**Supplementary Material: Garnet Trade in Early Medieval Europe: The Italian Network**

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**Material and Methods**

All objects were investigated by optical microscopy, and compositional analyses were conducted at the Centre Ernest-Babelon of the CNRS Institut de Recherches sur les Archéomatériaux at the University of Orléans using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). The mass spectrometer is an Element XR from Thermo Fisher Scientific and the ablation device is a Resolution M50E from Resonetics/ASI (Eximer ArF laser working at 193 nm). The excimer laser was operated at 5.5 mJ with a repetition rate of 10 Hz. The beam diameter was adjusted between 70 μm and 100 μm. A pre-ablation time of 20s was set so as to remove any corrosion layer and the transient part of the signal. The signal is then measured for 30s corresponding to 9 mass scans in counts per second in low resolution mode for 58 different isotopes from lithium to uranium to include all major, minor and trace elements which are present in glass and rocks samples (Gratuze, 2016, Palumbi et al. 2014). From one to six ablations were carried out on the garnet and one for the glass. The standard reference glasses NIST 610 from the National Institute for Standards and Technology and Corning B, C and D from the Corning laboratory were used for calibration. 28Si serves as an internal standard to calculate quantitative concentrations. In order to validate the results, calculated concentration obtained on glass reference standards Corning A and NIST 612 from the National Institute for Standards and Technology were analysed as unknown samples. Calculated values agree with the certified ones within a 5% accuracy (Adlington, 2017) (see Table S1).

**References**

Adlington, L.W. 2017. The Corning Archaeological Reference Glasses: New Values for “Old” Compositions. *Papers from the Institute of Archaeology*, 27: p.Art. 2. <https://doi.org/10.5334/pia-515>

Gratuze, B. 2016. Glass Characterization Using Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry Methods. In: L. Dussubieux, M. Golitko & B. Gratuze, eds. *Recent Advances in Laser Ablation ICP-MS for Archaeology*. Berlin & Heidelberg: Springer, pp. 179–96. <https://doi.org/10.1007/978-3-662-49894-1_12>

Palumbi G., Gratuze, B., Harutyunyan A. & Chataigner C. 2014. Obsidian-Tempered Pottery in the Southern Caucasus: A New Approach to Obsidian as A Ceramic-Temper. *Journal of Archaeological Science*, 44: 43–54. <https://doi.org/10.1016/j.jas.2014.01.017>

**Table S1. Average, RSD, median, minimum, and maximum values for repeated analyses of type 1, 2, and 3a garnets. Contents are expressed in weight % for SiO2 to CaO and in parts per million for Cr2O3 to Li2O.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **SiO2** | **TiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** |  | **Cr2O3** | **Y2O3** | **V2O5** | **CoO** | **NiO** | **Li2O** | **Almandine** | **Grossular** | **Pyrope** | **Spessartine** |
| **T.1 GR 4 017 b 17** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| average | 37.3 | 0.0014 | 22.2 | 35.4 | 0.29 | 4.09 | 0.50 |  | 2.90 | 133 | 0.19 | 2.73 | 0.11 | 81.3 | 81.4 | 1.44 | 16.5 | 0.66 |
| RSD (6) | 1.3% | 25.1% | 2.0% | 0.4% | 22.0% | 3.8% | 18.4% |  | 45.2% | 13.4% | 92.3% | 5.6% | 72.7% | 18.4% | 0.4% | 18.9% | 3.6% | 22.4% |
| median | 37.4 | 0.0015 | 22.2 | 35.4 | 0.32 | 4.02 | 0.53 |  | 2.93 | 142 | 0.16 | 2.71 | 0.09 | 84.3 | 81.5 | 1.53 | 16.3 | 0.72 |
| min | 36.4 | 0.0009 | 21.7 | 35.2 | 0.18 | 3.97 | 0.35 |  | 0.52 | 101 | 0.01 | 2.60 | 0.03 | 60.8 | 81.1 | 0.99 | 15.9 | 0.41 |
| max | 37.7 | 0.0020 | 22.9 | 35.6 | 0.35 | 4.38 | 0.57 |  | 4.29 | 147 | 0.47 | 3.02 | 0.22 | 98.4 | 81.8 | 1.69 | 17.5 | 0.81 |
| **T.2 GR 4 007 d** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| average | 38.9 | 0.0068 | 21.8 | 29.8 | 1.83 | 5.94 | 1.43 |  | 574 | 725 | 122 | 52.0 | 4.26 | 41.2 | 68.3 | 3.89 | 23.6 | 4.12 |
| RSD (6) | 2.1% | 47.1% | 2.0% | 0.9% | 10.4% | 0.9% | 1.8% |  | 27.4% | 12.1% | 4.0% | 1.2% | 2.9% | 8.9% | 0.7% | 2.0% | 0.6% | 10.1% |
| median | 39.2 | 0.0054 | 21.6 | 29.7 | 1.83 | 5.93 | 1.42 |  | 623 | 750 | 122 | 51.7 | 4.20 | 41.2 | 68.4 | 3.87 | 23.6 | 4.12 |
| min | 37.7 | 0.0045 | 21.3 | 29.6 | 1.56 | 5.87 | 1.40 |  | 259 | 610 | 116 | 51.4 | 4.13 | 36.4 | 67.4 | 3.79 | 23.4 | 3.54 |
| max | 39.7 | 0.013 | 22.5 | 30.4 | 2.11 | 6.02 | 1.47 |  | 695 | 842 | 128 | 53.1 | 4.46 | 47.1 | 68.8 | 3.98 | 23.7 | 4.75 |
| **T.3a GR 4 040 is** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| average | 39.4 | 0.017 | 23.0 | 25.2 | 0.27 | 10.3 | 1.70 |  | 15.3 | 68.8 | 28.2 | 15.6 | 0.64 | 5.71 | 55.5 | 4.67 | 39.2 | 0.59 |
| RSD (3) | 1.4% | 5.4% | 1.9% | 0.1% | 0.6% | 0.5% | 1.7% |  | 0.9% | 8.1% | 2.5% | 0.9% | 7.4% | 5.6% | 0.6% | 1.8% | 0.6% | 0.7% |
| median | 39.2 | 0.016 | 23.1 | 25.2 | 0.27 | 10.3 | 1.70 |  | 15.2 | 68.4 | 28.5 | 15.6 | 0.63 | 5.81 | 55.7 | 4.65 | 39.1 | 0.59 |
| min | 38.9 | 0.016 | 22.5 | 25.1 | 0.27 | 10.2 | 1.67 |  | 15.2 | 63.4 | 27.4 | 15.5 | 0.60 | 5.35 | 55.1 | 4.59 | 39.1 | 0.59 |
| max | 40.0 | 0.018 | 23.4 | 25.2 | 0.27 | 10.3 | 1.73 |  | 15.4 | 74.6 | 28.8 | 15.8 | 0.69 | 5.97 | 55.7 | 4.76 | 39.5 | 0.60 |

**Table S2. Analytical data of the sixty-four garnets from Campo Marchione in Leno and Corte Bassa in Lodi Vecchio**.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Object** | **Inventory no.** | **Na2O** | **MgO** | **Al2O3** | **SiO2** | **P2O5** | **Cl** | **K2O** | **CaO** | **MnO** | **Fe2O3** | **CuO** | **PbO** |
| Foy 3.2 | False garnet | 2013.4.017 a 04 | 21.0% | 0.63% | 1.72% | 64.7% | 0.10% | 1.15% | 0.32% | 7.43% | 2.04% | 0.64% | 0.0021% | 0.0029% |
| Foy 3.2 | False garnet | 2013.4.017 b 21 | 21.4% | 0.62% | 1.72% | 64.5% | 0.03% | 1.13% | 0.32% | 7.37% | 2.02% | 0.60% | 0.0021% | 0.0031% |
| Foy 3.2 | False garnet | 2013.4.017 b 22 | 21.1% | 0.62% | 1.75% | 64.7% | 0.05% | 1.10% | 0.34% | 7.36% | 2.04% | 0.63% | 0.0025% | 0.0033% |
| Foy 3.2 | False garnet | 2013.4.017 b 23 | 21.5% | 0.59% | 1.60% | 64.8% | 0.04% | 1.23% | 0.31% | 7.06% | 1.98% | 0.59% | 0.0022% | 0.0037% |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 1 | 15.9% | 0.49% | 1.95% | 73.3% | 0.03% | 1.62% | 0.28% | 5.41% | 0.02% | 0.59% | 0.057% | 0.052% |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 2 | 17.0% | 0.46% | 1.81% | 72.8% | 0.03% | 1.53% | 0.30% | 5.02% | 0.02% | 0.60% | 0.058% | 0.051% |
| Cuprite Cu/Pb | Orange plaque | 2013.4.005 E v1 | 6.6% | 1.38% | 3.71% | 38.6% | 0.50% | 0.50% | 0.99% | 7.24% | 0.55% | 2.52% | 7.46% | 26.9% |
| HIMT | Green plaque | 2013.4.005 G v1 | 17.1% | 0.95% | 2.70% | 62.2% | 0.12% | 0.79% | 0.58% | 6.77% | 1.07% | 2.66% | 3.35% | 0.51% |
| HIMT | Green plaque | 2013.4.005 G v3 | 17.0% | 0.99% | 2.75% | 62.7% | 0.12% | 0.76% | 0.59% | 6.81% | 1.03% | 2.64% | 3.05% | 0.44% |
| HIMT | Green plaque | 2013.4.005 G v2 | 17.2% | 0.95% | 2.73% | 63.0% | 0.12% | 0.79% | 0.55% | 6.59% | 1.06% | 2.64% | 2.84% | 0.40% |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | TiO2 | V2O5 | Cr2O3 | CoO | NiO | ZnO | SrO | ZrO2 | As2O3 | SnO2 | Sb2O3 | BaO |
| Foy 3.2 | False garnet | 2013.4.017 a 04 | 764 | 73.2 | 14.8 | 13.3 | 12.8 | 25.2 | 604 | 67.6 | 5.69 | 6.90 | 0.45 | 308 |
| Foy 3.2 | False garnet | 2013.4.017 b 21 | 747 | 73.2 | 0.95 | 13.1 | 13.2 | 16.4 | 601 | 67.7 | 5.51 | 6.97 | 0.23 | 310 |
| Foy 3.2 | False garnet | 2013.4.017 b 22 | 757 | 74.0 | 1.83 | 13.4 | 12.9 | 18.2 | 597 | 67.6 | 5.70 | 7.33 | 1.12 | 314 |
| Foy 3.2 | False garnet | 2013.4.017 b 23 | 702 | 73.1 | nd | 12.5 | 12.5 | 19.9 | 588 | 64.0 | 5.87 | 7.40 | nd | 307 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 1 | 617 | 16.7 | 15.3 | 579 | 18.0 | 30.5 | 409 | 56.7 | 4.70 | 8.35 | 0.29 | 149 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 2 | 580 | 16.8 | 24.0 | 638 | 20.0 | 30.0 | 378 | 53.4 | 5.26 | 10.6 | 0.22 | 138 |
| Cuprite Cu/Pb | Orange plaque | 2013.4.005 E v1 | 2959 | 78.4 | 50.3 | 21.1 | 59.0 | 1866 | 544 | 106 | 198 | 8731 | 15508 | 242 |
| HIMT | Green plaque | 2013.4.005 G v1 | 3730 | 95.6 | 71.4 | 32.5 | 55.9 | 4083 | 628 | 268 | 109 | 1723 | 78.3 | 271 |
| HIMT | Green plaque | 2013.4.005 G v3 | 3852 | 93.9 | 73.0 | 31.2 | 50.0 | 3577 | 636 | 276 | 92.3 | 1489 | 66.8 | 265 |
| HIMT | Green plaque | 2013.4.005 G v2 | 3707 | 95.0 | 70.6 | 32.0 | 49.0 | 3206 | 606 | 260 | 87.2 | 1334 | 63.4 | 263 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Li2O | B2O3 | GaO | Rb2O | Y2O3 | Nb2O3 | Cs2O | La2O3 | CeO2 | PrO2 | Nd2O3 | Sm2O3 |
| Foy 3.2 | False garnet | 2013.4.017 a 04 | 10.5 | 661 | 3.45 | 4.62 | 8.03 | 1.84 | 0.11 | 6.69 | 11.6 | 1.56 | 6.39 | 1.50 |
| Foy 3.2 | False garnet | 2013.4.017 b 21 | 11.0 | 689 | 3.86 | 4.93 | 8.01 | 1.82 | 0.19 | 6.64 | 11.3 | 1.54 | 6.42 | 1.26 |
| Foy 3.2 | False garnet | 2013.4.017 b 22 | 11.2 | 672 | 3.93 | 5.21 | 8.05 | 1.78 | 0.18 | 6.75 | 11.8 | 1.58 | 6.40 | 1.18 |
| Foy 3.2 | False garnet | 2013.4.017 b 23 | 9.46 | 773 | 4.33 | 5.00 | 7.68 | 1.76 | 0.25 | 6.59 | 11.3 | 1.60 | 6.14 | 1.28 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 1 | 4.50 | 989 | 4.85 | 5.96 | 6.36 | 1.54 | 0.06 | 6.03 | 10.7 | 1.41 | 5.62 | 1.18 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 2 | 5.07 | 941 | 4.82 | 5.66 | 5.97 | 1.42 | 0.02 | 5.36 | 9.94 | 1.33 | 5.25 | 1.11 |
| Cuprite Cu/Pb | Orange plaque | 2013.4.005 E v1 | 14.9 | 300 | 7.40 | 9.61 | 10.1 | 5.38 | 0.29 | 10.2 | 19.4 | 2.32 | 9.41 | 1.91 |
| HIMT | Green plaque | 2013.4.005 G v1 | 14.9 | 586 | 5.47 | 7.22 | 13.4 | 5.65 | 0.15 | 12.2 | 20.3 | 2.86 | 11.7 | 2.50 |
| HIMT | Green plaque | 2013.4.005 G v3 | 13.8 | 592 | 5.65 | 7.76 | 13.4 | 5.75 | 0.13 | 12.3 | 20.5 | 2.87 | 11.5 | 2.43 |
| HIMT | Green plaque | 2013.4.005 G v2 | 12.2 | 596 | 5.45 | 6.98 | 13.0 | 5.54 | 0.13 | 12.0 | 19.8 | 2.80 | 11.3 | 2.32 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Eu2O3 | Gd2O3 | Tb2O3 | Dy2O3 | Ho2O3 | Er2O3 | Tm2O3 | Yb2O3 | Lu2O3 | HfO2 | Ta2O3 | UO2 |
| Foy 3.2 | False garnet | 2013.4.017 a 04 | 0.36 | 1.12 | 0.19 | 1.14 | 0.26 | 0.65 | 0.10 | 0.63 | 0.09 | 1.49 | 0.10 | 1.62 |
| Foy 3.2 | False garnet | 2013.4.017 b 21 | 0.38 | 1.42 | 0.20 | 1.22 | 0.24 | 0.70 | 0.10 | 0.66 | 0.09 | 1.46 | 0.09 | 1.64 |
| Foy 3.2 | False garnet | 2013.4.017 b 22 | 0.41 | 1.26 | 0.20 | 1.20 | 0.24 | 0.68 | 0.10 | 0.63 | 0.09 | 1.47 | 0.10 | 1.68 |
| Foy 3.2 | False garnet | 2013.4.017 b 23 | 0.42 | 1.42 | 0.19 | 1.17 | 0.23 | 0.64 | 0.10 | 0.60 | 0.09 | 1.41 | 0.10 | 1.65 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 1 | 0.25 | 0.03 | 0.17 | 0.98 | 0.19 | 0.52 | 0.08 | 0.56 | 0.06 | 1.23 | 0.08 | 1.55 |
| Foy 3.2 | Blue cabochon | 2013.4.040 vbl 2 | 0.20 | 0.00 | 0.16 | 0.83 | 0.17 | 0.53 | 0.07 | 0.51 | 0.08 | 1.17 | 0.07 | 1.41 |
| Cuprite Cu/Pb | Orange plaque | 2013.4.005 E v1 | 0.49 | 1.53 | 0.28 | 1.76 | 0.33 | 0.92 | 0.13 | 0.90 | 0.13 | 2.34 | 0.29 | 1.18 |
| HIMT | Green plaque | 2013.4.005 G v1 | 0.61 | 2.12 | 0.35 | 2.13 | 0.42 | 1.23 | 0.17 | 1.29 | 0.19 | 5.35 | 0.30 | 1.79 |
| HIMT | Green plaque | 2013.4.005 G v3 | 0.59 | 2.11 | 0.34 | 2.09 | 0.45 | 1.22 | 0.18 | 1.24 | 0.19 | 5.52 | 0.31 | 1.79 |
| HIMT | Green plaque | 2013.4.005 G v2 | 0.60 | 2.06 | 0.34 | 2.02 | 0.43 | 1.19 | 0.18 | 1.25 | 0.18 | 5.32 | 0.30 | 1.72 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |