ^a	granat12.0	0.58	0.14	0.00	0.02	0.26		351.90	370.48	554.09	852.69	906.66
S1 ^a	GRANAT12.1	0.54	0.26	0.04	0.02	0.14		351.62	373.71	555.23	858.51	910.91
S1 ^a	GRANAT13.0	0.72	0.18	0.08	0.02	0.00		346.03	373.14	555.75	861.87	915.90
S1 ^a	GRANAT14.0	0.78	0.00	0.00	0.00	0.22		349.47	360.90	555.05	853.90	908.24
S1 ^a	GRANAT16.0	0.44	0.12	0.32	0.00	0.12		349.73	374.25	555.11	855.37	908.79
S1 ^a	GRANAT17.0	0.78	0.20	0.00	0.00	0.02		347.57	372.70	557.21	869.23	911.49
S1 ^a	GRANAT18.0	0.00	0.26	0.62	0.00	0.12		354.76	378.38	554.82	852.60	907.33
S1 ^a	GRANAT18.1	0.00	0.24	0.62	0.00	0.14		354.86	375.50	554.84	850.93	907.34
S6 ^a	GRANAT1.0	0.46	0.06	0.48	0.00	0.00		346.79	371.81	554.68	856.63	912.12
S6 ^a	GRANAT3.0	0.74	0.18	0.02	0.06	0.00	214.53	346.87	371.08	554.85	861.20	913.21
S6 ^a	GRANAT5.0	0.72	0.16	0.02	0.10	0.00	212.82	347.12	368.52	554.39	856.88	911.49
S6 ^a	GRANAT6.0	0.72	0.06	0.20	0.02	0.00		345.00	371.94	554.67	859.51	913.86
S6 ^a	GRANAT7.0	0.48	0.02	0.46	0.00	0.04		346.41	372.75	555.08	855.28	909.96
S6 ^a	GRANAT7.1	0.40	0.20	0.20	0.00	0.20		350.17	376.20	554.27	854.14	909.32
S6 ^a	GRANAT8.0	0.72	0.00	0.08	0.00	0.20		347.39	372.13	554.23	854.73	906.60
S6 ^a	GRANAT9.0	0.40	0.20	0.20	0.00	0.20		350.00	378.82	554.19	853.24	908.11
S6 ^a	GRANAT9.1	0.48	0.24	0.00	0.02	0.26		354.63	368.39	554.46	852.19	908.51
S6 ^a	GRANAT10.0	0.62	0.14	0.20	0.02	0.02		349.10	371.26	555.34	859.15	863.44
S6 ^a	GRANAT12.0	0.72	0.12	0.02	0.02	0.12		348.24	368.22	555.15	856.84	912.11
S6 ^a	GRANAT12.1	0.58	0.10	0.30	0.02	0.00	216.49	346.48	371.35	555.03	857.93	912.70
S6 ^a	GRANAT14.0	0.88	0.12	0.00	0.00	0.00		343.64	370.73	554.69	865.81	916.12
S6 ^a	GRANAT15.0	0.80	0.10	0.00	0.02	0.08		346.50	369.89	555.24	859.41	912.41
D3 ^a	granat1.0	0.84	0.12	0.00	0.04	0.00		345.05	371.05	555.3	861.47	914.87
D3 ^a	granat4.0	0.86	0.14	0.00	0.00	0.00		345.03	372.13	555.58	864.96	916.36
D3 ^a	granat5.0	0.56	0.08	0.12	0.00	0.24		350.63	369.36	554.78	851.22	907.51
D3 ^a	granat5.1	0.84	0.16	0.00	0.00	0.00	213.59	345.25	371.17	556.27	864.84	917.56
D3 ^a	granat7.0	0.50	0.26	0.02	0.00	0.22		353.52	370.24	555.81	855.39	910.19
D3 ^a	granat8.0	0.78	0.06	0.14	0.00	0.02	215.6	345.06	371.46	556.69	861.20	912.32
D3 ^a	granat9.0	0.74	0.14	0.00	0.02	0.10		348.21	369.74	555.32	858.82	912.45
D3 ^a	GRANAT10.0	0.74	0.20	0.04	0.02	0.00		347.13	370.36	556.09	862.68	916.45
D3 ^a	GRANAT11.0	0.68	0.14	0.00	0.02	0.16		349.54	370.16	554.81	856.44	910.49
D3 ^a	GRANAT12.0	0.60	0.16	0.24	0.00	0.00		347.05	371.20	556.07	859.83	915.91
D3 ^a	GRANAT13.0	0.46	0.20	0.34	0.00	0.00		348.30	375.79	555.76	860.43	913.61
D3 ^a	GRANAT14.0	0.84	0.14	0.00	0.02	0.00	216.32	345.94	370.65	555.76	863.70	915.07
D3 ^a	GRANAT15.0	0.76	0.18	0.06	0.00	0.00		346.18	371.31	556.49	863.79	917.14
D3 ^a	GRANAT16.0	0.58	0.06	0.32	0.00	0.04		346.86	371.31	555.29	857.29	911.83
D3 ^a	GRANAT18.0	0.38	0.28	0.12	0.00	0.22		354.02	375.08	555.80	855.11	908.44
D3 ^a	granat20.0	0.40	0.14	0.34	0.00	0.12		350.64	370.47	555.00	853.81	910.42
D3 ^a	granat21.0	0.74	0.06	0.16	0.04	0.00	218.2	344.62	371.43	553.70		913.64
D3 ^a	granat24.0	0.12	0.16	0.58	0.00	0.14		353.36	372.99	554.78	850.24	907.5
D3 ^a	GRANAT1.0	0.62	0.14	0.24	0.00	0.00		346.82	370.83	555.68	860.35	915.31
D3 ^a	GRANAT2.0	0.84	0.16	0.00	0.00	0.00		345.47	371.84	556.23	864.76	917.66
D3 ^a	GRANAT3.0	0.80	0.16	0.00	0.02	0.02		346.35	371.07	555.56	863.51	914.39
D3 ^a	GRANAT4.0	0.38	0.28	0.08	0.02	0.24		354.45	374.57	554.53	854.16	907.2
D3 ^a	GRANAT5.0	0.76	0.18	0.06	0.00	0.00		346.46	371.52	556.06	863.99	916.59
D3 ^a	granat5.1	0.74	0.20	0.06	0.00	0.00		346.42	371.53	556.41	863.79	916.88
D3 ^a	GRANAT7.0	0.84	0.16	0.00	0.00	0.00		345.19	371.11	555.92	864.13	917.19
D3 ^a	GRANAT8.1	0.58	0.08	0.32	0.02	0.00		346.41	371.62	554.66	858.41	912.5
D3 ^a	GRANAT9.0	0.84	0.16	0.00	0.00	0.00		346.59	369.16	555.88	865.84	915.15
D3 ^a	GRANAT9.1	0.68	0.10	0.00	0.00	0.22		350.69	367.20	554.47	855.82	908.62
D3 ^a	GRANAT11.0	0.76	0.18	0.00	0.06	0.00		346.42	371.10	555.02	861.40	914.5
D3 ^a	GRANAT11.1	0.84	0.16	0.00	0.00	0.00		345.55	372.33	556.06	864.45	917.89
D3 ^a	GRANAT12.0	0.74	0.24	0.00	0.02	0.00		346.69	372.21	556.38	863.57	917.11
D3 ^a	GRANAT13.0	0.72	0.18	0.10	0.00	0.00		346.39	372.14	556.38	862.25	916.86
D3 ^a	GRANAT15.0	0.70	0.08	0.14	0.00	0.08		347.06	370.65	555.23	858.29	912.27
D3 ^a	GRANAT16.0	0.76	0.24	0.00	0.00	0.00		346.66	370.79	556.51	864.16	917.94
D5 ^a	GRANAT1.0	0.84	0.10	0.02	0.04	0.00	214.57	344.70	370.77	555.13	860.32	914.57
D5 ^a	GRANAT2.0	0.66	0.08	0.00	0.00	0.26		351.07	367.82	553.93	853.32	907.13
D5 ^a	GRANAT3.1	0.60	0.20	0.00	0.00	0.20		352.79	373.01	555.05	859.85	912.80
D5 ^a	GRANAT5.0	0.72	0.24	0.02	0.02	0.00		347.12	372.18	556.69	862.49	917.69
D5 ^a	GRANAT6.0	0.74	0.20	0.00	0.04	0.02		347.28	371.17	555.59	861.99	914.24
D5 ^a	GRANAT8.0	0.68	0.16	0.10	0.02	0.04		347.64	370.45	555.82	859.53	914.33
D5 ^a	GRANAT10.0	0.76	0.18	0.04	0.02	0.00		345.88	371.12	555.96	862.35	916.08
D5 ^a	GRANAT11.0	0.38	0.12	0.40	0.00	0.10		350.00	371.97	555.43	853.73	910.09
D5 ^a	GRANAT12.0	0.76	0.14	0.02	0.06	0.02		345.89	371.79	554.32	860.18	912.84
D5 ^a	GRANAT13.0	0.40	0.20	0.20	0.00	0.20		351.76	368.75	554.16	852.34	907.09
D5 ^a	GRANAT15.0	0.60	0.20	0.00	0.00	0.20		350.75	376.79	554.89	855.28	909.36
D5 ^a	GRANAT18.0	0.78	0.06	0.02	0.00	0.14		347.47	366.45	555.51	855.77	

