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 | SiO₂ (%) | TiO₂ (%) | Al₂O₃ (%) | Cr₂O₃ (%) | FeO (%) | MnO (%) | MgO (%) | CaO (%) | Na₂O (%) | K₂O (%) | P₂O₅ (%) | Y₂O₃ (%) | ZnO (%) | V₂O₃ (%) | 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    | 0.78    | 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     | 0.01    | 0.07     | 0.18     | 0.00     | 0.00     | 100.59   |
| Garnet 05 | 36.69    | 0.02     | 21.22     | 0.01      | 33.95    | 1.05    | 2.68    | 4.12    | 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 (%) | K₂O (%) | P₂O₅ (%) | Na₂O (%) | MgO (%) | Al₂O₃ (%) | SiO₂ (%) | BaO (%) | V₂O₅ (%) | ZnO (%) | FeO (%) | MnO (%) | TiO₂ (%) | 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    | 0.01     | 63.18   | 36.79     | 0.024    | 0.022   | 0.009    | 0.287   | 0       | 0.112   |          | 100.49    |
| Kyanite 03 | 0.001   | 0.002   | 0        | 0.015    | 63.80   | 36.93     | 0.033    | 0.014   | 0.028    | 0.176   | 0.034   | 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    | UO₂ (%) | ThO₂ (%) | P₂O₅ (%) | Y₂O₃ (%) | SiO₂ (%) | HfO₂ (%) | Al₂O₃ (%) | Na₂O (%) | CaO (%) | ZrO₂ (%) | Yb₂O₃ (%) | Ce₂O₃ (%) | FeO (%) | Sc₂O₃ (%) | 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      |          | 0.00    | 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      | 0.11     | 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    | 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    | 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    | 100.79   |
| Samples   | CaO (%) | UO₂ (%) | ThO₂ (%) | Y₂O₃ (%) | F (%) | SrO (%) | SiO₂ (%) | Al₂O₃ (%) | Gd₂O₃ (%) | Sm₂O₃ (%) | Pr₂O₃ (%) | Nd₂O₃ (%) | Ce₂O₃ (%) | La₂O₃ (%) | FeO (%) | MnO (%) | TiO₂ (%) | 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     | 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     | 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     | 0.515   | 0.844   | 95.588   |

| Samples   | CaO (%) | UO₂ (%) | ThO₂ (%) | P₂O₅ (%) | Y₂O₃ (%) | SiO₂ (%) | Ho₂O₃ (%) | Yb₂O₃ (%) | Gd₂O₃ (%) | Dy₂O₃ (%) | Tb₂O₃ (%) | Sm₂O₃ (%) | Eu₂O₃ (%) | Pr₂O₃ (%) | Nd₂O₃ (%) | Ce₂O₃ (%) | La₂O₃ (%) | 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   | UO₂ (%) | ThO₂ (%) | PbO (%) | P₂O₅ (%) | Y₂O₃ (%) | SiO₂ (%) | La₂O₃ (%) | Ho₂O₃ (%) | Yb₂O₃ (%) | Gd₂O₃ (%) | Tb₂O₃ (%) | Sm₂O₃ (%) | Eu₂O₃ (%) | Pr₂O₃ (%) | Nd₂O₃ (%) | Ce₂O₃ (%) | La₂O₃ (%) | Total (%) |
|-----------|---------|---------|---------|----------|----------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|-----------|----------|
| Xenotime 01 | 1.938   | 0.847   | 0.125   | 35.351   | 45.442   | 0.640    | 1.619     | 1.007     | 3.664     | 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     | 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 (%) | V₂O₅ (%) | 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    |
| 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   |
| Cassiterite 01| 0.060   | 0.589    | 2.465     | 0.041   | 0.9339   | 0.115     | 0.528   | 0.012   | 0.035     | 0.0145  | 98.399   | 99.966    |
| Titanite 01   | 28.985  | 0.028    | 0.028     | 0.017   | 0.109    | 0.026     | 0.055   | 0.025   | 0.33      | 0.352   | 0.076    | 98.966    |
| Barite 01     | 66.829  | 0.015    | 0.013     | 34.813  | 0.090    | 0.139     | 0.056   | 0.077   | 0.117     | 102.149 |          |           |
| Titanite 02   |         |          |           |         |         |           |         |         |           |         |          |           |
| Barite 02     |         |          |           |         |         |           |         |         |           |         |          |           |
| Barite 03     |         |          |           |         |         |           |         |         |           |         |          |           |