

Supplementary Material

Micro-Raman - a tool for the heavy mineral analysis of gold placer-type deposits (Pianu Valley, Romania)

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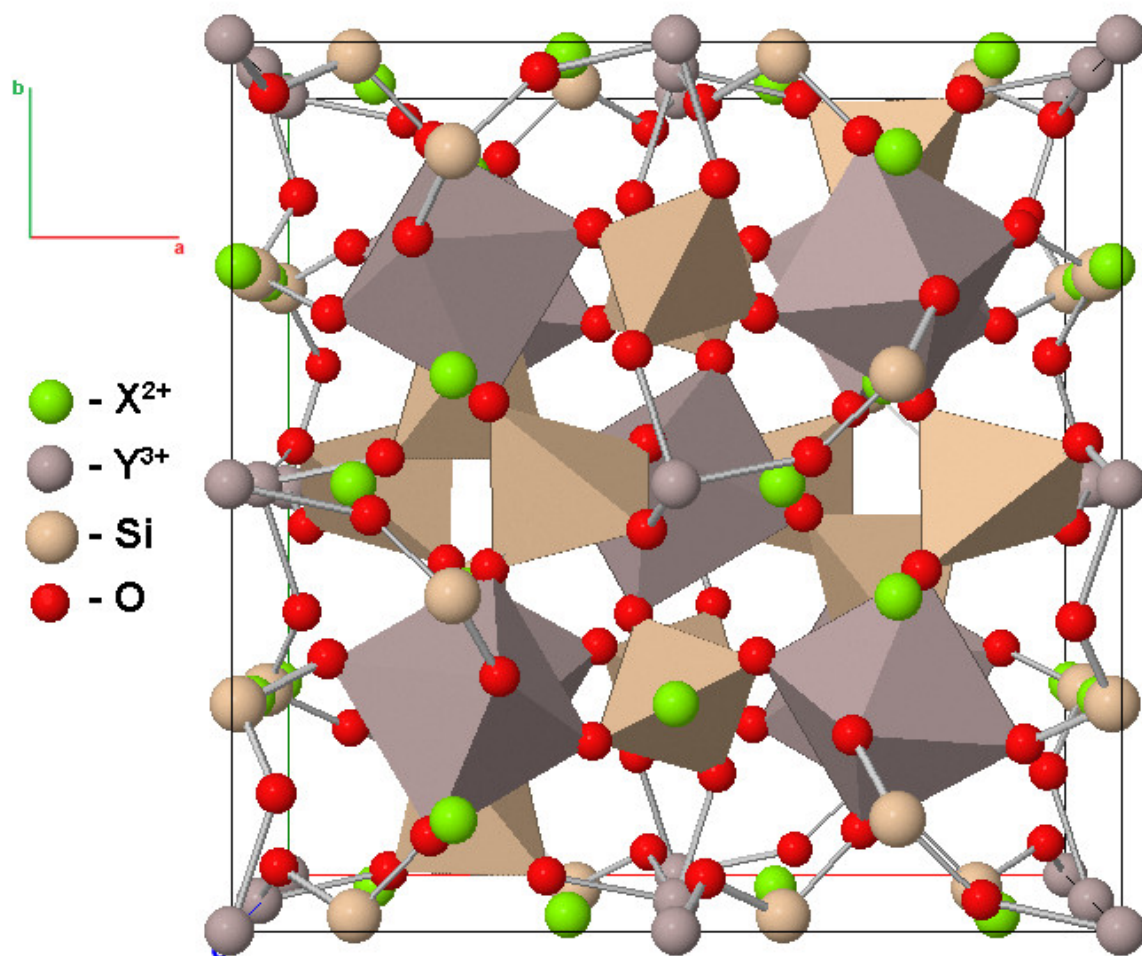


Figure S1. Crystal structure of garnets.

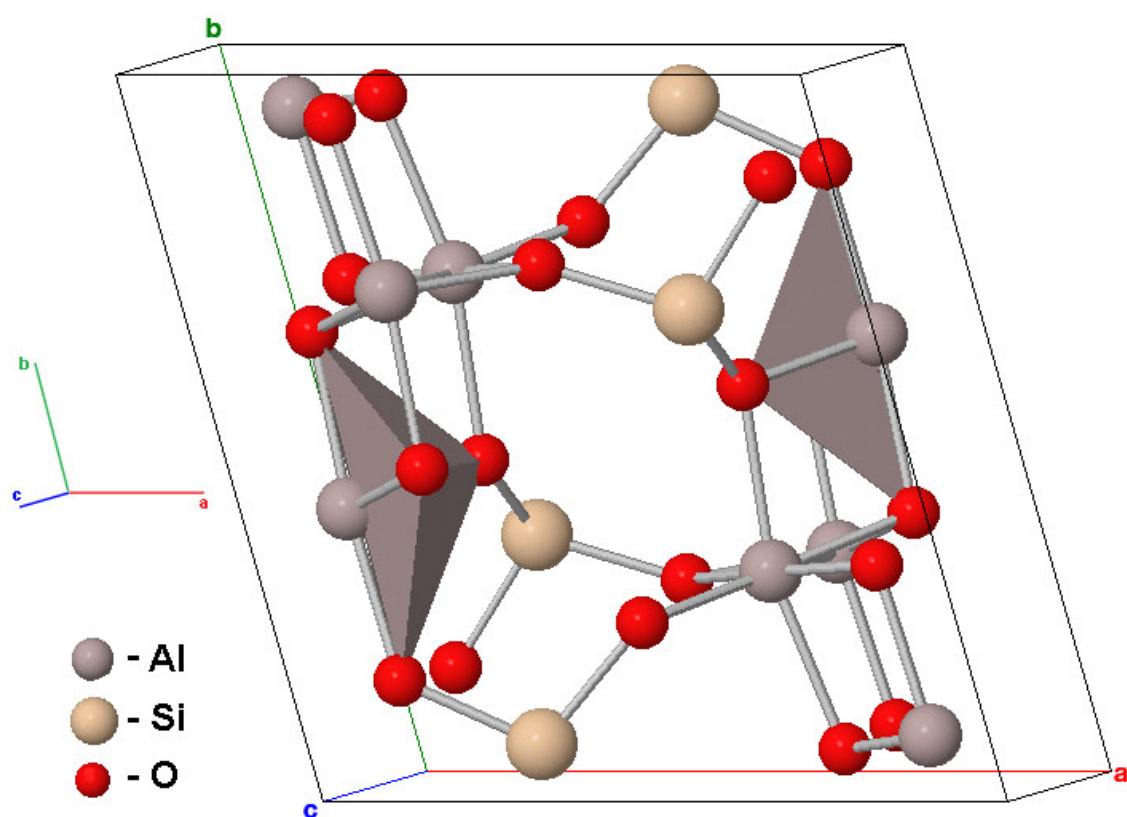


Figure S2. Crystal structure of kyanite.

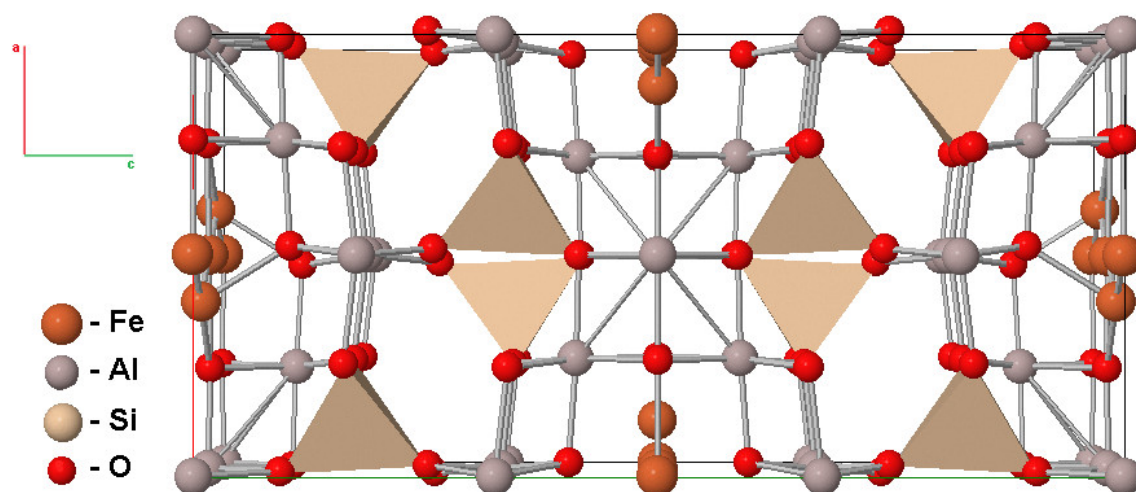


Figure S3. Crystal structure of staurolite.

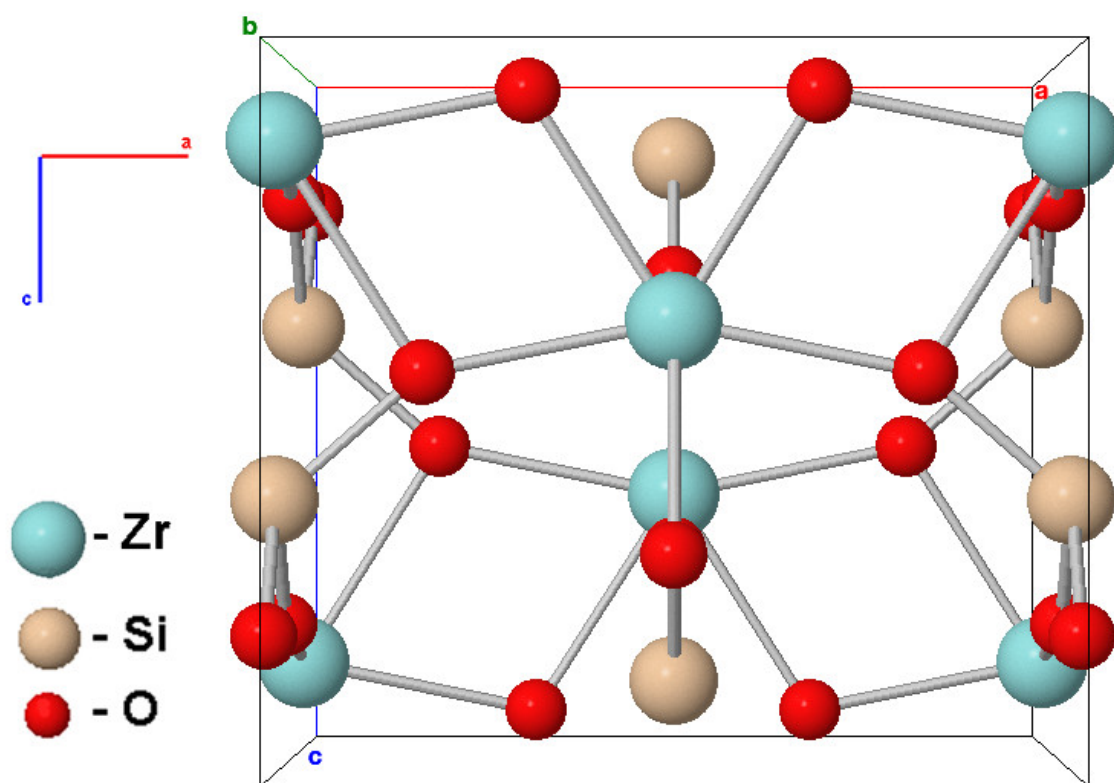


Figure S4. Crystal structure of zircon.

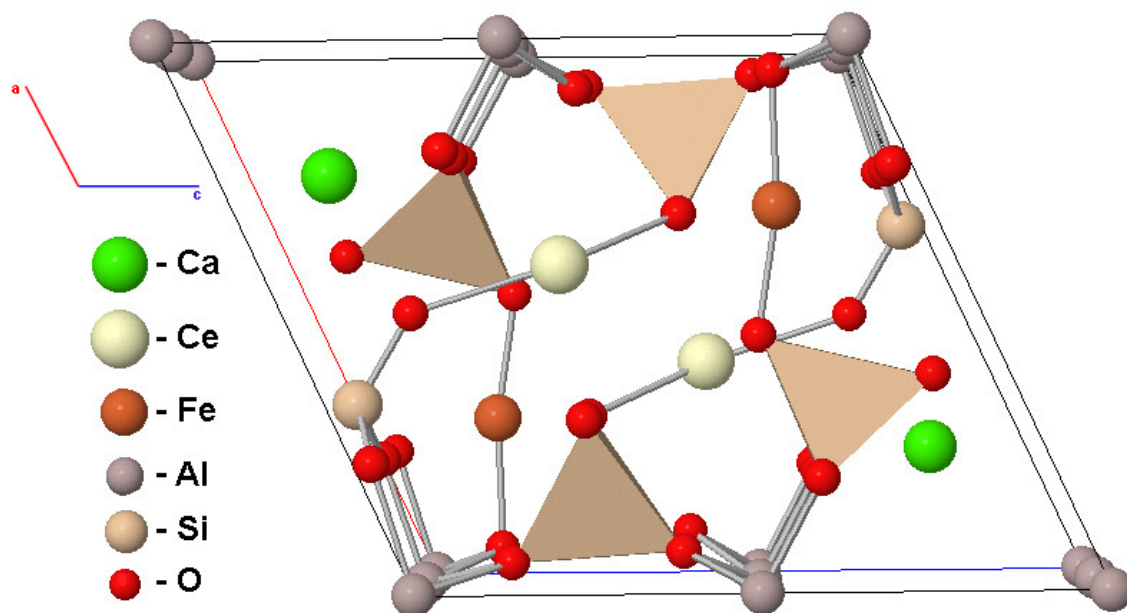


Figure S5. Crystal structure of allanite-(Ce).

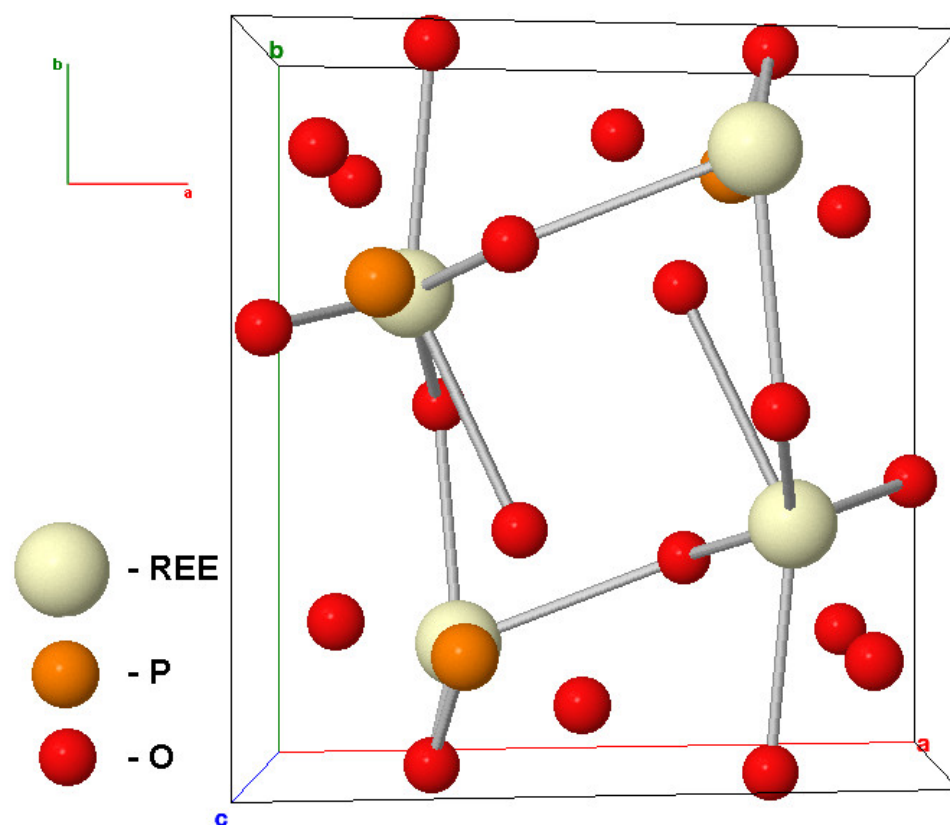


Figure S6. Crystal structure of monazite.

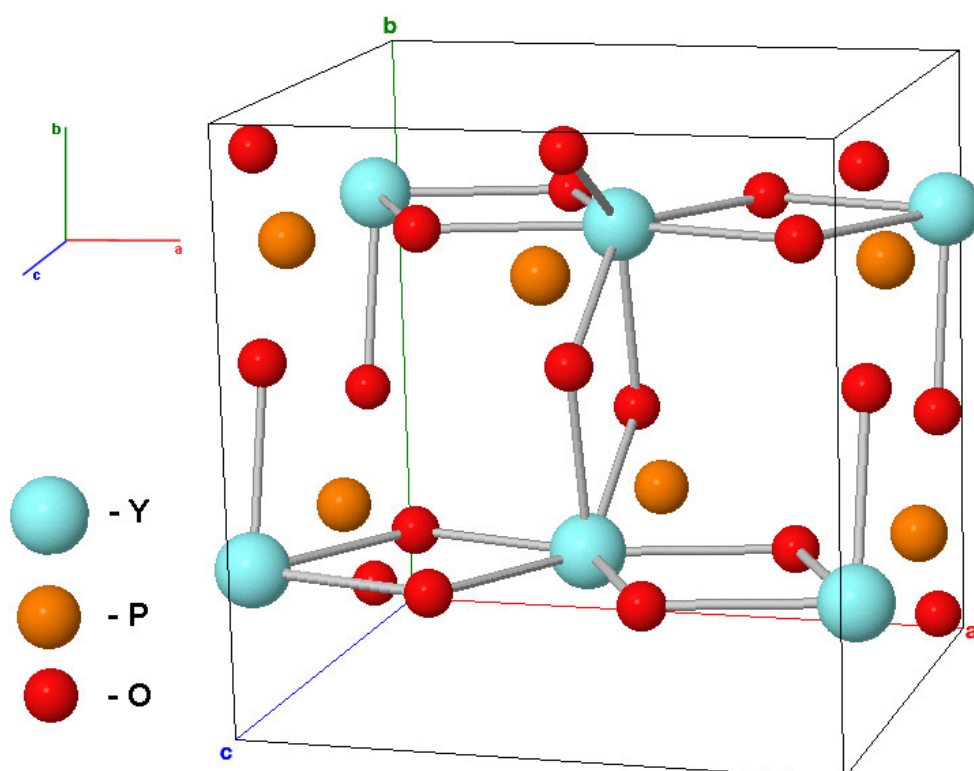


Figure S7. Crystal structure of xenotime-(Y).

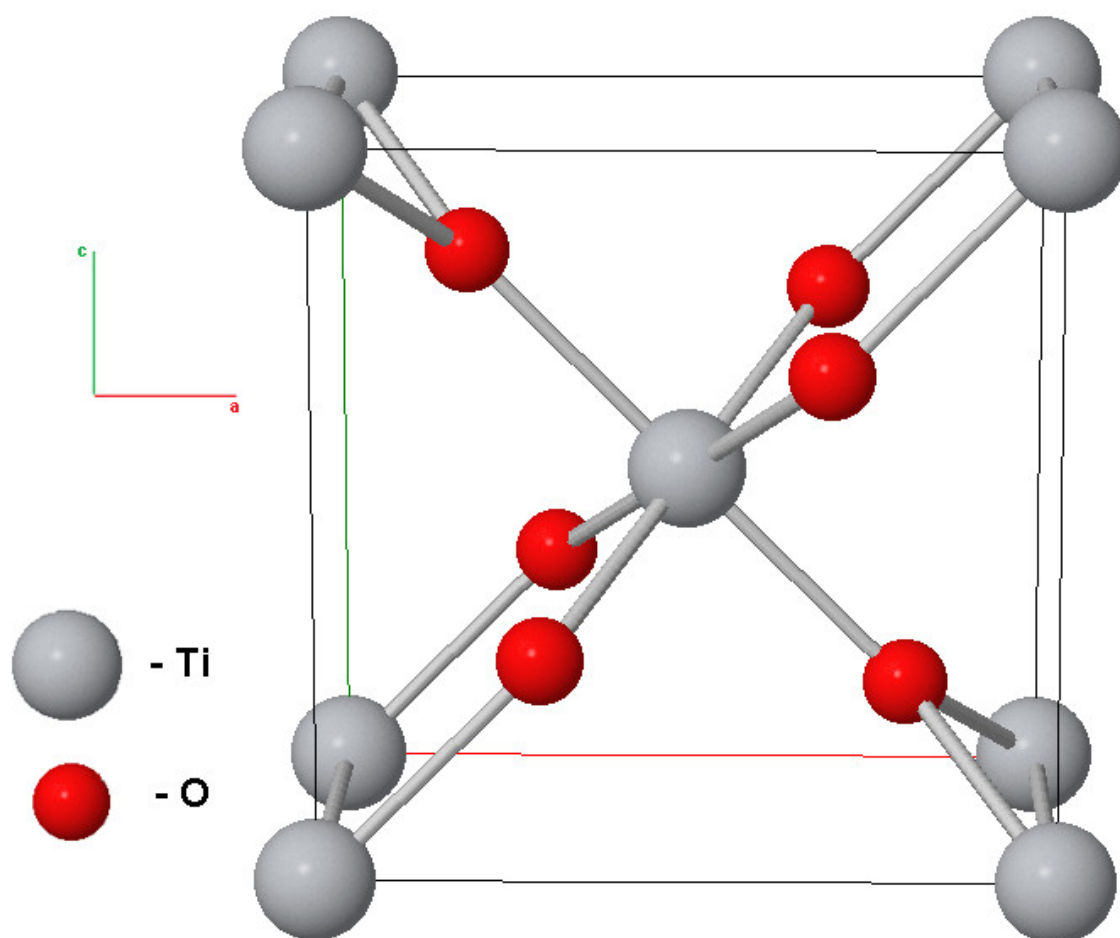


Figure S8. Crystal structure of rutile.

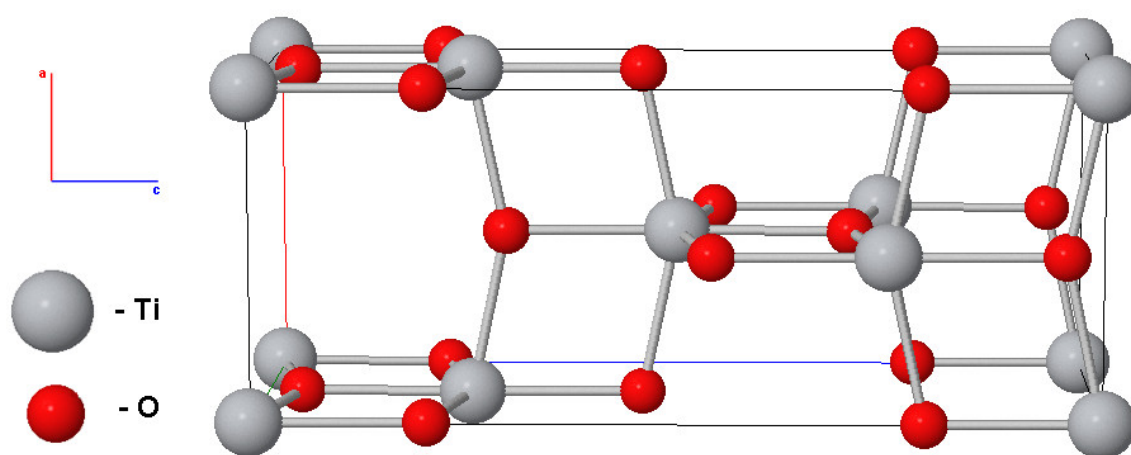


Figure S9. Crystal structure of anatase.

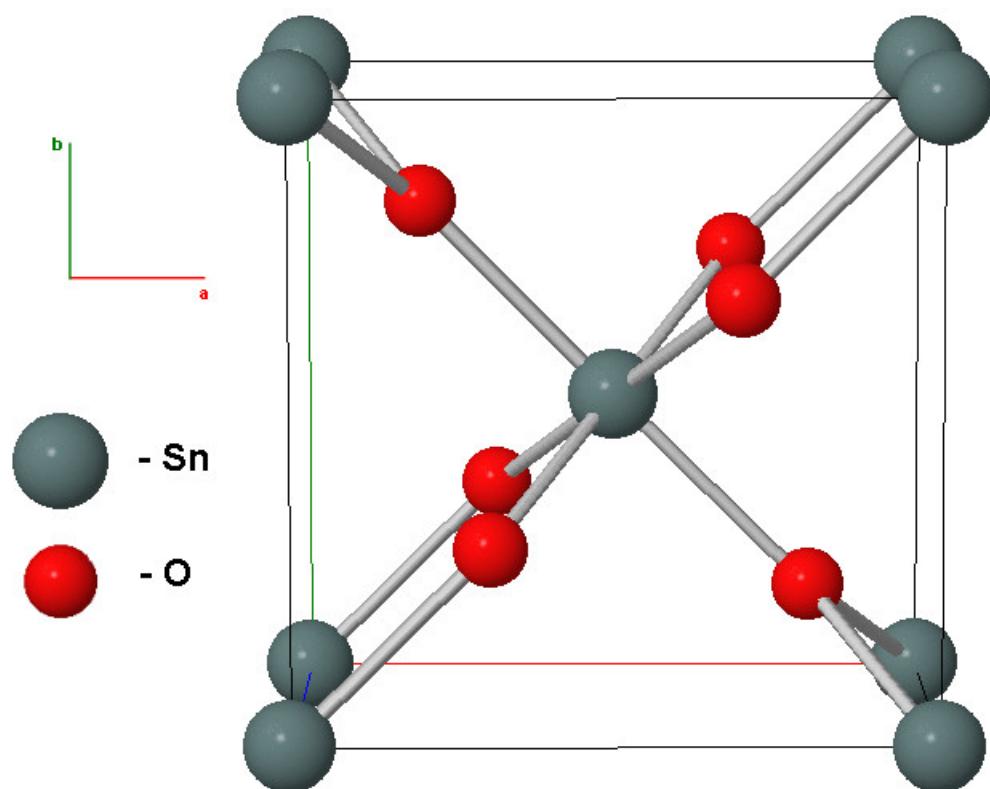


Figure S10. Crystal structure of cassiterite.

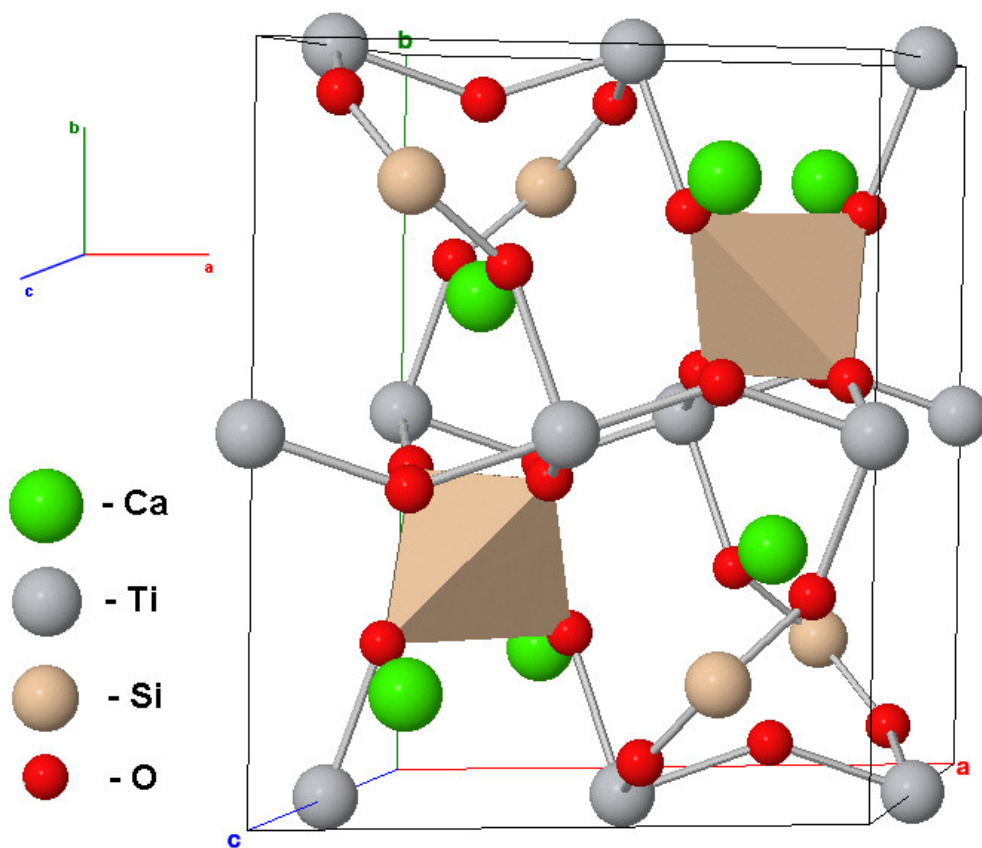


Figure S11. Crystal structure of titanite.

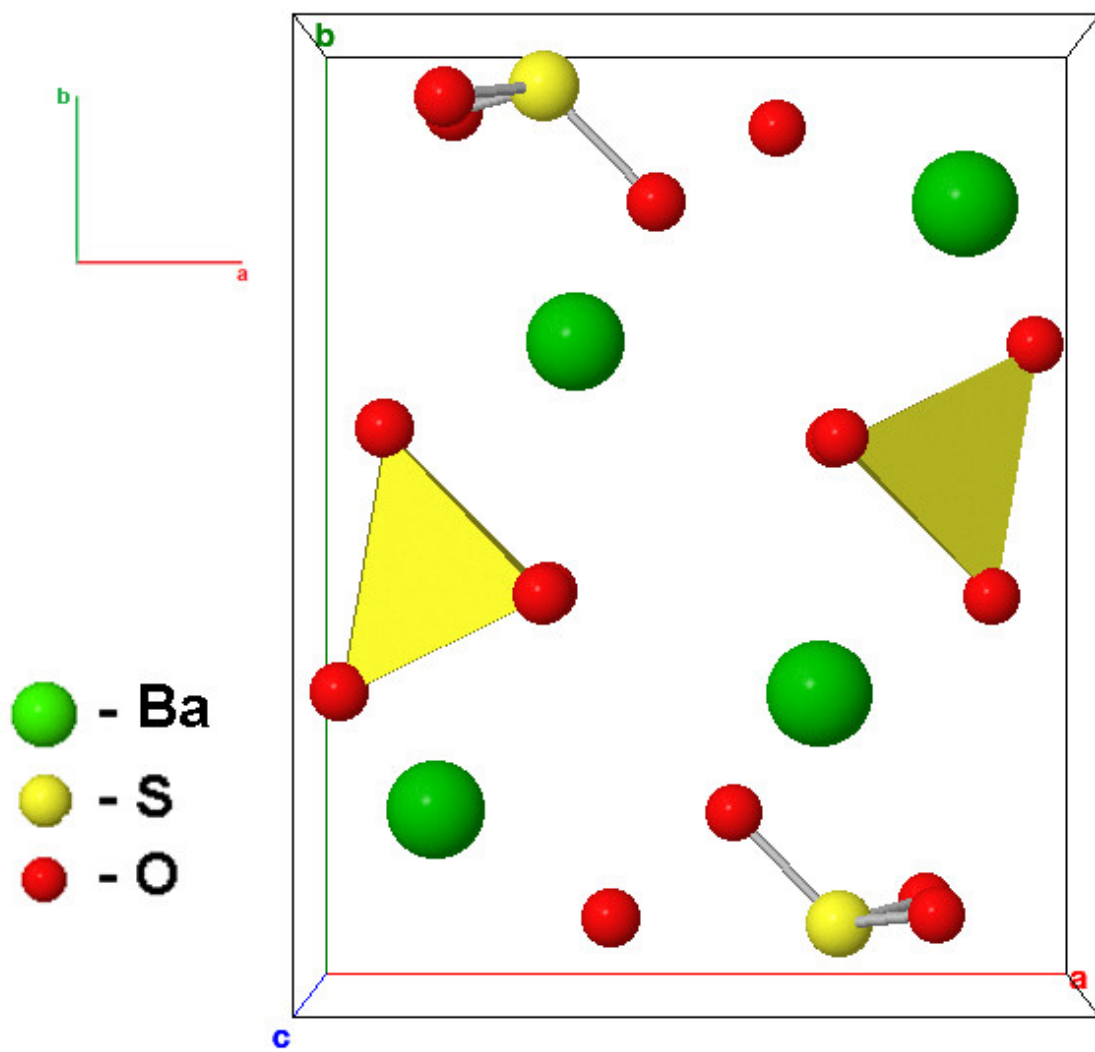


Figure S12. Crystal structure of barite.

Table S1. Chemical composition of the studied garnets.

Samples	SiO ₂ (%)	TiO ₂ (%)	Al ₂ O ₃ (%)	Cr ₂ O ₃ (%)	FeO (%)	MnO (%)	MgO (%)	CaO (%)	Na ₂ O (%)	K ₂ O (%)	P ₂ O ₅ (%)	Y ₂ O ₃ (%)	ZnO (%)	V ₂ O ₃ (%)	Total (%)
Garnet 01	37.05	0.18	21.10	0.01	29.32	1.71	0.45	9.14	0.03	0.01	0.03	0.00	0.04	0.01	99.06
Garnet 02	36.89	0.19	20.99	0.00	21.08	9.78	0.37	9.96	0.01	0.01	0.02	0.02	0.00	0.05	99.36
Garnet 03	39.09	0.17	22.59	0.00	20.91	0.34	8.47	9.28	0.00	0.00	0.06	0.00	0.00	0.01	100.93
Garnet 04	37.92	0.00	21.94	0.05	30.17	1.04	4.42	4.84	0.01	0.00	0.07	0.13	0.00	0.00	100.59
Garnet 05	36.69	0.02	21.22	0.01	33.96	1.05	2.68	4.18	0.03	0.01	0.01	0.00	0.03	0.00	99.89
Garnet 06	35.97	0.11	20.86	0.03	30.32	12.61	0.20	0.12	0.04	0.01	0.11	0.03	0.00	0.00	100.41
Garnet 07	37.25	0.06	21.58	0.05	27.59	10.02	3.24	1.06	0.01	0.01	0.01	0.03	0.00	0.00	100.89
Garnet 08	37.06	0.02	21.43	0.01	36.08	0.89	3.06	2.16	0.01	0.01	0.01	0.00	0.00	0.00	100.73
Garnet 09	37.32	0.08	21.42	0.06	35.24	0.20	3.95	1.78	0.02	0.00	0.05	0.00	0.11	0.01	100.23
Garnet 10	37.53	0.00	21.48	0.00	37.00	0.08	4.60	0.47	0.01	0.00	0.10	0.01	0.00	0.00	101.27
Garnet 11	37.02	0.04	21.36	0.01	31.59	2.25	5.31	0.81	0.02	0.00	0.12	0.08	0.00	0.04	98.66

Table S2. Chemical composition of the studied kyanite and staurolite samples.

Samples	CaO (%)	K ₂ O (%)	P ₂ O ₅ (%)	Na ₂ O (%)	MgO (%)	Al ₂ O ₃ (%)	SiO ₂ (%)	BaO (%)	V ₂ O ₃ (%)	ZnO (%)	FeO (%)	MnO (%)	TiO ₂ (%)	Total (%)
Kyanite 01	0	0	0	0	0	62.86	36.73	0.006	0.011	0.042	0.109	0.004	0.034	99.803
Kyanite 02	0.001	0.008	0.032	0	0.01	63.18	36.79	0.024	0.022	0.009	0.287	0	0.112	100.49
Kyanite 03	0.001	0.002	0	0	0.015	63.80	36.93	0.033	0.014	0.028	0.176	0.04	0	101.05
Staurolite 01	0.006	0	0.006	0.026	1.494	54.835	27.599	0.022	0.019	0.329	12.41	0.013	0.939	97.699
Staurolite 02	0	0	0.004	0.044	1.932	52.968	27.166	0.098	0.04	1.077	13.204	0.254	0.511	97.298
Staurolite 03	0.009	0	0.002	0.038	2.259	52.645	26.748	0.01	0.061	0.276	14.713	0.299	0.592	97.662

Table S3. Chemical composition of zircons.

Samples	UO ₂ (%)	ThO ₂ (%)	P ₂ O ₅ (%)	Y ₂ O ₃ (%)	SiO ₂ (%)	HfO ₂ (%)	Al ₂ O ₃ (%)	Na ₂ O (%)	CaO (%)	ZrO ₂ (%)	Yb ₂ O ₃ (%)	Ce ₂ O ₃ (%)	FeO (%)	Sc ₂ O ₃ (%)	Total (%)
Zircon 01	0.00	0.00	0.03	0.05	33.28	1.73	0.01	0.00	0.00	66.28	0.00	0.01	0.00	0.01	101.41
Zircon 02	0.12	0.02	0.06	0.04	33.27	1.50	0.03	0.03	0.01	65.30	0.03	0.07	0.11	0.01	100.59
Zircon 03	0.07	0.01	0.31	0.22	33.09	2.19	0.00	0.00	0.01	64.68	0.12	0.04	0.02	0.08	100.84
Zircon 04	0.16	0.10	0.06	0.22	33.15	1.26	0.00	0.00	0.00	64.89	0.11	0.04	0.10	0.02	100.11
Zircon 05	0.04	0.03	0.31	0.19	33.05	1.74	0.00	0.00	0.00	65.30	0.01	0.01	0.08	0.03	100.79

Table S4. Chemical composition of REE minerals (allanite, monazite and xenotime).

Samples	CaO (%)	UO ₂ (%)	ThO ₂ (%)	Y ₂ O ₃ (%)	F (%)	SrO (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	Gd ₂ O ₃ (%)	Sm ₂ O ₃ (%)	Pr ₂ O ₃ (%)	Nd ₂ O ₃ (%)	Ce ₂ O ₃ (%)	La ₂ O ₃ (%)	FeO (%)	MnO (%)	TiO ₂ (%)	Total (%)
Allanite 01	9.735	0.050	0.913	0.223	0.053	0.052	30.111	13.748	0.299	0.307	1.112	4.187	11.882	6.446	15.804	0.599	0.602	96.186
Allanite 02	9.970	0.047	0.717	0.094	0.141	0.183	30.143	13.919	0.144	0.000	1.241	3.326	12.289	6.859	14.656	0.236	1.195	95.239
Allanite 03	9.486	0.026	1.135	0.262	0.000	0.154	29.650	13.348	0.252	0.298	1.281	3.997	12.265	6.317	15.487	0.515	0.844	95.588

Samples	CaO (%)	UO ₂ (%)	ThO ₂ (%)	P ₂ O ₅ (%)	Y ₂ O ₃ (%)	SiO ₂ (%)	Ho ₂ O ₃ (%)	Yb ₂ O ₃ (%)	Gd ₂ O ₃ (%)	Dy ₂ O ₃ (%)	Tb ₂ O ₃ (%)	Sm ₂ O ₃ (%)	Eu ₂ O ₃ (%)	Pr ₂ O ₃ (%)	Nd ₂ O ₃ (%)	Ce ₂ O ₃ (%)	La ₂ O ₃ (%)	Total (%)
Monazite 01	1.596	1.029	7.785	29.798	1.077	0.575	0.058	0.071	1.131	0.539	0.078	1.603	0.204	2.662	10.846	26.769	13.261	99.438
Monazite 02	0.936	0.760	4.057	30.920	2.040	0.226	0.245	0.106	1.615	0.606	0.129	2.087	0.276	3.028	11.921	27.321	13.870	100.58
Monazite 03	0.991	0.200	5.157	30.510	1.023	0.338	0.000	0.060	1.436	0.395	0.103	1.712	0.171	3.107	12.767	27.252	13.830	99.488

Samples	UO ₂ (%)	ThO ₂ (%)	PbO (%)	P ₂ O ₅ (%)	Y ₂ O ₃ (%)	SiO ₂ (%)	Lu ₂ O ₃ (%)	Ho ₂ O ₃ (%)	Yb ₂ O ₃ (%)	Tm ₂ O ₃ (%)	Er ₂ O ₃ (%)	Gd ₂ O ₃ (%)	Dy ₂ O ₃ (%)	Tb ₂ O ₃ (%)	Sm ₂ O ₃ (%)	Nd ₂ O ₃ (%)	Ce ₂ O ₃ (%)	Total (%)
Xenotime 01	1.938	0.847	0.125	35.351	45.442	0.640	1.619	1.007	3.664	0.744	3.859	1.341	5.227	0.602	0.444	0.130	0.135	103.32
Xenotime 02	0.892	0.274	0.046	34.603	42.774	0.144	1.565	1.032	4.047	0.668	4.482	1.534	5.066	0.619	0.541	0.400	0.063	99.114

Table S5. Selective chemical compositions of rutile, anatase, cassiterite, titanite and barite.

Samples	MnO (%)	V2O3 (%)	Nb2O5 (%)	MgO (%)	SiO2 (%)	Al2O3 (%)	ZnO (%)	NiO (%)	Cr2O3 (%)	FeO (%)	TiO2 (%)				Total (%)
Rutile 01	0.002	0.707	0.06	0	0.021	0.031	0	0	0.162	0.158	98.204				99.345
Rutile 02	0.006	0.525	0.208	0.007	0.054	0.011	0	0.003	0.04	0.149	99.356				100.35
Rutile 03	0.016	0.389	0	0	0	0.023	0.024	0	0.218	0.12	97.895				98.685
Samples	MnO (%)	SnO2 (%)	Nb2O5 (%)	CaO (%)	SiO2 (%)	Na2O (%)	FeO (%)	V2O3 (%)	TiO2 (%)	Sc2O3 (%)	Ta2O5 (%)	ZrO2 (%)	Cr2O3 (%)	Total (%)	
Anatase 01	0.008	0	0.351	0.016	0.051	0	0.173	0.674	100.89	0.077	0.032	0.061	0.028	102.45	
Anatase 02	0	0.059	1.605	0.023	0.053	0.022	0.88	0.687	98.091	0.03	0.152	0.281	0.027	101.95	
Anatase 03	0.014	0.03	0.63	0.025	0.051	0.006	0.586	0.668	98.926	0.076	0.103	0.116	0	101.28	
Samples	ZrO2 (%)	Nb2O5 (%)	Ta2O5 (%)	MgO (%)	SnO2 (%)	ZnO (%)	FeO (%)	MnO (%)	Cr2O3 (%)	TiO2 (%)				Total (%)	
Cassiterite 01	0.060	0.589	2.465	0.041	98.339	0.115	0.528	0.012	0.035	0.145				102.33	
Samples	CaO (%)	ZrO2 (%)	P2O5 (%)	MgO (%)	SrO (%)	SiO2 (%)	Al2O3 (%)	Dy2O3 (%)	Ce2O3 (%)	La2O3 (%)	Nb2O5 (%)	TiO2 (%)	FeO (%)	MnO (%)	Total (%)
Titanite 01	28.985	0.028	0.028	0.017	0.109	30.630	1.633	0.026	0.055	0.025	0.033	36.599	0.352	0.076	98.966
Samples	BaO (%)	CaO (%)	K2O (%)	SO3 (%)	SrO (%)	Na2O (%)	Al2O3 (%)	FeO (%)	TiO2 (%)						Total (%)
Barite 01	66.829	0.015	0.013	34.813	0.090	0.139	0.056	0.077	0.117						102.149