Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

Supplementary Material - B - Tables of mineral compositions by WDS - electron microprobe analysis

Calibration routines and standards for each element and mineral analysed by
electron microprobe.

Major element concentration of olivine from all samples. Structural formula Table B2 calculated on the basis of 4 oxygens . C - core; R - rim; I - intermediated; mega megacrystals, macro - macrocrysts, micro - microcrysts.

- Table B3Major element concentration of monticellite from all samples. Structural formula
calculated on the basis of 4 oxigens. C core; R rim; I intermediate.
- Table B4Major element compositions of perovskite from TR-IV LM-I. Structural formula
calculated on the basis of 4 oxigens. C core; R rim; I intermediate.
- Table B5Major element compositions of ilmenite from LMI all samples. Structural formula
calculated on the basis of 6 oxigens. C core; R rim; I intermediate.

Major element compostions of clinopyroxene from TR-IV and LM-I. Structural Table B6 formula calculated on the basis of 6 oxigens, following Morimoto (1988). C - core; R - rim; I - intermediate; mt - matrix; mega - megacryst

Major element compositons of garnet from TR-IV . Structural formula calculated Table B7 on the basis of 8 cations and 12 anions. Endmembers calculated following Locock, (2008). C - core; R - rim; I - intermediate.

| Table B1 - Ca | libration routines and | l standards for eacl | element and | l mineral | analysed by | y electron | microprobe |
|---------------|------------------------|----------------------|-------------|-----------|-------------|------------|------------|
|---------------|------------------------|----------------------|-------------|-----------|-------------|------------|------------|

| Element | X-ray line | Crystal | Standards | Standards | Standards | Standards |
|---------|------------|---------|-----------------------------------|----------------------------|-------------------------|--------------------|
| | | | Olivine/monticellite ¹ | Perovskite ² | Ilmenite | Pyroxene |
| S1 | Κα | IAP | diopside | anorthite | diopside | olivine |
| Al | Κα | TAP | anorthite_%ele | | Spinel_%ele | microcline |
| Fe | Κα | LIFL | fayalite | ilmenite | ilmenite | fayalite |
| Mn | Κα | LIFL | fayalite | | fayalite | MnTiO ₃ |
| K | Κα | PETJ | Ortoclase | | Ortoclase | |
| Ca | Κα | PETJ | Wollastonite | Wollastonite | Wollastonite | Wollastonite |
| Sr | Lα | PETJ | | strontianite | | |
| Ti | Κα | LIFL | Rutile | Rutile | ilmenite | MnTiO ₃ |
| Ва | Lα | LIFL | | benitoite | | MnTiO ₃ |
| Na | Κα | TAPH | Albite | Albite | Albite | Albite |
| Mg | Κα | TAPH | basalt_#8 | | diopside | olivine |
| Ni | Κα | LIFL | glass_rhyolitic_#37 | | glass_rhyolitic_ #37 | NiO |
| Cr | Κα | LIFL | chromite_%ele | | chromite_%ele | Cr_2O_3 |
| Zn | Κα | LIFL | | | Willemite | |
| Nb | Lα | PETJ | | ilmenite | ilmenite | |
| Nd | Lα | LIFL | | neodymium- phosphate | | |
| La | Lα | LIFL | | lanthanium- phosphate | | |
| Sm | Lα | LIFL | | samarium-phosphate | | |
| Pr | Lβ | LIFL | | praseodymium- phosphate | | |
| Zr | Lα | PETJ | | zircon | | |
| Th | Μα | PETJ | | glass_rhyolitic_#32 | | |
| Ce | Lα | LIFL | | cerium-phosphate | | |

¹15.0 kV, 20nA ²25.0 kV, 100 nA

> DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

C - core; R - rim; I - intermediate; mega - megacrystals, macro - macrocrysts, micro - microcrysts.

| Sample | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | Č LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 |
|----------------|-------|-------|--------|--------|-------|-------|-------|--------|--------|-----------|--------|--------|--------|--------|--------|
| Grain/Analysis | 01/01 | 01/02 | 02/03 | 02/04 | 03/05 | 03/06 | 04/07 | 04/08 | 05/09 | 05/10 | 06/11 | 06/12 | 07/13 | 07/14 | 08/15 |
| Location | С | R | C | R | С | Я | Я | C | С | Я | С | К | C | Я | С |
| Crystal type | mega | mega | mega | mega | mega | mega | macro | macro | macro | macro | micro | micro | micro | micro | macro |
| SiO_2 | 40.17 | 40.46 | 40.61 | 40.40 | 40.19 | 39.86 | 39.71 | 40.66 | 40.23 | 39.82 | 40.63 | 40.04 | 40.45 | 40.16 | 40.06 |
| Al_2O_3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.05 | 0.04 | 0.00 |
| FeO | 8.50 | 9.67 | 10.04 | 10.31 | 9.89 | 13.50 | 13.33 | 10.13 | 11.78 | 13.61 | 9.57 | 12.77 | 10.37 | 10.38 | 12.51 |
| MnO | 0.16 | 0.15 | 0.15 | 0.14 | 0.17 | 0.21 | 0.21 | 0.15 | 0.17 | 0.19 | 0.16 | 0.21 | 0.11 | 0.12 | 0.24 |
| NiO | 0.39 | 0.39 | 0.35 | 0.41 | 0.36 | 0.20 | 0.21 | 0.38 | 0.34 | 0.24 | 0.39 | 0.16 | 0.44 | 0.46 | 0.33 |
| CaO | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.06 | 0.07 | 0.05 | 0.02 | 0.09 | 0.01 | 0.05 | 0.13 | 0.14 | 0.02 |
| K_2O | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 |
| TiO_2 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.04 | 0.09 | 0.01 | 0.00 | 0.06 | 0.02 | 0.00 |
| Cr_2O_3 | 0.01 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.05 | 0.03 | 0.00 | 0.10 | 0.00 | 0.01 | 0.06 | 0.12 | 0.00 |
| MgO | 50.34 | 49.19 | 48.79 | 48.96 | 48.94 | 46.02 | 46.21 | 48.72 | 47.57 | 45.89 | 49.62 | 46.80 | 48.53 | 48.73 | 47.32 |
| Na_2O | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| Total: | 09.66 | 99.92 | 100.06 | 100.22 | 99.58 | 99.66 | 99.83 | 100.12 | 100.17 | 100.06 | 100.41 | 100.07 | 100.20 | 100.20 | 100.47 |
| Si | 0.986 | 0.994 | 0.997 | 0.992 | 0.992 | 0.996 | 0.993 | 0.998 | 0.995 | 0.995 | 0.993 | 0.995 | 0.994 | 0.988 | 0.992 |
| \mathbf{AI} | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| Fe | 0.174 | 0.199 | 0.206 | 0.212 | 0.204 | 0.282 | 0.279 | 0.208 | 0.244 | 0.284 | 0.196 | 0.265 | 0.213 | 0.214 | 0.259 |
| Mn | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.003 | 0.003 | 0.004 | 0.003 | 0.004 | 0.002 | 0.003 | 0.005 |
| Ni | 0.008 | 0.008 | 0.007 | 0.008 | 0.007 | 0.004 | 0.004 | 0.008 | 0.007 | 0.005 | 0.008 | 0.003 | 0.009 | 0.009 | 0.006 |
| Ca | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.003 | 0.004 | 0.001 |
| K | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 |
| Ï | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Cr | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 |
| Mg | 1.842 | 1.801 | 1.786 | 1.792 | 1.800 | 1.714 | 1.722 | 1.783 | 1.754 | 1.709 | 1.807 | 1.734 | 1.778 | 1.788 | 1.746 |
| Na | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Cations: | 3.014 | 3.006 | 3.002 | 3.008 | 3.008 | 3.004 | 3.007 | 3.002 | 3.004 | 3.003 | 3.007 | 3.005 | 3.003 | 3.010 | 3.009 |
| Fayalite | 0.09 | 0.10 | 0.10 | 0.11 | 0.10 | 0.14 | 0.14 | 0.10 | 0.12 | 0.14 | 0.10 | 0.13 | 0.11 | 0.11 | 0.13 |
| Forsterite | 0.91 | 0.90 | 06.0 | 0.89 | 0.90 | 0.86 | 0.86 | 0.90 | 0.88 | 0.86 | 0.90 | 0.87 | 0.89 | 0.89 | 0.87 |

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C - core: R - rim: I - intermediate: mega - megacrystals. macro - macrocrysts, micro - microcrysts.

| | Gra | | U U | | Γ | DO | 1: 10 | .159 | 90/2 | 317 | -488 | 3920 | 202 | 019 | 008 | 7 | | | | | | | | | | | - | | 1 |
|--------|-------------|----------|-------------|---------|-----------|-------|-------|------|------|-----------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|-----------|
| Sample | in/Analysis | Location | rystal type | SiO_2 | Al_2O_3 | FeO | MnO | NiO | CaO | $ m K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ni | Ca | К | Ti | Cr | Mg | Na | Cations: | Fayalite | orsterite |
| LM-2 | 08/16 | R | macro | 40.07 | 0.00 | 12.43 | 0.22 | 0.33 | 0.04 | 0.01 | 0.05 | 0.01 | 47.15 | 0.01 | 100.32 | 0.993 | 0.000 | 0.258 | 0.005 | 0.007 | 0.001 | 0.000 | 0.001 | 0.000 | 1.742 | 0.001 | 3.006 | 0.13 | 0.87 |
| LM-2 | 09/17 | C | micro | 40.20 | 0.04 | 11.65 | 0.15 | 0.39 | 0.15 | 0.00 | 0.06 | 0.09 | 47.54 | 0.03 | 100.30 | 0.993 | 0.001 | 0.241 | 0.003 | 0.008 | 0.004 | 0.000 | 0.001 | 0.002 | 1.751 | 0.001 | 3.005 | 0.12 | 0.88 |
| LM-2 | 09/18 | Ч | micro | 40.45 | 0.04 | 11.61 | 0.16 | 0.37 | 0.13 | 0.00 | 0.00 | 0.08 | 47.46 | 0.02 | 100.32 | 0.998 | 0.001 | 0.240 | 0.003 | 0.007 | 0.004 | 0.000 | 0.000 | 0.002 | 1.746 | 0.001 | 3.001 | 0.12 | 0.88 |
| LM3-1 | 10/19 | C | mega | 40.32 | 0.00 | 10.10 | 0.18 | 0.40 | 0.01 | 0.01 | 0.01 | 0.00 | 49.29 | 0.02 | 100.33 | 0.989 | 0.000 | 0.207 | 0.004 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.802 | 0.001 | 3.012 | 0.10 | 0.90 |
| LM3-1 | 10/20 | Ч | mega | 39.55 | 0.00 | 12.22 | 0.17 | 0.29 | 0.02 | 0.00 | 0.03 | 0.03 | 48.12 | 0.00 | 100.42 | 0.979 | 0.000 | 0.253 | 0.004 | 0.006 | 0.001 | 0.000 | 0.000 | 0.001 | 1.776 | 0.000 | 3.020 | 0.12 | 0.88 |
| LM3-1 | 11/21 | C | mega | 40.90 | 0.01 | 7.46 | 0.12 | 0.35 | 0.04 | 0.00 | 0.01 | 0.03 | 51.20 | 0.00 | 100.13 | 0.992 | 0.000 | 0.151 | 0.002 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 1.852 | 0.000 | 3.007 | 0.08 | 0.92 |
| LM3-1 | 11/22 | R | mega | 41.10 | 00.0 | 7.53 | 0.13 | 0.37 | 0.03 | 0.00 | 0.05 | 0.01 | 50.91 | 0.01 | 100.14 | 0.997 | 0.000 | 0.153 | 0.003 | 0.007 | 0.001 | 0.000 | 0.001 | 0.000 | 1.841 | 0.000 | 3.002 | 0.08 | 0.92 |
| LM3-1 | 12/23 | C | mega | 40.20 | 0.02 | 12.18 | 0.16 | 0.31 | 0.07 | 0.00 | 0.02 | 0.00 | 47.50 | 0.00 | 100.46 | 0.993 | 0.001 | 0.252 | 0.003 | 0.006 | 0.002 | 0.000 | 0.000 | 0.000 | 1.749 | 0.000 | 3.006 | 0.13 | 0.87 |
| LM3-1 | 12/24 | Ч | mega | 40.36 | 0.01 | 11.79 | 0.16 | 0.36 | 0.05 | 0.02 | 0.00 | 0.00 | 47.15 | 0.01 | 99.91 | 1.000 | 0.000 | 0.244 | 0.003 | 0.007 | 0.001 | 0.001 | 0.000 | 0.000 | 1.742 | 0.001 | 3.000 | 0.12 | 0.88 |
| LM3-1 | 13/25 | C | macro | 40.73 | 0.01 | 8.18 | 0.10 | 0.37 | 0.01 | 0.00 | 0.00 | 0.01 | 51.15 | 0.00 | 100.55 | 0.988 | 0.000 | 0.166 | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 1.849 | 0.000 | 3.012 | 0.08 | 0.92 |
| LM3-1 | 13/26 | Ч | macro | 40.22 | 0.00 | 13.91 | 0.20 | 0.19 | 0.08 | 0.00 | 0.02 | 0.04 | 45.79 | 0.01 | 100.45 | 1.000 | 0.000 | 0.289 | 0.004 | 0.004 | 0.002 | 0.000 | 0.000 | 0.001 | 1.698 | 0.001 | 2.999 | 0.15 | 0.85 |
| LM3-1 | 14/27 | C | macro | 39.93 | 0.05 | 11.29 | 0.13 | 0.39 | 0.11 | 0.00 | 0.06 | 0.11 | 48.22 | 0.01 | 100.32 | 0.986 | 0.002 | 0.233 | 0.003 | 0.008 | 0.003 | 0.000 | 0.001 | 0.002 | 1.774 | 0.001 | 3.012 | 0.12 | 0.88 |
| LM3-1 | 14/28 | Ч | macro | 40.47 | 0.05 | 10.89 | 0.16 | 0.40 | 0.14 | 0.02 | 0.03 | 0.08 | 47.90 | 0.02 | 100.16 | 0.997 | 0.001 | 0.224 | 0.003 | 0.008 | 0.004 | 0.001 | 0.001 | 0.002 | 1.760 | 0.001 | 3.001 | 0.11 | 0.89 |
| LM3-1 | 15/29 | C | macro | 39.89 | 0.00 | 13.15 | 0.15 | 0.34 | 0.03 | 0.00 | 0.04 | 0.01 | 47.18 | 0.01 | 100.80 | 0.987 | 0.000 | 0.272 | 0.003 | 0.007 | 0.001 | 0.000 | 0.001 | 0.000 | 1.741 | 0.000 | 3.012 | 0.14 | 0.86 |
| LM3-1 | 15/30 | Ч | macro | 40.25 | 0.00 | 13.01 | 0.22 | 0.31 | 0.08 | 0.00 | 0.03 | 0.02 | 46.37 | 0.00 | 100.29 | 0.999 | 0.000 | 0.270 | 0.005 | 0.006 | 0.002 | 0.000 | 0.001 | 0.000 | 1.716 | 0.000 | 3.000 | 0.14 | 0.86 |

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| Early stats, interlo Interlo Interlo LM3-1 LM3-2 LM3-2 LM3-2 LM3-1 LM3-2 LM3-2 LM3-2 I8/36 19/37 19/37 19/38 R C R R micro mega mega mega 40.38 39.77 39.91 0.02 0.00 0.002 0.02 0.02 0.13 0.14 0.15 0.14 0.13 0.14 0.15 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.001 0.002 0.00 0.000 0.001 0.000 0.000 0.000 0.001 0.000 0.000 0.000 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.001 0.000 0.001 | Eductry Sectory Index or LIM3-1 LM13-1 LM13-2 LM13-2 <thlm3-2< th=""> LM13-2 <thlm3-2< td="" th<=""><td>Bactystats, interior Interior<</td><td>Bart Jonary Index - Index of years, Iso's 19/37 19/38 20/39 20/40 21/41 R C R C R C Anicro mega micro micro mega micro mega 0.000 0.012 0.022 0.02 0.011 0.010 0.001 0.133 0.14 0.15 0.15 0.114 0.17 0.000 0.133 0.14 0.15 0.115 0.119 0.114 0.017 0.133 0.14 0.15 0.010 0.010 0.011 0.000 0.133 0.14 0.15 0.15 0.17 0.36 0.36 0.000 0.001 0.010 0.011 0.010 0.011 0.011 0.143 0.43 0.43 0.36 0.36 0.36 0.36 0.000 0.001 0.010 0.011 0.010 0.011 0.011 0.13 0.143 0.25 <t< td=""><td>gary static - Inductory side, III June - Inductory side, IIII June - IIIII June - IIII June - IIIII June - IIII June - IIII June - IIII June - IIII June - IIIII June - IIII June - IIIIIIIIII June - IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII</td><td>Bactystats, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interformed and interval and int</td><td>Eacry starts, intacto - intactoryses, intervo IM3-2 LM3-2 <</td><td>Barty Statis, InterVo - InterVol ystas, InterVo Ethelo - InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, Isy37 21937 19/37 19/37 20/39 20/40 21/41 21/42 22/43 22/44 23/45 18/36 19/37 19/37 39/91 40.58 39/69 40.26 40.26 40.53 2/44</td><td>Limits the contraction of the contract of</td></t<></td></thlm3-2<></thlm3-2<> | Bactystats, interior Interior< | Bart Jonary Index - Index of years, Iso's 19/37 19/38 20/39 20/40 21/41 R C R C R C Anicro mega micro micro mega micro mega 0.000 0.012 0.022 0.02 0.011 0.010 0.001 0.133 0.14 0.15 0.15 0.114 0.17 0.000 0.133 0.14 0.15 0.115 0.119 0.114 0.017 0.133 0.14 0.15 0.010 0.010 0.011 0.000 0.133 0.14 0.15 0.15 0.17 0.36 0.36 0.000 0.001 0.010 0.011 0.010 0.011 0.011 0.143 0.43 0.43 0.36 0.36 0.36 0.36 0.000 0.001 0.010 0.011 0.010 0.011 0.011 0.13 0.143 0.25 <t< td=""><td>gary static - Inductory side, III June - Inductory side, IIII June - IIIII June - IIII June - IIIII June - IIII June - IIII June - IIII June - IIII June - IIIII June - IIII June - IIIIIIIIII June - IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII</td><td>Bactystats, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interformed and interval and int</td><td>Eacry starts, intacto - intactoryses, intervo IM3-2 LM3-2 <</td><td>Barty Statis, InterVo - InterVol ystas, InterVo Ethelo - InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, Isy37 21937 19/37 19/37 20/39 20/40 21/41 21/42 22/43 22/44 23/45 18/36 19/37 19/37 39/91 40.58 39/69 40.26 40.26 40.53 2/44</td><td>Limits the contraction of the contract of</td></t<> | gary static - Inductory side, III June - Inductory side, IIII June - IIIII June - IIII June - IIIII June - IIII June - IIII June - IIII June - IIII June - IIIII June - IIII June - IIIIIIIIII June - IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII | Bactystats, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interfor - interlocitysts, interformed and interval and int | Eacry starts, intacto - intactoryses, intervo IM3-2 LM3-2 < | Barty Statis, InterVo - InterVol ystas, InterVo Ethelo - InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, InterVol ystas, Isy37 21937 19/37 19/37 20/39 20/40 21/41 21/42 22/43 22/44 23/45 18/36 19/37 19/37 39/91 40.58 39/69 40.26 40.26 40.53 2/44 | Limits the contraction of the contract of | |
| J. Itacto - Itacto - Litacto - Lucito - Local - 23.77 - 39.91 - 0.02 - 0.02 - 0.02 - 0.02 - 0.01 - 0.05 - 0.06 - 0.06 - 0.06 - 0.06 - 0.06 - 0.06 - 0.00 - 0. | J. Inacto - Inactod Pysis, III, M3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 L9/37 19/38 20/39 C R C mega mega micro 39.77 39.91 40.58 0.02 0.02 0.01 12.79 12.76 10.29 0.14 0.15 0.15 0.15 0.15 0.15 0.14 0.15 0.15 0.14 0.15 0.15 0.15 0.00 0.06 0.06 0.06 0.06 0.06 0.06 0.00 0.01 0.01 0.01 0.01 0.01 0.026 0.01 0.01 0.01 0.02 0.00 0.0990 0.991 0.993 0.001 0.001 0.000 0.266 0.265 0.211 0.003 0.003 0.003 0.003 0.003 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.001 0.000 0.000 0.001 0.001 0.000 0.001 0.000 0.000 0.001 0.001 0.000 0.001 0.001 0.000 0.001 0.001 0.000 0.001 0.001 0.000 0.001 0.000 0.001 0.000 0.001 0.000 0.000 0.000 0.001 0.000 0.000 0.001 0.000 0.000 0.00 | Jinacto - Inacto | Structor Indector | A. Mactor - Inductor Jysis, Inductor Inductor Jysis, LM3-2 | A. Inderto - Indertocitysis, Interto - Indertocitysis, Inderto - Indertocitysis, IM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 19/37 19/38 20/39 20/40 21/41 21/42 22/43 C R C R C R C <i>mega mega micro micro micro mega mega mega</i> 0.02 0.02 0.01 0.01 0.01 0.01 0.00 12.79 12.76 10.29 13.39 11.41 13.45 7.72 0.14 0.15 0.15 0.19 0.16 0.00 0.00 0.05 0.00 0.01 0.00 0.01 0.01 0.01 0.06 0.03 0.00 0.01 0.00 0.00 0.01 0.014 0.015 0.010 0.001 0.001 0.002 0.00 0.010 < | S. Indecto - Indectorysis, Indecto S. Indecto Indeto Indecto Indecto | S. Interfor - Interforuptise, interforment of the sector of the | S. mactor - intactor/pass, muctor introductyses. LM3-2 LM3-2 <thlm3-2< th=""> LM3-2 LM3-2<!--</td--></thlm3-2<> | |
| - Inductor IP/38 IP/38 R R 39.91 0.02 0.15 0.15 0.15 0.15 0.01 0.01 0.02 0.00 0.002 0.002 0.002 0.002 0.002 0.002 0.0000 0.000 0.000 0.000 0.000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000000 | IIII.4.0001 yass, IIII. I.M.3-2 LM.3-2 I.M.3-2 LM.3-2 I.P.38 20/39 R C mega micro 39.91 40.58 0.02 0.01 12.76 10.29 0.15 0.15 0.15 0.43 0.36 0.06 0.06 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.01 0.00 0.025 0.00 0.001 0.000 0.002 0.001 0.0991 0.9933 0.001 0.000 0.265 0.211 0.000 | Inactodysis, interestination - functional sector interestination interestinatina interestination interestination interestination inter | Inductoryses, induce - inductoryses, inductoryses, induce - inductoryses, induce - inductoryses, | Inactocrysts, intege - integer sector LM3-2 LM3-2 <thlm3-2< th=""> LM3-2 LM3-2</thlm3-2<> | Imatter of the constraint of the cons | Imacrocryses, integer integer of the collocation of the collocating the collocation of the collocation of the collocation of thec | - Indecorpase, indecorpose, indecorpose, indecorpase, indecorpase, indecorpase, indeco | Imatoropyse, much or indication of the form of the for | |
| | III (size) III (size) LM3-2 20/39 20 20/39 C 0.01 C 0.01 10.29 0.03 0.15 0.03 0.01 0.03 0.02 0.03 0.036 0.03 0.001 0.00 0.002 0.00 0.003 0.00 0.001 0.00 0.001 0.00 0.001 0.000 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 | Image: Number of the system of the | Aysts, Intero - Interocrysts. LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 20/39 20/40 21/41 C C R C C micro micro mega 40.58 39.69 40.26 0.01 0.01 0.01 0.01 0.00 10.25 13.39 11.41 0.17 0.36 0.36 0.36 0.36 0.00 0.01 0.01 0.01 0.36 0.36 0.36 0.36 0.00 0.01 0.01 0.01 0.01 0.04 0.01 0.01 0.01 0.04 0.01 0.01 100.54 99.67 100.59 0.090 0.001 0.000 0.000 0.000 0.001 0.000 0.000 0.000 0.001 0.000 0.000 0.000 0.000 0.001 0.00 | Jysus, Interior - Interocrysus. LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 20/39 20/40 21/41 21/42 C R C R micro micro mega mega 40.58 39.69 40.26 40.20 0.01 0.01 0.01 0.01 0.15 0.19 0.17 0.20 0.15 0.19 0.17 0.20 0.036 0.36 0.19 0.11 0.00 0.01 0.00 0.00 0.16 0.01 0.00 0.00 0.01 0.01 0.01 0.00 0.01 0.01 0.01 0.02 0.00 0.01 0.01 0.02 0.000 0.001 0.01 0.02 0.001 0.001 0.001 0.001 0.001 0.001 0.000 0.001 0.000 0.000 0.000 0.000 | Jysts, interior - interocupats. LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 C R C micro micro micro 0.01 0.01 0.01 0.019 0.19 0.19 0.019 0.010 0.010 0.019 0.019 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 0.010 | Types, interio Interior | Aysos, Indue - Inductysis. LM3-2 LM3-2 <thlm3-2< th=""> LM3-2 LM3-2<</thlm3-2<> | Application - Introductions. LM3-2 20/39 20/40 21/41 21/42 22/43 23/45 C R LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 LM3-2 20/39 20/40 21/41 21/42 22/43 23/45 C R R C R C 20/40 21/41 21/42 22/43 23/45 23/46 C R C R 0.01 0.01 0.00 0.00 0.01 0.01 0.00 0.00 0.01 0.01 0.00 0.00 0.01 0.01 0.00 0.00 0.01 0.01 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.00 0.01 0.01 0.01 <th colspan="</td> | |

TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS

Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

| | | | O T B S | XYG RÊS runa viser | iEN F RAN(a Col ro | UG/ CHO deb | ACIT S IV ella, | Y OI ANI Roj | F TH D LIN gérie | ie a Vieif o Gi | LTO RA I uita | PAI INTI rrari | RAN RUS i Az | AÍB ION: zone | AKI S ≥, Li | MB Jani | ERLI na C | TES Chm [.] | ANI yz, I | D DI Exce | AM Iso | ONC Rub |) IN: erti | STA | BILI | ГҮ: Р. | | | | |
|-------------------------|---------|----------------|------------------|-----------------------------|------------------------------|-------------------|-----------------------|--------------------|------------------------|-----------------------|---------------------|----------------------|--------------------|---------------------|-------------------|------------|--------------|-------------------------|--------------|--------------|-----------|------------|---------------|-------|-------|-----------|-------|----------|----------|------------|
| T MI D1 | LMI-BI | 31/02 | R | mega | 40.81 | 0.02 | 9.40 | 0.14 | 0.43 | 0.03 | 0.01 | 0.02 | 0.00 | 49.16 | 0.14 | 100.15 | 0.999 | 0.000 | 0.192 | 0.003 | 0.009 | 0.001 | 0.000 | 0.000 | 0.000 | 1.793 | 0.007 | 3.004 | 0.303 | 0.697 |
| T MT D1 | LMI-BI | 31/01 | C | mega | 40.66 | 0.00 | 9.42 | 0.13 | 0.39 | 0.02 | 0.02 | 0.03 | 0.02 | 50.03 | 0.00 | 100.72 | 0.990 | 0.000 | 0.192 | 0.003 | 0.008 | 0.001 | 0.001 | 0.001 | 0.000 | 1.816 | 0.000 | 3.010 | 1.000 | 0.000 |
| T MT D1 | LMI-B1 | 30/60 | R | mega | 40.49 | 0.01 | 11.10 | 0.15 | 0.40 | 0.01 | 0.00 | 0.02 | 0.00 | 48.59 | 0.00 | 100.75 | 0.992 | 0.000 | 0.228 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.776 | 0.000 | 3.007 | 1.000 | 0.000 |
| I MI DI | LMI-BI | 90/08 | C | mega | 40.75 | 0.00 | 9.02 | 0.12 | 0.35 | 0.02 | 0.00 | 0.00 | 0.03 | 50.10 | 0.00 | 100.40 | 0.993 | 0.000 | 0.184 | 0.003 | 0.007 | 0.000 | 0.000 | 0.000 | 0.001 | 1.820 | 0.000 | 3.007 | 0.943 | 0.057 |
| S. I MI D1 | LMI-BI | 80/67 | Ч | mega | 40.39 | 0.00 | 10.82 | 0.16 | 0.38 | 0.01 | 0.00 | 0.00 | 0.02 | 48.51 | 0.00 | 100.30 | 0.993 | 0.000 | 0.223 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.779 | 0.000 | 3.006 | 1.000 | 0.000 |
| nicrocryst | LMI-BI | 10/67 | C | mega | 40.53 | 0.00 | 9.68 | 0.15 | 0.38 | 0.01 | 0.00 | 0.00 | 0.01 | 49.51 | 0.01 | 100.29 | 0.992 | 0.000 | 0.198 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.806 | 0.000 | 3.008 | 0.896 | 0.104 |
| i, micro - I I MI D1 | LMI-BI | 90/87 | К | mega | 40.77 | 0.01 | 8.15 | 0.12 | 0.35 | 0.00 | 0.01 | 0.00 | 0.00 | 50.14 | 0.00 | 99.55 | 0.997 | 0.000 | 0.167 | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 1.829 | 0.000 | 3.003 | 1.000 | 0.000 |
| acrocrysts | LMI-BI | CC/87 | C | mega | 40.50 | 0.00 | 8.27 | 0.11 | 0.37 | 0.00 | 0.04 | 0.04 | 0.00 | 50.83 | 0.00 | 100.17 | 0.987 | 0.000 | 0.169 | 0.002 | 0.007 | 0.000 | 0.001 | 0.001 | 0.000 | 1.846 | 0.000 | 3.013 | 1.000 | 0.000 |
| macro - m | LMI-BI | 2//24 | К | mega | 39.83 | 0.02 | 12.74 | 0.19 | 0.31 | 0.03 | 0.00 | 0.00 | 00.00 | 47.53 | 0.00 | 100.64 | 0.986 | 0.001 | 0.264 | 0.004 | 0.006 | 0.001 | 0.000 | 0.000 | 0.000 | 1.753 | 0.000 | 3.014 | 1.000 | 0.000 |
| acrystals, | LMI-BI | 50/17 | C | mega | 40.33 | 0.00 | 11.93 | 0.18 | 0.33 | 0.00 | 0.01 | 0.04 | 0.00 | 48.03 | 0.00 | 100.85 | 0.991 | 0.000 | 0.245 | 0.004 | 0.007 | 0.000 | 0.000 | 0.001 | 0.000 | 1.760 | 0.000 | 3.008 | 0.961 | 0.039 |
| ega - meg | LIM13-2 | 70/97 | Ч | macro | 38.81 | 0.00 | 16.56 | 0.22 | 0.28 | 0.04 | 0.02 | 0.02 | 0.05 | 44.11 | 0.01 | 100.14 | 0.984 | 0.000 | 0.351 | 0.005 | 0.006 | 0.001 | 0.001 | 0.000 | 0.001 | 1.667 | 0.000 | 3.016 | 0.17 | 0.83 |
| | LIM13-2 | 10/97 | C | macro | 39.38 | 0.00 | 16.60 | 0.24 | 0.27 | 0.03 | 0.02 | 00.00 | 00.00 | 43.94 | 0.00 | 100.47 | 0.993 | 0.000 | 0.350 | 0.005 | 0.005 | 0.001 | 0.001 | 0.000 | 0.000 | 1.652 | 0.000 | 3.007 | 0.17 | 0.83 |
| | LM3-2 | 00/07 | Ч | micro | 39.88 | 0.00 | 12.75 | 0.20 | 0.22 | 0.07 | 0.04 | 0.00 | 0.03 | 46.70 | 0.01 | 96.66 | 0.994 | 0.000 | 0.266 | 0.004 | 0.004 | 0.002 | 0.001 | 0.000 | 0.001 | 1.735 | 0.000 | 3.007 | 0.13 | 0.87 |
| (- 1111; 1 1 M12 7 | LM3-2 | 64/07 | C | micro | 40.65 | 0.00 | 9.66 | 0.14 | 0.37 | 0.03 | 0.01 | 0.00 | 0.00 | 49.80 | 0.01 | 100.67 | 0.991 | 0.000 | 0.197 | 0.003 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 1.810 | 0.000 | 3.009 | 0.10 | 0.90 |
| - core; h | LM3-2 | 24/48 | Я | macro | 39.07 | 0.00 | 12.89 | 0.19 | 0.23 | 0.41 | 0.00 | 0.03 | 0.00 | 47.50 | 0.00 | 100.32 | 0.973 | 0.000 | 0.269 | 0.004 | 0.005 | 0.011 | 0.000 | 0.001 | 0.000 | 1.764 | 0.000 | 3.026 | 0.13 | 0.87 |
| Comula | Sample | Urain/Analysis | Location | Crystal type | SiO_2 | Al_2O_3 | FeO | MnO | NiO | CaO | K_2O | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | Al | Fe | Mn | Ni | Са | K | Τi | Cr | Mg | Na | Cations: | Fayalite | Forsterite |

DOI: 10.1590/2317-4889202020190087

| | ent concei - rim· I - i | ntration of ntermedia | olivine fro | om all sam megacryst | iples. Struc 'als macro | ctural form - macrocr | ula calcula vsts micro | ated on th o - micro | ne basis crysts | of 4 ox | vgens . | | | | | |
|---------------|----------------------------|--------------------------|-------------------|-------------------------|----------------------------|--------------------------|---------------------------|-------------------------|--------------------|---------|---------|-------|--------|-------|-------|-------|
| LMI-C1 LMI-C1 | LMI-CI | * I | w, musu LMI-CI | LMI-C2 | LMI-C2 | LMI-C2 | LMI-C2 | TR-4 | TR-4 | TR-4 | TR-4 | TR-4 | TR-4 | TR-4 | TR-4 | |
| 33/66 34/67 | 34/67 | | 34/68 | 36/71 | 36/72 | 37/73 | 37/74 | 01/01 | 01/02 | 02/03 | 02/04 | 03/05 | 03/06 | 04/07 | 04/08 | 05/09 |
| R C | C | | R | C | Ч | С | R | C | Я | C | Я | C | R | C | R | C |
| mega mega | mega | 1 | mega | mega | mega | mega | mega | mega | mega | micro | micro | macro | macro | micro | micro | micro |
| 39.55 40.40 | 40.40 | | 40.22 | 40.54 | 39.55 | 40.16 | 41.26 | 41.04 | 40.75 | 41.38 | 41.63 | 40.86 | 39.97 | 40.48 | 41.10 | 39.29 |
| 0.00 0.01 | 0.01 | | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 |
| 11.26 11.55 | 11.55 | | 11.30 | 8.98 | 9.22 | 12.40 | 12.83 | 8.06 | 7.89 | 8.19 | 8.03 | 8.02 | 8.03 | 8.46 | 8.63 | 13.53 |
| 0.20 0.18 | 0.18 | | 0.18 | 0.14 | 0.16 | 0.16 | 0.17 | 0.12 | 0.09 | 0.08 | 0.09 | 0.11 | 0.09 | 0.11 | 0.11 | 0.14 |
| 0.40 	0.34 | 0.34 | | 0.33 | 0.38 | 0.37 | 0.36 | 0.35 | 0.35 | 0.37 | 0.38 | 0.39 | 0.36 | 0.39 | 0.42 | 0.40 | 0.38 |
| 0.01 0.02 | 0.02 | | 0.01 | 0.02 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.03 | 0.04 | 0.00 | 0.04 | 0.03 | 0.02 | 0.07 |
| 0.01 0.01 | 0.01 | | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| 0.00 0.00 | 0.00 | | 0.00 | 0.01 | 0.03 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 |
| 0.00 0.05 | 0.05 | | 0.03 | 0.00 | 0.01 | 0.03 | 0.04 | 0.02 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.02 |
| 49.38 48.36 | 48.36 | | 49.29 | 49.63 | 50.82 | 47.00 | 45.06 | 50.38 | 50.39 | 49.64 | 48.70 | 50.25 | 51.58 | 49.74 | 49.46 | 46.19 |
| 0.02 0.01 | 0.01 | | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 |
| 100.84 100.93 | 100.93 | ~ | 101.36 | 99.72 | 100.20 | 100.17 | 77.66 | 100.00 | 99.50 | 99.74 | 98.89 | 99.65 | 100.13 | 99.26 | 99.75 | 99.67 |
| 0.973 0.991 | 0.991 | | 0.982 | 0.994 | 0.970 | 0.996 | 1.025 | 0.999 | 0.996 | 1.009 | 1.021 | 0.998 | 0.975 | 0.995 | 1.005 | 0.986 |
| 0.000 0.000 | 0.000 | _ | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| 0.232 0.237 | 0.237 | _ | 0.231 | 0.184 | 0.189 | 0.257 | 0.267 | 0.164 | 0.161 | 0.167 | 0.165 | 0.164 | 0.164 | 0.174 | 0.176 | 0.284 |
| 0.004 0.002 | 0.00 | — | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 |
| 0.008 0.007 | 0.00 | ~ | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 |
| 0.00 0.00 | 0.00 | _ | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 |
| 0.00 0.000 | 0.00 | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.00 0.00 | 0.00 | 0 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 0.00 0.00 | 0.00 | - | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 1.810 1.76 | 1.76 | 8 | 1.794 | 1.815 | 1.858 | 1.738 | 1.669 | 1.828 | 1.837 | 1.804 | 1.781 | 1.829 | 1.875 | 1.823 | 1.803 | 1.728 |
| 0.001 0.00 | 0.00 | 0 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| 3.028 3.00 | 3.00 | 6 | 3.018 | 3.005 | 3.030 | 3.003 | 2.975 | 3.001 | 3.004 | 2.991 | 2.978 | 3.001 | 3.025 | 3.004 | 2.995 | 3.014 |
| 0.818 0.933 | 0.933 | ~ | 0.932 | 1.000 | 0.843 | 0.948 | 0.873 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.14 |
| 0.182 0.067 | 0.067 | | 0.068 | 0.000 | 0.157 | 0.052 | 0.127 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.91 | 0.91 | 0.86 |

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P.

Svisero

TABELA B2 - Major element concentration of olivine from all samples. Structural formula calculated on the basis of 4 oxygens

| | TR4-1 | 14/27 | C | micro | 39.62 | 0.00 | 12.75 | 0.19 | 0.27 | 0.02 | 0.01 | 0.01 | 0.01 | 46.49 | 0.02 | 99.38 | 0.993 | 0.000 | 0.267 | 0.004 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 1.736 | 0.001 | 3.008 | 0.13 | 0.87 |
|------------|--------|----------------|----------|--------------|---------|-----------------------------|-------|------|------|------|-----------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|------------|
| | TR4-1 | 13/26 | К | mega | 40.42 | 0.01 | 8.29 | 0.11 | 0.39 | 0.04 | 0.00 | 0.00 | 0.03 | 49.71 | 0.01 | 99.01 | 0.996 | 0.000 | 0.171 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.001 | 1.825 | 0.000 | 3.004 | 0.09 | 0.91 |
| | TR4-1 | 13/25 | C | mega | 40.34 | 0.00 | 7.96 | 0.09 | 0.37 | 0.03 | 0.02 | 0.02 | 0.03 | 50.59 | 0.02 | 99.48 | 0.988 | 0.000 | 0.163 | 0.002 | 0.007 | 0.001 | 0.001 | 0.000 | 0.001 | 1.848 | 0.001 | 3.012 | 0.08 | 0.92 |
| | TR4-1 | 12/24 | R | mega | 39.82 | 0.00 | 11.24 | 0.18 | 0.34 | 0.04 | 0.00 | 0.04 | 0.02 | 47.36 | 0.01 | 90.06 | 0.994 | 0.000 | 0.235 | 0.004 | 0.007 | 0.001 | 0.000 | 0.001 | 0.000 | 1.763 | 0.001 | 3.005 | 0.12 | 0.88 |
| | TR4-1 | 12/23 | C | mega | 40.72 | 0.00 | 7.68 | 0.12 | 0.43 | 0.00 | 0.00 | 0.00 | 0.01 | 50.46 | 0.02 | 99.44 | 0.996 | 0.000 | 0.157 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.840 | 0.001 | 3.004 | 0.08 | 0.92 |
| | TR4-1 | 11/22 | Я | mega | 40.01 | 0.01 | 9.11 | 0.12 | 0.32 | 0.01 | 0.00 | 0.06 | 0.01 | 49.54 | 0.00 | 91.00 | 0.988 | 0.000 | 0.188 | 0.003 | 0.006 | 0.000 | 0.000 | 0.001 | 0.000 | 1.824 | 0.000 | 3.011 | 0.09 | 0.91 |
| ocrysts. | TR4-1 | 11/21 | C | mega | 40.16 | 0.00 | 8.85 | 0.14 | 0.33 | 0.00 | 0.02 | 0.04 | 0.04 | 49.46 | 0.00 | 99.03 | 0.992 | 0.000 | 0.183 | 0.003 | 0.007 | 0.000 | 0.001 | 0.001 | 0.001 | 1.821 | 0.000 | 3.007 | 0.09 | 0.91 |
| ro - micr | TR-4 | 10/20 | Ч | macro | 41.40 | 0.00 | 8.16 | 0.11 | 0.41 | 0.01 | 0.00 | 0.03 | 0.02 | 49.75 | 0.01 | 99.92 | 1.008 | 0.000 | 0.166 | 0.002 | 0.008 | 0.000 | 0.000 | 0.001 | 0.000 | 1.805 | 0.000 | 2.992 | 0.08 | 0.92 |
| sts, mic | TR-4 | 10/19 | C | macro | 40.70 | 0.00 | 8.38 | 0.12 | 0.39 | 0.00 | 0.01 | 0.00 | 0.03 | 49.96 | 0.01 | 99.61 | 0.997 | 0.000 | 0.172 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.001 | 1.824 | 0.000 | 3.003 | 0.09 | 0.91 |
| nacrocry | TR-4 | 09/18 | Я | macro | 41.43 | 0.02 | 8.36 | 0.10 | 0.39 | 0.01 | 0.01 | 0.00 | 0.00 | 48.63 | 0.02 | 98.99 | 1.018 | 0.000 | 0.172 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.781 | 0.001 | 2.983 | 0.09 | 0.91 |
| nacro - n | TR-4 | 09/17 | C | macro | 41.13 | 0.01 | 8.60 | 0.09 | 0.42 | 0.02 | 0.03 | 0.03 | 0.03 | 49.65 | 0.01 | 100.01 | 1.003 | 0.000 | 0.175 | 0.002 | 0.008 | 0.001 | 0.001 | 0.001 | 0.001 | 1.805 | 0.000 | 2.997 | 0.09 | 0.91 |
| rystals, 1 | TR-4 | 08/16 | C | mega | 40.74 | 0.00 | 9.36 | 0.13 | 0.39 | 0.07 | 0.01 | 0.00 | 0.02 | 49.29 | 0.01 | 100.02 | 0.998 | 0.000 | 0.192 | 0.003 | 0.008 | 0.002 | 0.000 | 0.000 | 0.000 | 1.800 | 0.000 | 3.002 | 0.10 | 0.90 |
| - megacı | TR-4 | 08/15 | Ч | mega | 40.68 | 0.01 | 9.41 | 0.14 | 0.37 | 0.08 | 0.00 | 0.06 | 0.03 | 48.72 | 0.01 | 99.53 | 1.001 | 0.000 | 0.194 | 0.003 | 0.007 | 0.002 | 0.000 | 0.001 | 0.001 | 1.787 | 0.000 | 2.997 | 0.10 | 0.90 |
| ; mega | TR-4 | 07/14 | К | mega | 41.16 | 0.01 | 8.38 | 0.11 | 0.40 | 0.02 | 0.00 | 0.00 | 0.00 | 48.88 | 0.00 | 98.97 | 1.012 | 0.000 | 0.172 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.792 | 0.000 | 2.988 | 0.09 | 0.91 |
| mediate | TR-4 | 07/13 | C | mega | 41.03 | 0.01 | 8.38 | 0.11 | 0.39 | 0.01 | 0.01 | 0.00 | 0.01 | 49.82 | 0.00 | 99.78 | 1.002 | 0.000 | 0.171 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.814 | 0.000 | 2.998 | 0.09 | 0.91 |
| I - inter | TR-4 | 06/12 | К | micro | 42.15 | 0.01 | 8.10 | 0.11 | 0.39 | 0.01 | 0.01 | 0.01 | 0.00 | 49.27 | 0.00 | 100.05 | 1.022 | 0.000 | 0.164 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.781 | 0.000 | 2.978 | 0.08 | 0.92 |
| R - rim; | TR-4 | 06/11 | C | micro | 41.21 | 0.01 | 8.11 | 0.11 | 0.41 | 0.03 | 0.00 | 0.00 | 0.04 | 49.97 | 0.00 | 99.88 | 1.004 | 0.000 | 0.165 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.001 | 1.814 | 0.000 | 2.996 | 0.08 | 0.92 |
| - core; | TR-4 | 05/10 | Ч | micro | 40.18 | 0.02 | 13.47 | 0.13 | 0.38 | 0.08 | 0.00 | 0.04 | 0.02 | 45.40 | 0.04 | 99.78 | 1.005 | 0.001 | 0.282 | 0.003 | 0.008 | 0.002 | 0.000 | 0.001 | 0.000 | 1.692 | 0.002 | 2.995 | 0.14 | 0.86 |
| C | Sample | Grain/Analysis | Location | Crystal type | SiO_2 | $\mathrm{Al}_2\mathrm{O}_3$ | FeO | MnO | NiO | CaO | $ m K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ni | Ca | K | Τi | Cr | Mg | Na | Cations: | Fayalite | Forsterite |

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|---------------------------------------|--------|----------------|----------|--------------|---------|-----------|---------------|------------|------|------|-----------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|------------|
| | TR4-2 | 23/45 | C | micro | 40.87 | 0.01 | 8.32 | 0.09 | 0.36 | 0.00 | 0.01 | 0.00 | 0.01 | 50.87 | 0.01 | 100.54 | 1.007 | 0.000 | 0.172 | 0.003 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 1.803 | 0.000 | 2.992 | 0.09 | 0.91 |
| | TR4-2 | 22/44 | R | macro | 40.57 | 0.01 | 7.87 | 0.10 | 0.40 | 0.04 | 0.00 | 0.01 | 0.02 | 52.00 | 0.02 | 101.05 | 0.991 | 0.000 | 0.169 | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 1.839 | 0.000 | 3.009 | 0.08 | 0.92 |
| | TR4-2 | 22/43 | C | macro | 41.07 | 0.00 | 7.93 | 0.10 | 0.43 | 0.03 | 0.00 | 0.00 | 0.01 | 51.18 | 0.01 | 100.75 | 0.979 | 0.000 | 0.159 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.870 | 0.001 | 3.021 | 0.08 | 0.92 |
| | TR4-2 | 21/42 | К | macro | 39.40 | 0.00 | 11.11 | 0.14 | 0.42 | 0.01 | 0.00 | 0.04 | 0.02 | 49.01 | 0.01 | 100.14 | 0.992 | 0.000 | 0.160 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.843 | 0.000 | 3.008 | 0.08 | 0.92 |
| | TR4-2 | 21/41 | C | macro | 40.03 | 0.01 | 11.63 | 0.13 | 0.40 | 0.01 | 0.00 | 0.03 | 0.01 | 48.47 | 0.00 | 100.71 | 0.975 | 0.000 | 0.230 | 0.003 | 0.008 | 0.000 | 0.000 | 0.001 | 0.000 | 1.807 | 0.000 | 3.025 | 0.11 | 0.89 |
| | TR4-2 | 20/40 | R | mega | 41.49 | 0.01 | 8.11 | 0.13 | 0.42 | 0.03 | 0.01 | 0.03 | 0.00 | 50.40 | 0.00 | 100.63 | 0.985 | 0.000 | 0.239 | 0.003 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.778 | 0.000 | 3.014 | 0.12 | 0.88 |
| | TR4-2 | 20/39 | C | mega | 40.84 | 0.00 | 8.22 | 0.10 | 0.39 | 0.00 | 0.00 | 0.01 | 0.00 | 51.28 | 0.01 | 100.84 | 1.003 | 0.000 | 0.164 | 0.003 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.816 | 0.000 | 2.996 | 0.08 | 0.92 |
| | TR4-2 | 19/38 | R | mega | 40.53 | 0.00 | 7.71 | 0.11 | 0.42 | 0.04 | 0.00 | 0.00 | 0.00 | 51.91 | 0.00 | 100.71 | 0.980 | 0.000 | 0.156 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.872 | 0.000 | 3.020 | 0.08 | 0.92 |
| | TR4-2 | 19/37 | C | mega | 41.06 | 0.01 | 7.79 | 0.09 | 0.42 | 0.00 | 0.00 | 0.02 | 0.01 | 51.34 | 0.01 | 100.74 | 0.992 | 0.000 | 0.157 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.848 | 0.000 | 3.008 | 0.08 | 0.92 |
| 1001 y 213, | TR4-1 | 18/36 | R | macro | 39.94 | 0.01 | 9.76 | 0.16 | 0.36 | 0.02 | 0.00 | 0.00 | 0.02 | 49.17 | 0.01 | 99.46 | 0.987 | 0.000 | 0.202 | 0.003 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 1.811 | 0.001 | 3.013 | 0.10 | 0.90 |
| | TR4-1 | 18/35 | C | macro | 40.17 | 0.04 | 8.96 | 0.12 | 0.36 | 0.01 | 0.00 | 0.00 | 0.00 | 49.41 | 0.01 | 70.66 | 0.992 | 0.001 | 0.185 | 0.003 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 1.819 | 0.000 | 3.008 | 0.09 | 0.91 |
| uus, 111uv | TR4-1 | 17/34 | Ч | micro | 39.70 | 0.01 | 12.18 | 0.18 | 0.34 | 0.08 | 0.01 | 0.03 | 0.08 | 46.73 | 0.04 | 99.39 | 0.993 | 0.000 | 0.255 | 0.004 | 0.007 | 0.002 | 0.000 | 0.001 | 0.002 | 1.742 | 0.002 | 3.007 | 0.13 | 0.87 |
| 105401 y 3 | TR4-1 | 17/33 | C | micro | 40.11 | 0.00 | 10.44 | 0.16 | 0.36 | 0.02 | 0.00 | 0.00 | 0.06 | 47.65 | 0.00 | 98.80 | 1.000 | 0.000 | 0.218 | 0.003 | 0.007 | 0.000 | 0.000 | 0.000 | 0.001 | 1.770 | 0.000 | 3.000 | 0.11 | 0.89 |
| mcon m | TR4-1 | 16/32 | R | micro | 40.53 | 0.01 | 8.48 | 0.11 | 0.38 | 0.06 | 0.01 | 0.00 | 0.03 | 49.80 | 0.00 | 99.42 | 0.995 | 0.000 | 0.174 | 0.002 | 0.008 | 0.002 | 0.000 | 0.000 | 0.000 | 1.823 | 0.000 | 3.005 | 0.09 | 0.91 |
| uvuluw, ' | TR4-1 | 16/31 | C | micro | 40.29 | 0.02 | 8.41 | 0.12 | 0.36 | 0.01 | 0.02 | 0.04 | 0.00 | 50.12 | 0.00 | 99.38 | 0.990 | 0.001 | 0.173 | 0.003 | 0.007 | 0.000 | 0.000 | 0.001 | 0.000 | 1.835 | 0.000 | 3.010 | 0.09 | 0.91 |
| | TR4-1 | 15/30 | Я | macro | 40.45 | 0.00 | 8.24 | 0.12 | 0.37 | 0.02 | 0.00 | 0.01 | 0.02 | 50.16 | 0.00 | 99.39 | 0.993 | 0.000 | 0.169 | 0.002 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 1.835 | 0.000 | 3.007 | 0.08 | 0.92 |
| · · · · · · · · · · · · · · · · · · · | TR4-1 | 15/29 | C | macro | 40.81 | 0.00 | 8.24 | 0.08 | 0.38 | 0.03 | 0.00 | 0.00 | 0.02 | 50.07 | 0.00 | 99.64 | 0.998 | 0.000 | 0.168 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.825 | 0.000 | 3.002 | 0.08 | 0.92 |
| , 202 , | TR4-1 | 14/28 | К | micro | 39.50 | 0.01 | 12.98 | 0.20 | 0.28 | 0.03 | 0.02 | 0.00 | 0.00 | 46.80 | 0.01 | 99.83 | 0.987 | 0.000 | 0.271 | 0.004 | 0.006 | 0.001 | 0.001 | 0.000 | 0.000 | 1.743 | 0.001 | 3.013 | 0.13 | 0.87 |
| | Sample | Grain/Analysis | Location | Crystal type | SiO_2 | Al_2O_3 | FeO | MnO | NiO | CaO | $ m K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ni | Ca | K | Τi | Cr | Mg | Na | Cations: | Fayalite | Forsterite |

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OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS

| J | C - core; l | R - rim; I | - interm | ediate; m | ega - meg | acrystals. | , macro - | macrocry | sts, micrc | - microc | rysts. | | | | |
|----------------|-------------|------------|----------|-----------|-----------|------------|-----------|----------|------------|----------|--------|----------|----------|----------|----------|
| Sample | TR4-2 | TR4-2 | TR4-2 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 |
| Grain/Analysis | 23/46 | 24/47 | 24/48 | 25/49 | 25/50 | 26/51 | 26/52 | 27/53 | 27/54 | 28/55 | 28/56 | 29/57 | 29/58 | 30/59 | 30/60 |
| Location | Ч | C | Ч | C | R | C | R | C | R | C | Ч | C | R | C | R |
| Crystal type | micro | micro | micro | mega | mega | mega | mega | mega | mega | mega | mega | mega | mega | mega | mega |
| SiO_2 | 41.46 | 40.85 | 41.84 | 40.79 | 40.41 | 40.77 | 41.39 | 40.80 | 40.77 | 40.96 | 41.64 | 39.25 | 39.33 | 40.61 | 41.24 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.03 | 0.03 | 0.01 | 0.00 |
| FeO | 8.46 | 8.45 | 8.35 | 9.26 | 8.91 | 8.88 | 8.86 | 11.06 | 11.20 | 8.49 | 8.68 | 15.73 | 15.64 | 8.57 | 8.36 |
| MnO | 0.13 | 0.09 | 0.12 | 0.13 | 0.09 | 0.10 | 0.11 | 0.18 | 0.22 | 0.12 | 0.09 | 0.17 | 0.15 | 0.13 | 0.10 |
| NiO | 0.37 | 0.43 | 0.39 | 0.39 | 0.38 | 0.39 | 0.36 | 0.31 | 0.35 | 0.40 | 0.36 | 0.36 | 0.36 | 0.42 | 0.40 |
| CaO | 0.01 | 0.02 | 0.08 | 0.01 | 0.02 | 0.01 | 0.03 | 0.03 | 0.03 | 0.01 | 0.01 | 0.07 | 0.06 | 0.00 | 0.03 |
| $ m K_2O$ | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.01 | 0.03 | 0.01 | 0.00 | 00.00 | 0.00 |
| TiO_2 | 0.01 | 0.01 | 0.05 | 0.00 | 0.00 | 0.06 | 0.02 | 0.02 | 0.04 | 0.03 | 0.03 | 0.04 | 0.05 | 0.02 | 0.00 |
| Cr_2O_3 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | 0.03 | 00.00 | 0.05 | 0.03 | 0.04 | 0.03 | 0.06 | 00.00 |
| MgO | 49.78 | 50.93 | 48.60 | 49.88 | 49.86 | 50.15 | 49.75 | 48.32 | 47.99 | 50.28 | 49.26 | 44.63 | 45.15 | 50.29 | 49.94 |
| Na_2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 |
| Total: | 100.24 | 100.79 | 99.42 | 100.51 | 99.70 | 100.38 | 100.55 | 100.75 | 100.64 | 100.37 | 100.12 | 100.35 | 100.82 | 100.09 | 100.07 |
| Si | 0.989 | 1.022 | 0.987 | 0.994 | 0.991 | 0.993 | 1.004 | 0.999 | 1.000 | 0.996 | 1.013 | 0.988 | 0.985 | 0.991 | 1.004 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| Fe | 0.171 | 0.171 | 0.182 | 0.189 | 0.183 | 0.181 | 0.180 | 0.226 | 0.230 | 0.173 | 0.177 | 0.331 | 0.328 | 0.175 | 0.170 |
| Mn | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.004 | 0.005 | 0.003 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 |
| Ni | 0.008 | 0.008 | 0.000 | 0.008 | 0.008 | 0.008 | 0.007 | 0.006 | 0.007 | 0.008 | 0.007 | 0.007 | 0.007 | 0.008 | 0.008 |
| Ca | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.001 |
| K | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Τi | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| Cr | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 |
| Mg | 1.839 | 1.770 | 1.830 | 1.812 | 1.824 | 1.821 | 1.800 | 1.764 | 1.755 | 1.822 | 1.786 | 1.675 | 1.686 | 1.830 | 1.812 |
| Na | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 |
| Cations: | 3.011 | 2.977 | 3.009 | 3.006 | 3.009 | 3.006 | 2.995 | 3.001 | 2.999 | 3.003 | 2.987 | 3.011 | 3.014 | 3.008 | 2.996 |
| Fayalite | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.11 | 0.12 | 0.09 | 0.09 | 0.17 | 0.16 | 0.09 | 0.09 |
| Forsterite | 0.91 | 0.91 | 0 91 | 0 91 | 0.91 | 0.91 | 0.91 | 0.89 | 0.88 | 0.91 | 0 91 | 0.83 | 0.84 | 0.91 | 0.91 |

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS

Svisero

Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P.

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|--------------------------------------|--------------|---------|-----------|------|------|------|-------|-----------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|------------|
| TR-07 06/11 C | mega | 39.91 | 0.01 | 8.64 | 0.10 | 0.00 | 0.02 | 0.00 | 0.03 | 0.36 | 50.23 | 0.00 | 99.31 | 0.987 | 0.000 | 0.176 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.006 | 1.836 | 0.000 | 3.010 | 0.09 | 0.91 |
| TR-07 05/10 R | mega | 40.02 | 0.00 | 8.29 | 0.07 | 0.05 | 0.03 | 0.01 | 0.00 | 0.39 | 50.89 | 0.00 | 99.74 | 0.982 | 0.000 | 0.178 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.007 | 1.843 | 0.000 | 3.014 | 0.09 | 0.91 |
| TR-07 05/09 C | mega | 40.69 | 0.00 | 8.22 | 0.11 | 0.00 | 0.01 | 0.01 | 0.05 | 0.38 | 50.66 | 0.00 | 100.13 | 0.980 | 0.000 | 0.170 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.008 | 1.857 | 0.000 | 3.017 | 0.08 | 0.92 |
| TR-04B 04/08 R | mega | 40.92 | 0.00 | 8.26 | 0.16 | 0.00 | 0.00 | 0.01 | 0.03 | 0.37 | 50.92 | 0.01 | 100.68 | 0.990 | 0.000 | 0.167 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.007 | 1.837 | 0.000 | 3.006 | 0.08 | 0.92 |
| TR-04B 04/07 C | mega | 40.77 | 0.01 | 8.47 | 0.09 | 0.03 | 0.00 | 0.00 | 0.00 | 0.37 | 50.94 | 0.01 | 100.70 | 0.990 | 0.000 | 0.167 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.837 | 0.000 | 3.006 | 0.08 | 0.92 |
| TR-04A 03/06 R | mega | 39.56 | 0.00 | 8.26 | 0.03 | 0.01 | 0.01 | 0.00 | 0.00 | 0.38 | 50.10 | 0.00 | 98.36 | 0.988 | 0.000 | 0.172 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.007 | 1.839 | 0.001 | 3.009 | 0.09 | 0.91 |
| TR-04A 03/05 C | mega | 40.44 | 0.00 | 8.33 | 0.09 | 0.00 | 0.01 | 0.01 | 0.00 | 0.34 | 50.36 | 0.00 | 99.57 | 0.982 | 0.000 | 0.171 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.853 | 0.000 | 3.015 | 0.08 | 0.92 |
| TR-04A 02/04 R | mega | 40.13 | 0.02 | 7.74 | 0.11 | 0.01 | 0.02 | 0.01 | 0.02 | 0.38 | 51.87 | 0.00 | 100.29 | 0.990 | 0.000 | 0.171 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.838 | 0.000 | 3.007 | 0.08 | 0.92 |
| TR-04A 02/03 C | mega | 40.48 | 0.01 | 7.62 | 0.11 | 0.00 | 0.01 | 0.01 | 0.00 | 0.39 | 50.64 | 0.01 | 99.28 | 0.975 | 0.001 | 0.157 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.007 | 1.878 | 0.000 | 3.021 | 0.08 | 0.92 |
| TR-03 01/02 R | mega | 39.05 | 0.00 | 9.12 | 0.16 | 0.02 | 0.03 | 0.01 | 0.00 | 0.30 | 49.94 | 0.01 | 98.63 | 0.991 | 0.000 | 0.156 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 1.848 | 0.000 | 3.006 | 0.08 | 0.92 |
| TR-03 01/01 C | mega | 40.64 | 0.00 | 8.94 | 0.14 | 0.02 | 0.01 | 0.00 | 0.05 | 0.32 | 50.54 | 0.01 | 100.66 | 0.972 | 0.000 | 0.190 | 0.003 | 0.000 | 0.001 | 0.000 | 0.000 | 0.006 | 1.853 | 0.000 | 3.025 | 0.09 | 0.91 |
| TRIV-5-3 32/64 R | mega | 40.15 | 0.00 | 9.88 | 0.11 | 0.39 | 0.04 | 0.03 | 0.01 | 0.01 | 50.13 | 0.00 | 100.76 | 0.981 | 0.000 | 0.202 | 0.002 | 0.008 | 0.001 | 0.001 | 0.000 | 0.000 | 1.825 | 0.000 | 3.020 | 0.10 | 0.90 |
| TRIV-5-3 32/63 C | mega | 40.75 | 0.00 | 9.77 | 0.09 | 0.42 | 0.02 | 0.00 | 0.00 | 0.00 | 49.39 | 0.00 | 100.44 | 0.996 | 0.000 | 0.200 | 0.002 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 1.799 | 0.000 | 3.004 | 0.10 | 0.90 |
| TRIV-5-3 31/62 R | mega | 40.86 | 0.02 | 8.75 | 0.09 | 0.38 | 0.01 | 0.02 | 0.03 | 0.00 | 49.95 | 0.00 | 100.11 | 766.0 | 0.001 | 0.178 | 0.002 | 0.007 | 0.000 | 0.001 | 0.001 | 0.000 | 1.816 | 0.000 | 3.003 | 0.09 | 0.91 |
| TRIV-5-3 31/61 C | mega | 40.87 | 0.00 | 8.91 | 0.10 | 0.40 | 0.02 | 0.00 | 0.03 | 0.02 | 49.92 | 0.01 | 100.28 | 0.996 | 0.000 | 0.182 | 0.002 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 1.814 | 0.001 | 3.004 | 0.09 | 0.91 |
| Sample Grain/Analysis Location | Crystal type | SiO_2 | Al_2O_3 | FeO | MnO | NiO | CaO | $ m K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ż | Ca | K | Ti | Cr | Mg | Na | Cations: | Fayalite | Forsterite |

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| TR-07 07/14 R | macro | 39.91 | 0.00 | 8.90 | 0.10 | 0.00 | 0.03 | 0.00 | 0.00 | 0.37 | 50.30 | 0.00 | 99.61 | 0.966 | 0.000 | 0.156 | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.007 | 1.897 | 0.000 | 3.030 | 0.08 | 0.92 |
|--------------------------------------|--------------|---------|-----------|------|------|------|------|------------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|------------|
| TR-07 07/13 C | macro | 40.49 | 0.00 | 8.58 | 0.07 | 0.04 | 0.01 | 0.00 | 0.03 | 0.40 | 49.95 | 0.02 | 99.59 | 0.981 | 0.000 | 0.183 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.007 | 1.842 | 0.000 | 3.016 | 0.09 | 0.91 |
| TR-07 06/12 R | macro | 40.49 | 0.01 | 7.79 | 0.09 | 0.00 | 0.02 | 0.02 | 0.00 | 0.41 | 49.74 | 0.00 | 98.56 | 0.992 | 0.000 | 0.176 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.008 | 1.824 | 0.001 | 3.004 | 0.09 | 0.91 |
| TR-07 06/11 C | macro | 40.51 | 0.00 | 7.72 | 0.11 | 0.03 | 0.01 | 0.01 | 0.01 | 0.40 | 51.10 | 0.00 | 99.90 | 0.998 | 0.000 | 0.161 | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.008 | 1.828 | 0.000 | 2.998 | 0.08 | 0.92 |
| TR-04B 05/10 R | macro | 41.14 | 0.00 | 7.45 | 0.12 | 0.05 | 0.02 | 0.01 | 0.02 | 0.38 | 51.50 | 0.02 | 100.71 | 0.987 | 0.000 | 0.157 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.008 | 1.855 | 0.000 | 3.010 | 0.08 | 0.92 |
| TR-04B 05/09 C | macro | 41.23 | 0.01 | 7.61 | 0.07 | 0.00 | 0.01 | 0.02 | 0.00 | 0.35 | 52.00 | 0.02 | 101.32 | 0.992 | 0.000 | 0.150 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.007 | 1.851 | 0.001 | 3.005 | 0.08 | 0.92 |
| TR-04B 04/08 R | macro | 40.83 | 0.01 | 8.01 | 0.12 | 0.03 | 0.03 | 0.00 | 0.01 | 0.35 | 50.56 | 0.01 | 99.95 | 0.988 | 0.000 | 0.153 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.007 | 1.858 | 0.001 | 3.009 | 0.08 | 0.92 |
| TR-04B 04/07 C | macro | 40.91 | 0.00 | 7.77 | 0.10 | 0.00 | 0.01 | 0.00 | 0.02 | 0.36 | 51.37 | 0.01 | 100.56 | 0.994 | 0.000 | 0.163 | 0.003 | 0.001 | 0.001 | 0.000 | 0.000 | 0.007 | 1.834 | 0.000 | 3.003 | 0.08 | 0.92 |
| TR-04A 03/06 R | macro | 40.06 | 0.00 | 8.37 | 0.10 | 0.00 | 0.06 | 0.00 | 0.00 | 0.40 | 51.03 | 0.00 | 100.02 | 0.989 | 0.000 | 0.157 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.851 | 0.000 | 3.007 | 0.08 | 0.92 |
| TR-04A 03/05 C | macro | 40.49 | 0.00 | 8.46 | 0.11 | 0.04 | 0.01 | 0.00 | 0.01 | 0.37 | 50.74 | 0.00 | 100.24 | 0.978 | 0.000 | 0.171 | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.008 | 1.857 | 0.000 | 3.018 | 0.08 | 0.92 |
| TR-04A 02/04 R | macro | 40.52 | 0.00 | 8.45 | 0.09 | 0.03 | 0.02 | 0.02 | 0.00 | 0.39 | 51.04 | 0.01 | 100.56 | 0.986 | 0.000 | 0.172 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.007 | 1.841 | 0.000 | 3.010 | 0.09 | 0.91 |
| TR-04A 02/03 C | macro | 40.81 | 0.00 | 8.44 | 0.11 | 0.02 | 0.00 | 0.00 | 0.00 | 0.38 | 50.95 | 0.00 | 100.70 | 0.984 | 0.000 | 0.171 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.007 | 1.847 | 0.000 | 3.013 | 0.08 | 0.92 |
| TR-03 01/02 R | macro | 43.07 | 0.03 | 7.76 | 0.11 | 0.00 | 0.04 | 0.02 | 0.01 | 0.45 | 48.21 | 0.01 | 99.71 | 0.988 | 0.000 | 0.171 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.839 | 0.000 | 3.008 | 0.09 | 0.91 |
| TR-03 01/01 C | macro | 39.89 | 0.00 | 7.95 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.36 | 51.56 | 0.01 | 99.82 | 1.042 | 0.001 | 0.157 | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.009 | 1.739 | 0.001 | 2.953 | 0.08 | 0.92 |
| TR-07 06/13 R | mega | 40.10 | 0.00 | 8.35 | 0.13 | 0.00 | 0.06 | 0.00 | 0.03 | 0.40 | 49.97 | 0.03 | 99.07 | 0.974 | 0.000 | 0.162 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 1.877 | 0.000 | 3.022 | 0.08 | 0.92 |
| TR-07 06/12 I | mega | 40.27 | 0.00 | 8.60 | 0.12 | 0.01 | 0.03 | 0.01 | 0.01 | 0.33 | 50.24 | 0.00 | 99.62 | 0.988 | 0.000 | 0.172 | 0.003 | 0.000 | 0.002 | 0.000 | 0.001 | 0.008 | 1.835 | 0.001 | 3.008 | 0.09 | 0.91 |
| Sample Grain/Analysis Location | Crystal type | SiO_2 | Al_2O_3 | FeO | MnO | NiO | CaO | $\rm K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ni | Ca | K | Ti | Cr | Mg | Na | Cations: | Fayalite | Forsterite |

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| C | - core; H | R - rim; I - | intermedia | ate; mega | - megacry | stals, macı | o - macro | crysts, mie | cro - micr | ocrysts. | | |
|----------------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|
| Sample n/Analysis | TR-02 01/01 | TR-04A 02/02 | TR-04A 02/03 | TR-04A 03/04 | TR-04A 04/05 | TR-04A 05/06 | TR-04A 06/07 | TR-04B 07/08 | TR-04B 07/09 | TR-04B 08/10 | TR-04B 09/11 | TR-07 12/15 |
| ocation | C | C | Я | C | C | C | C | C | R | C | C | C |
| ystal type | micro | micro | micro | micro | micro | micro | micro | micro | micro | micro | micro | micro |
| SiO_2 | 39.52 | 40.71 | 40.96 | 40.52 | 40.13 | 40.48 | 40.38 | 40.68 | 41.08 | 40.83 | 40.18 | 40.13 |
| Al_2O_3 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | 0.01 |
| FeO | 7.65 | 7.81 | 9.68 | 7.66 | 8.38 | 9.43 | 8.72 | 8.56 | 10.28 | 7.85 | 12.29 | 10.55 |
| MnO | 0.12 | 0.10 | 0.17 | 0.10 | 0.13 | 0.14 | 0.09 | 0.13 | 0.16 | 0.09 | 0.15 | 0.16 |
| NiO | 0.04 | 0.00 | 0.03 | 0.07 | 0.00 | 0.02 | 0.00 | 0.01 | 0.01 | 0.00 | 0.09 | 0.01 |
| CaO | 0.01 | 0.01 | 0.04 | 00.00 | 0.03 | 0.03 | 0.01 | 0.01 | 0.05 | 0.01 | 0.12 | 0.08 |
| $\rm K_2O$ | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 |
| TiO_2 | 0.00 | 0.02 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 | 0.02 | 0.07 | 0.03 |
| Cr_2O_3 | 0.35 | 0.37 | 0.35 | 0.37 | 0.34 | 0.41 | 0.39 | 0.39 | 0.37 | 0.45 | 0.36 | 0.30 |
| MgO | 52.06 | 50.75 | 49.14 | 51.12 | 50.30 | 49.36 | 49.87 | 50.30 | 48.58 | 51.65 | 46.68 | 48.51 |
| Na_2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.04 | 0.00 |
| Total: | 99.76 | 99.79 | 100.40 | 99.89 | 99.34 | 99.87 | 99.47 | 100.12 | 100.56 | 100.91 | 100.02 | 77.66 |
| Si | 0.992 | 0.999 | 0.987 | 0.986 | 0.993 | 0.991 | 0.991 | 1.003 | 0.985 | 0.997 | 0.972 | 1.025 |
| AI | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Fe | 0.159 | 0.197 | 0.156 | 0.172 | 0.193 | 0.179 | 0.174 | 0.210 | 0.158 | 0.255 | 0.174 | 0.208 |
| Mn | 0.002 | 0.004 | 0.002 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 |
| Ni | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 |
| Са | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.001 | 0.001 |
| К | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Τi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Cr | 0.007 | 0.007 | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.007 | 0.009 | 0.007 | 0.008 | 0.006 |
| Mg | 1.843 | 1.788 | 1.855 | 1.842 | 1.805 | 1.825 | 1.827 | 1.768 | 1.857 | 1.727 | 1.865 | 1.727 |
| Na | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| Cations: | 3.004 | 2.997 | 3.009 | 3.011 | 3.003 | 3.005 | 3.005 | 2.994 | 3.011 | 2.999 | 3.023 | 2.972 |
| Fayalite | 0.08 | 0.10 | 0.08 | 0.09 | 0.10 | 0.09 | 0.09 | 0.11 | 0.08 | 0.13 | 0.09 | 0.11 |
| orsterite | 0.92 | 06.0 | 0.92 | 0.91 | 0.90 | 0.91 | 0.91 | 0.89 | 0.92 | 0.87 | 0.91 | 0.89 |

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TABLE B3. Major element concentration of monticellite from all samples. Structural formula calculated on the basis of 4 oxigens. C - core; R - rim; I - intermediate

| LM-2 17/20 C | $\begin{array}{c} 36.18\\ 0.00\\ 12.37\\ 0.72\\ 0.01\\ 32.93\\ 0.00\\ 0.03\\ 0.05\\ 17.82\\ 0.04\end{array}$ | 100.16 | $\begin{array}{c} 0.996\\ 0.000\\ 0.285\\ 0.017\\ 0.000\\ 0.971\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.002\\ 0.002\end{array}$ | 3.004 | 71.96 0.12 0.09 -4.23 |
|--------------------------------------|--|--------|---|----------|---------------------------------|
| LM-2 16/19 C | 37.15 0.09 3.27 0.25 0.06 3.4.55 0.05 0.16 0.16 0.06 24.50 0.08 | 100.21 | $\begin{array}{c} 0.981\\ 0.003\\ 0.072\\ 0.006\\ 0.001\\ 0.978\\ 0.002\\ 0.003\\ 0.001\\ 0.065\\ 0.004\end{array}$ | 3.016 | 93.03 0.12 0.02 2.19 |
| LM-2 15/18 C | $\begin{array}{c} 37.66\\ 0.03\\ 0.03\\ 4.44\\ 0.41\\ 0.04\\ 0.04\\ 0.05\\ 0.05\\ 0.05\\ 0.03\\ 0.03\end{array}$ | 100.74 | $\begin{array}{c} 0.993\\ 0.001\\ 0.009\\ 0.009\\ 0.001\\ 0.973\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.001 \end{array}$ | 3.005 | 90.42 0.12 0.03 1.24 |
| LM-2 14/17 C | 36.67 0.11 2.97 0.32 0.32 0.13 0.14 0.14 0.04 0.04 | 99.46 | $\begin{array}{c} 0.977\\ 0.004\\ 0.006\\ 0.007\\ 0.000\\ 0.989\\ 0.003\\ 0.003\\ 0.001\\ 0.003\\ 0.003\\ 0.003 \end{array}$ | 3.022 | 93.60 0.12 0.02 2.47 |
| LM-2 13/16 C | $\begin{array}{c} 37.22\\ 0.04\\ 3.88\\ 0.26\\ 0.05\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.26\\ 0.03\\ 0.03\\ 0.03\\ 0.02\\ 0.02\\ 0.02\end{array}$ | 99.81 | $\begin{array}{c} 0.989\\ 0.001\\ 0.086\\ 0.006\\ 0.001\\ 0.005\\ 0.005\\ 0.005\\ 0.038\\ 0.001\\ 0.038\\ 0.001\\ 0.038\\ 0.001\\ 0.$ | 3.006 | 91.58 0.12 0.03 1.66 |
| LM-2 12/15 C | $\begin{array}{c} 37.59\\ 0.11\\ 2.95\\ 0.27\\ 0.27\\ 0.09\\ 0.15\\ 0.15\\ 0.03\\ 0.15\\ 0.03\\ 0.06\end{array}$ | 100.78 | $\begin{array}{c} 0.985\\ 0.004\\ 0.065\\ 0.006\\ 0.001\\ 0.970\\ 0.003\\ 0.$ | 3.013 | 93.77 0.12 0.02 2.47 |
| LM-2 11/14 C | $\begin{array}{c} 37.93\\ 0.06\\ 3.15\\ 0.04\\ 0.04\\ 0.04\\ 0.07\\ 0.01\\ 0.01\\ 0.04\\ 0.01\\ 0.01\\ 0.04\end{array}$ | 99.92 | $\begin{array}{c} 1.002\\ 0.070\\ 0.011\\ 0.001\\ 0.973\\ 0.001\\ 0.001\\ 0.002\\ 0.933\\ 0.002\\ \end{array}$ | 2.997 | 93.06 0.12 0.02 2.24 |
| LM-2 10/13 C | 38.19 0.02 3.74 0.35 0.04 0.04 0.18 0.04 0.06 0.06 | 100.61 | $\begin{array}{c} 1.005\\ 0.001\\ 0.082\\ 0.008\\ 0.001\\ 0.981\\ 0.081\\ 0.001\\ 0.001\\ 0.003\\ 0.003\\ 0.003\end{array}$ | 2.997 | 91.69 0.12 0.03 1.73 |
| LM-2 09/12 C | $\begin{array}{c} 37.40\\ 0.07\\ 0.07\\ 3.01\\ 0.54\\ 0.04\\ 0.02\\ 0.14\\ 0.02\\ 0.14\\ 0.02\\ 0.02\\ 0.02\\ 0.02\end{array}$ | 100.26 | $\begin{array}{c} 0.987\\ 0.002\\ 0.006\\ 0.012\\ 0.001\\ 0.985\\ 0.003\\ 0.003\\ 0.001\\ 0.951\\ 0.001\\ 0.001 \end{array}$ | 3.010 | 93.47 0.12 0.02 2.41 |
| LM-2 08/11 C | $\begin{array}{c} 36.50\\ 0.02\\ 0.02\\ 0.39\\ 0.02\\ 0.02\\ 0.12\\ 0.00\\ 0.12\\ 0.00\\ 0.12\\ 0.00\\ 0.00\\ 0.00\\ 0.08\end{array}$ | 96.66 | $\begin{array}{c} 0.988\\ 0.001\\ 0.203\\ 0.009\\ 0.001\\ 0.947\\ 0.000\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.004\end{array}$ | 3.011 | 80.81 0.12 0.06 -1.57 |
| LM-2 07/10 R | $\begin{array}{c} 36.92\\ 0.03\\ 6.49\\ 0.32\\ 0.03\\ 33.74\\ 0.05\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\end{array}$ | 99.04 | $\begin{array}{c} 0.999\\ 0.001\\ 0.147\\ 0.007\\ 0.001\\ 0.979\\ 0.002\\ 0.000\\ 0.863\\ 0.002\\ 0.$ | 3.001 | 85.45 0.12 0.05 -0.12 |
| LM-2 07/09 C | 36.63 0.01 8.77 8.77 0.03 0.03 0.03 0.03 0.02 0.04 0.02 0.04 0.06 | 99.85 | $\begin{array}{c} 0.991\\ 0.000\\ 0.198\\ 0.007\\ 0.001\\ 0.945\\ 0.001\\ 0.001\\ 0.000\\ 0.862\\ 0.003\\ 0.$ | 3.010 | 81.27 0.12 0.06 -1.45 |
| LM-2 06/08 C | 35.85 0.01 0.22 0.04 0.15 0.04 0.15 0.04 0.15 0.04 | 99.42 | $\begin{array}{c} 0.990\\ 0.000\\ 0.250\\ 0.001\\ 1.003\\ 0.001\\ 0.003\\ 0.001\\ 0.750\\ 0.005\\ 0.005\end{array}$ | 3.010 | 74.99 0.12 0.08 -2.82 |
| LM-2 05/07 R | $\begin{array}{c} 36.41\\ 0.01\\ 9.36\\ 0.03\\ 0.02\\ 0.02\\ 0.02\\ 0.03\\ 0.02\\ 0.03\\ 0.02\\ 0.03\\ 0.03\\ 0.09\end{array}$ | 66.66 | $\begin{array}{c} 0.988\\ 0.000\\ 0.212\\ 0.008\\ 0.001\\ 0.949\\ 0.001\\ 0.001\\ 0.848\\ 0.005\\ 0.005\end{array}$ | 3.013 | 79.97 0.12 0.06 -1.81 |
| LM-2 05/06 C | $\begin{array}{c} 35.76\\ 0.00\\ 111.71\\ 0.25\\ 0.03\\ 33.76\\ 0.00\\ 0.04\\ 0.00\\ 0.01\\ 0.12\\ 0.12\end{array}$ | 99.54 | $\begin{array}{c} 0.990\\ 0.000\\ 0.271\\ 0.006\\ 0.001\\ 1.001\\ 0.000\\ 0.001\\ 0.000\\ 0.737\\ 0.006\end{array}$ | 3.013 | 73.11 0.12 0.08 -3.49 |
| LM-2 04/05 C | $\begin{array}{c} 36.36\\ 0.02\\ 0.02\\ 0.03\\ 0.03\\ 0.02\\ 0.12\\ 0.04\\ 0.12\\ 0.12\\ 0.12\\ 0.12\end{array}$ | 99.47 | $\begin{array}{c} 0.990\\ 0.001\\ 0.210\\ 0.001\\ 0.001\\ 0.001\\ 0.002\\ 0.002\\ 0.001\\ 0.848\\ 0.006\end{array}$ | 3.010 | 80.17 0.12 0.06 -1.74 |
| LM-2 03/04 C | $\begin{array}{c} 36.13\\ 0.02\\ 0.22\\ 0.03\\ 33.75\\ 0.05\\ 0.09\\ 0.04\\ 0.16\\ 0.16\end{array}$ | 99.78 | 0.992 0.001 0.249 0.005 0.002 0.002 0.002 0.001 0.757 0.009 | 3.010 | 75.27 0.12 0.08 -2.83 |
| LM-2 02/03 R | $\begin{array}{c} 37.02\\ 0.01\\ 6.29\\ 0.23\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.05\\ 0.05\end{array}$ | 99.85 | $\begin{array}{c} 0.995\\ 0.000\\ 0.141\\ 0.005\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.000\\ 0.859\\ 0.003\\ 0.003 \end{array}$ | 3.005 | 85.87 0.12 0.04 0.03 |
| LM-2 02/02 C | $\begin{array}{c} 36.44\\ 0.03\\ 8.72\\ 0.38\\ 0.38\\ 0.03\\ 0.02\\ 0.10\\ 0.01\\ 0.01\\ 0.01\\ 0.09\end{array}$ | 99.66 | 0.989 0.001 0.198 0.009 0.001 0.001 0.002 0.002 0.005 0.005 | 3.011 | 81.20 0.12 0.06 -1.42 |
| LM-2 01/01 C | $\begin{array}{c} 36.63\\ 0.01\\ 8.86\\ 0.38\\ 0.00\\ 0.04\\ 0.11\\ 0.01\\ 0.00\\ 0.00\\ 0.00\\ 0.00\end{array}$ | 99.55 | $\begin{array}{c} 0.995\\ 0.000\\ 0.201\\ 0.009\\ 0.001\\ 0.947\\ 0.001\\ 0.002\\ 0.846\\ 0.004\\ 0.004\end{array}$ | 3.006 | 80.78 0.12 0.06 -1.54 |
| Sample Grain/Analysis Location | $\begin{array}{c} \mathrm{SiO}_2\\\mathrm{Al}_2\mathrm{O}_3\\\mathrm{FeO}\\\mathrm{MnO}\\\mathrm{NiO}\\\mathrm{CaO}\\\mathrm{CaO}\\\mathrm{TiO}_2\\\mathrm{C1}_2\mathrm{O}_3\\\mathrm{MgO}\\\mathrm{Na}_2\mathrm{O}\\\mathrm{Na}_2\mathrm{O}\end{array}$ | Total: | Al Fe Ng C Ti K Ca Ng Cr | Cations: | Mg# XFeLiq XFeMtc ANNO |

OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P.

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Svisero

| LM3-1 29/38 R | 37.14 0.06 3.24 0.35 0.04 0.00 0.00 0.00 0.05 | 100.35 | $\begin{array}{c} 0.981\\ 0.002\\ 0.072\\ 0.008\\ 0.001\\ 0.987\\ 0.001\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\end{array}$ | 3.018 93.08 0.12 0.02 2.22 |
|--|---|--------|---|---|
| meature LM3-1 28/37 C | $\begin{array}{c} 37.40\\ 0.03\\ 7.53\\ 0.03\\ 0.03\\ 33.93\\ 0.06\\ 0.00\\ 0.00\\ 0.02\\ 0.02\end{array}$ | 101.12 | 0.996 0.001 0.168 0.013 0.001 0.968 0.001 0.001 0.001 0.855 0.001 | 3.003 83.59 0.12 0.05 -0.74 |
| n; 1 - uner LM3-1 27/36 R | 36.57 0.03 6.72 0.38 0.02 0.02 0.07 0.02 0.02 0.02 0.02 0.02 0.02 | 100.62 | 0.978 0.001 0.150 0.001 0.001 0.001 0.001 0.001 0.001 0.000 0.000 | 3.022 85.69 0.12 0.05 -0.18 |
| е, х - ти LM3-1 27/35 С | 37.01 0.01 9.59 0.03 0.03 0.00 0.16 0.03 0.16 0.16 0.10 | 100.72 | 0.996 0.000 0.216 0.001 0.001 0.003 0.003 0.003 0.003 0.003 | 3.003 79.14 0.12 0.07 -2.02 |
| LM3-1 LM3-1 26/34 C | $\begin{array}{c} 35.16\\ 0.12\\ 0.57\\ 0.57\\ 0.07\\ 0.07\\ 0.14\\ 0.05\\ 0.07\\ 0.07\\ 0.04\end{array}$ | 98.63 | $\begin{array}{c} 0.969\\ 0.004\\ 0.181\\ 0.181\\ 0.013\\ 1.000\\ 0.003\\ 0.003\\ 0.003\\ 0.001\\ 0.852\\ 0.002\end{array}$ | 3.028 82.47 0.12 0.05 -0.84 |
| 4 oxigen LM-2 25/33 R | $\begin{array}{c} 37.19\\ 0.03\\ 0.03\\ 0.31\\ 0.04\\ 0.06\\ 0.06\\ 0.06\\ 0.00\\ 0.00\\ 0.00\\ 0.00\end{array}$ | 100.19 | 0.988 0.001 0.100 0.007 0.001 0.001 0.001 0.001 0.019 0.000 0.010 | 3.010 90.20 0.12 0.03 1.22 |
| LM-2 LM-2 25/32 C | $\begin{array}{c} 36.25\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.05\\ 0.07\\ 0.01\\ 0.01\\ 0.04\end{array}$ | 100.55 | $\begin{array}{c} 0.983\\ 0.001\\ 0.229\\ 0.014\\ 0.001\\ 0.960\\ 0.002\\ 0.001\\ 0.002\\ 0.000\\ 0.002\\ 0.002\end{array}$ | 3.017 78.25 0.12 0.07 -2.27 |
| a on m LM-2 24/31 C | $\begin{array}{c} 36.98\\ 0.02\\ 9.77\\ 0.73\\ 0.04\\ 0.04\\ 0.04\\ 0.04\\ 0.04\\ 0.04\\ 0.04\\ 0.00\\ 0.04\end{array}$ | 99.84 | $\begin{array}{c} 1.004 \\ 0.001 \\ 0.222 \\ 0.017 \\ 0.000 \\ 0.934 \\ 0.001 \\ 0.001 \\ 0.001 \\ 0.000 \\ 0.815 \\ 0.002 \end{array}$ | 2.996 78.59 0.12 0.07 -2.19 |
| LM-2 LM-2 23/30 C | 37.81 0.01 3.95 0.23 0.05 34.75 0.03 0.03 0.03 0.01 23.92 0.01 | 100.88 | $\begin{array}{c} 0.993\\ 0.000\\ 0.087\\ 0.005\\ 0.001\\ 0.978\\ 0.001\\ 0.002\\ 0.002\\ 0.000\\ 0.937\\ 0.001\\ 0.001\\ 0.001\\ \end{array}$ | 3.006 91.52 0.12 0.03 1.61 |
| LM-2 22/29 R | 37.33 0.03 6.85 0.46 0.04 0.05 0.05 0.08 0.00 21.84 0.05 | 100.13 | $\begin{array}{c} 1.000\\ 0.001\\ 0.153\\ 0.153\\ 0.010\\ 0.001\\ 0.958\\ 0.002\\ 0.002\\ 0.002\\ 0.003\\ 0.003\end{array}$ | 3.001 85.03 0.12 0.05 -0.35 |
| ucturat. LM-2 22/28 C | $\begin{array}{c} 36.97\\ 0.01\\ 9.49\\ 0.61\\ 0.02\\ 32.60\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.04\\ 0.04\end{array}$ | 100.50 | $\begin{array}{c} 0.997\\ 0.000\\ 0.214\\ 0.014\\ 0.001\\ 0.942\\ 0.001\\ 0.001\\ 0.001\\ 0.002\\ 0.$ | 3.002 79.45 0.12 0.07 -1.97 |
| LM-2 LM-2 21/27 R | 37.94 0.03 5.35 0.36 0.01 33.59 0.00 0.00 0.00 0.02 0.03 | 100.38 | $\begin{array}{c} 1.004\\ 0.001\\ 0.118\\ 0.008\\ 0.000\\ 0.952\\ 0.000\\ 0.000\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ \end{array}$ | 2.996 88.47 0.12 0.04 0.59 |
| LM-2 LM-2 21/26 C | 36.52 0.02 9.88 0.61 0.04 0.06 0.06 0.06 0.06 0.06 0.06 0.06 | 99.83 | $\begin{array}{c} 0.994\\ 0.001\\ 0.225\\ 0.014\\ 0.001\\ 0.936\\ 0.001\\ 0.001\\ 0.001\\ 0.830\\ 0.003\\ 0.003 \end{array}$ | 3.006 78.68 0.12 0.07 -2.20 |
| LM-2 20/25 C | 36.78 0.10 7.45 0.49 0.04 0.03 0.12 0.03 0.12 0.00 0.03 | 100.11 | $\begin{array}{c} 0.988\\ 0.003\\ 0.167\\ 0.011\\ 0.001\\ 0.947\\ 0.001\\ 0.002\\ 0.002\\ 0.887\\ 0.002\end{array}$ | 3.010 84.12 0.12 0.05 -0.67 |
| monuce LM-2 19/24 R | $\begin{array}{c} 37.30\\ 0.06\\ 3.75\\ 0.26\\ 0.00\\ 35.05\\ 0.06\\ 0.04\\ 0.04\\ 0.04\\ 0.04\\ 0.05\\ 0.05\end{array}$ | 100.49 | $\begin{array}{c} 0.985\\ 0.002\\ 0.006\\ 0.006\\ 0.002\\ 0.002\\ 0.001\\ 0.001\\ 0.001\\ 0.001\\ 0.002\\ 0.002\\ 0.002\\ \end{array}$ | 3.015 91.90 0.12 0.03 1.79 |
| LM-2 LM-2 19/23 C | $\begin{array}{c} 36.63\\ 0.03\\ 9.75\\ 0.66\\ 0.01\\ 33.03\\ 0.02\\ 0.02\\ 0.06\\ 0.06\\ 0.06\end{array}$ | 100.20 | 0.995 0.001 0.221 0.015 0.001 0.001 0.001 0.001 0.001 0.003 | 3.005 78.43 0.12 0.07 -2.12 |
| concent LM-2 18/22 C | $\begin{array}{c} 37.96\\ 0.12\\ 5.19\\ 0.45\\ 0.04\\ 0.08\\ 0.08\\ 0.00\\ 0.03\\ 0.03\\ 0.03\end{array}$ | 98.90 | $\begin{array}{c} 1.017\\ 0.004\\ 0.116\\ 0.010\\ 0.002\\ 0.002\\ 0.002\\ 0.000\\ 0.886\\ 0.001\\ 0.001 \end{array}$ | 2.981 88.39 0.12 0.04 0.63 |
| LM-2 17/21 R | $\begin{array}{c} 37.20\\ 0.00\\ 6.08\\ 0.90\\ 0.03\\ 34.48\\ 0.02\\ 0.14\\ 0.02\\ 0.14\\ 0.00\\ 0.03\end{array}$ | 100.53 | $\begin{array}{c} 0.994\\ 0.000\\ 0.136\\ 0.020\\ 0.001\\ 0.987\\ 0.001\\ 0.003\\ 0.003\\ 0.002\\ 0.002\\ 0.002\end{array}$ | 3.005 86.39 0.12 0.04 0.13 |
| Sample Sample Grain/Analysis Location | $\begin{array}{c} \mathrm{SiO}_2 \\ \mathrm{AI}_2 \mathrm{O}_3 \\ \mathrm{FeO} \\ \mathrm{MnO} \\ \mathrm{NiO} \\ \mathrm{CaO} \\ \mathrm{K}_2 \mathrm{O} \\ \mathrm{K}_2 \mathrm{O} \\ \mathrm{MgO} \\ \mathrm{MgO} \\ \mathrm{Na}_2 \mathrm{O} \end{array}$ | Total: | Si Fe N Mn C T K a S N N Sa Si | Cations: Mg# XFeLiq XFeMtc ΔNNO |

nundiato . F . Q ζ VJU calculated on the basis 10 Incorre et lon 1 Ctro 20/0000 110 nticallita for 5 ; Supplementary Material B Svisero

| ero | 21 21 34 03 | 00 00 04 | 72 | 001 01 01 02 00 01 01 01 02 | 06 05 05 62 |
|--|---|---|--------|---|---|
| LM3 C C | | | . 99. | 0.0000000000000000000000000000000000000 | 3 3.0 83. 7 0.0 |
| LM3-1 43/57 C | $\begin{array}{c} 36.27\\ 0.02\\ 10.5^{2}\\ 0.76\\ 0.03\end{array}$ | 32.44 0.05 0.10 20.02 0.06 | 100.45 | 0.980 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 | 3.013 77.41 0.12 0.00 -2.60 |
| <i>iate</i> LM3-1 R R | 36.69 0.17 3.77 0.22 0.05 | $\begin{array}{c} 33.73\\ 0.14\\ 0.14\\ 0.22\\ 0.04\\ 25.14\\ 25.14\end{array}$ | 100.23 | $\begin{array}{c} 0.971\\ 0.005\\ 0.0083\\ 0.005\\ 0.005\\ 0.005\\ 0.004\\ 0.001\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.003\end{array}$ | 3.026 92.24 0.12 0.03 1.79 |
| ntermed LM3-1 42/55 C | 36.31 0.03 11.31 0.63 0.01 | 32.19 0.03 0.04 0.01 19.35 0.04 | 99.94 | $\begin{array}{c} 0.994\\ 0.001\\ 0.259\\ 0.015\\ 0.001\\ 0.944\\ 0.001\\ 0.001\\ 0.000\\ 0.790\\ 0.002\\ 0.002\\ \end{array}$ | 3.006 75.30 0.12 0.08 -3.24 |
| <i>rim; I - i</i> LM3-1 C C | 37.89 0.00 4.24 0.29 0.00 | 35.18 0.08 0.01 0.00 23.16 0.01 | 100.85 | $\begin{array}{c} 0.998\\ 0.000\\ 0.006\\ 0.006\\ 0.003\\ 0.000\\ 0.000\\ 0.000\\ 0.000\\ 0.000\\ 0.000\\ 0.000\\ 0.000 \end{array}$ | 3.003 90.68 0.12 0.03 1.38 |
| <i>core; R -</i> JM3-1] 41/53 C | 36.31 0.07 10.23 0.64 0.02 | $\begin{array}{c} 32.91 \\ 0.04 \\ 0.07 \\ 0.00 \\ 19.77 \\ 0.08 \end{array}$ | 100.14 | $\begin{array}{c} 0.989\\ 0.002\\ 0.233\\ 0.015\\ 0.001\\ 0.001\\ 0.001\\ 0.000\\ 0.803\\ 0.004\\ \end{array}$ | 3.011 77.49 0.12 0.07 -2.42 |
| ens. C - c JM3-1 1 40/52 C | 37.11 0.01 6.35 0.39 0.03 | 34.69 0.04 0.01 22.12 0.00 | 100.77 | $\begin{array}{c} 0.989\\ 0.000\\ 0.141\\ 0.001\\ 0.990\\ 0.000\\ 0.000\\ 0.879\\ 0.000\\ 0.000\\ 0.000\\ 0.000\end{array}$ | 3.011 86.12 0.12 0.04 0.01 |
| of 4 oxig JM3-1 1 39/51 C | 36.53 0.03 9.02 0.58 0.01 | 33.07 0.00 0.10 0.00 21.18 0.06 | 100.59 | $\begin{array}{c} 0.985\\ 0.001\\ 0.203\\ 0.013\\ 0.000\\ 0.955\\ 0.000\\ 0.002\\ 0.003\\ 0.003\end{array}$ | 3.014 80.71 0.12 0.06 -1.59 |
| <i>he basis</i> JM3-1 1 R | 37.83 0.02 4.12 0.23 0.05 | 34.97 0.02 0.00 0.00 23.91 0.02 | 101.29 | $\begin{array}{c} 0.991\\ 0.001\\ 0.005\\ 0.005\\ 0.001\\ 0.982\\ 0.001\\ 0.002\\ 0.001\\ 0.001\\ 0.001\\ 0.001\end{array}$ | 3.008 91.18 0.12 0.03 1.49 |
| lated on 1 M3-1 I 38/49 C | 36.38 0.02 8.04 0.58 0.04 | $\begin{array}{c} 33.64\\ 0.08\\ 0.67\\ 0.02\\ 21.26\\ 0.08\end{array}$ | 100.81 | $\begin{array}{c} 0.977\\ 0.001\\ 0.181\\ 0.181\\ 0.013\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.004\\ 0.000\\ 0.004\end{array}$ | 3.012 82.49 0.12 0.06 -1.02 |
| ıla calcu M3-1 I 37/48 R | 35.83 0.11 3.84 0.28 0.05 | 34.97 0.10 1.65 0.00 222.19 0.06 | 99.08 | $\begin{array}{c} 0.965\\ 0.003\\ 0.0087\\ 0.006\\ 0.001\\ 1.009\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.003\\ 0.003\end{array}$ | 3.003 91.15 0.12 0.03 1.67 |
| ral formu M3-1 I 37/47 C | 36.52 0.02 9.38 0.36 0.03 | $\begin{array}{c} 32.79\\ 0.04\\ 0.09\\ 0.00\\ 20.95\\ 0.10\end{array}$ | 100.30 | $\begin{array}{c} 0.988\\ 0.001\\ 0.212\\ 0.008\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.005\\ 0.005\end{array}$ | 3.013 79.92 0.12 0.07 -1.83 |
| s. Structu M3-1 1 36/46 C | 37.66 0.01 4.25 0.28 0.04 | 34.78 0.16 0.01 0.01 22.76 0.07 | 100.01 | $\begin{array}{c} 1.001\\ 0.000\\ 0.094\\ 0.005\\ 0.000\\ 0.000\\ 0.000\\ 0.000\\ 0.003\\ 0.003 \end{array}$ | 3.003 90.51 0.12 0.03 1.36 |
| l sample: | 36.60 0.01 10.09 0.44 0.02 | $\begin{array}{c} 32.53\\ 0.01\\ 0.06\\ 0.03\\ 20.83\\ 0.12\\ 0.12\end{array}$ | 100.74 | $\begin{array}{c} 0.988\\ 0.000\\ 0.228\\ 0.010\\ 0.001\\ 0.941\\ 0.001\\ 0.001\\ 0.838\\ 0.006\\ 0.006\end{array}$ | 3.014 78.62 0.12 0.07 -2.29 |
| e from al M3-1 I S4/44 C | 36.28 1.06 3.98 0.40 0.02 | 33.74 0.05 0.38 0.08 24.23 0.09 | 100.31 | $\begin{array}{c} 0.960\\ 0.033\\ 0.033\\ 0.088\\ 0.009\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.005\end{array}$ | 3.018 91.56 0.12 0.03 1.59 |
| onticellit M3-1 I 33/43 C | 38.01 0.02 2.99 0.21 0.06 | 34.92 0.08 0.07 0.04 24.81 0.03 | 01.24 | 0.991 0.001 0.005 0.005 0.001 0.975 0.001 0.001 0.001 0.002 | 3.009 93.66 0.12 0.02 2.43 |
| tion of m M3-1 L 82/42 T | 37.94 0.13 2.97 0.22 0.04 | 35.45 0.14 0.13 0.09 0.09 0.09 | 01.02 | $\begin{array}{c} 0.993\\ 0.004\\ 0.005\\ 0.005\\ 0.005\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.005\\ 0.$ | 3.006 93.46 0.12 0.02 2.42 |
| oncentra M3-1 L S1/40 C | 37.29 0.04 4.12 0.56 0.01 | 35.78 0.13 0.07 0.01 21.65 0.20 | 99.86 | $\begin{array}{c} 0.997\\ 0.001\\ 0.092\\ 0.013\\ 0.000\\ 1.025\\ 0.001\\ 0.001\\ 0.000\\ 0.863\\ 0.010\\ 0.010\\ \end{array}$ | 3.008 90.35 0.12 0.03 1.45 |
| aterial B element c M3-1 L 30/39 C | 37.78 0.13 4.35 0.38 0.03 | 34.14 0.13 0.10 0.00 23.50 0.02 | 100.57 | $\begin{array}{c} 0.997\\ 0.004\\ 0.0096\\ 0.009\\ 0.005\\ 0.002\\ 0.002\\ 0.002\\ 0.001\\ 0.001\\ 0.001\end{array}$ | 3.002 90.59 0.12 0.03 1.28 |
| Supplementary Mi <i>TABLE B3. Major i</i> Sample Grain/Analysis Location | SiO ₂ Al ₂ O ₃ FeO NiO | CaO K_2O Cr_2O_3 MgO Na_2O | Total: | Si Fe Al N M C Ti K a N M S N S Si Si Si Si Si Si Si Si Si Si Si Si S | Cations: Mg# XFeLiq XFeMtc ΔNNO |

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY:

TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P.

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| una Coldebella, | Rogério | Guitarrari | Azzone, | Luar | nna Cl | hmyz | , Exc | elso | Rube | erti, I | Darcy | / P. | | | | | | | | | | | | | |
|-----------------|--|--------------------------------------|---------|----------------------------|--------------|------|---------------|--------------|-------|---------|---------|--------|-------|----------------|-------|-------|-------|----------------|-------|----------------|----------|-------|--------|----------------|------|
| Isero | | LM3-2 62/82 C | 37.79 | 0.07 | 3.04 0.35 | 0.03 | 33.31 | 0.03 | 0.07 | 24.34 | 0.04 | 99.27 | 1.001 | 0.002 | 0.008 | 0.001 | 0.945 | 0.004 | 0.001 | 0.961 0.002 | 2.994 | 03 45 | 0.12 | 0.02 2 34 | |
| | | LM3-2 61/81 R | 37.52 | 0.12 | 3.23 0.21 | 0.01 | 33.91 | 0.16 | 00.0 | 24.45 | 0.08 | 99.81 | 0.992 | 0.004 | 0.005 | 0.000 | 0.961 | 0.002 | 0.000 | 0.964 0.004 | 3.008 | 03 10 | 0.12 | 0.02 2.20 | |
| | ate | LM3-2 61/80 C | 36.87 | 0.04 | 8.99 0.61 | 0.00 | 31.89 | 0.02 | 00.0 | 21.24 | 0.03 | 99.73 | 0.998 | 0.001 | 0.014 | 0.000 | 0.925 | 0.001 | 0.000 | 0.857 0.002 | 3.002 | 80.80 | 0.12 | 0.06 -1 64 | |
| | ntermedi | LM3-2] 60/79 C | 36.61 | 0.01 | 9.40 0.36 | 0.03 | 31.72 | 0.01 | 0.00 | 20.98 | 0.09 | 99.26 | 0.997 | 0.000 | 0.008 | 0.001 | 0.925 | 0.001 | 0.000 | 0.852 0.005 | 3.004 | 79.01 | 0.12 | 0.07 -1 89 | 0.4 |
| | rim; I - i | 59/78 C | 37.20 | 0.03 | 5.73 0.40 | 0.03 | 32.82 | 0.05 | 0.04 | 22.54 | 0.05 | 98.90 | 1.002 | 0.001 0.129 | 0.009 | 0.001 | 0.947 | 0.001 | 0.001 | 0.905 0.003 | 2.999 | 87 51 | 0.12 | 0.04 0.34 | |
| | core; R - | LM3-2 1 58/77 R | 36.52 | 0.07 | 6.99 0.42 | 0.03 | 32.63 | 0.05 | 0.01 | 22.14 | 0.04 | 99.10 | 0.989 | 0.002 | 0.010 | 0.001 | 0.946 | 0.002 0.004 | 0.000 | 0.894 0.002 | 3.007 | 84.95 | 0.12 | 0.05 -0.40 | 2 |
| | ens. C - i | 58/76 C | 36.83 | 0.01 | 8.89 0.51 | 0.02 | 31.97 | 0.02 | 0.04 | 21.07 | 0.07 | 99.56 | 0.998 | 0.000 | 0.012 | 0.000 | 0.929 | 0.003 | 0.001 | 0.851 0.004 | 3.001 | 80.85 | 0.12 | 0.06 -1 59 | 2.1 |
| | of 4 oxig | LM3-2] 57/74 C | 37.30 | 0.02 | 7.53 0 49 | 0.05 | 32.54 | 0.02 | 0.07 | 21.62 | 0.06 | 99.71 | 1.004 | 0.001 0.169 | 0.011 | 0.001 | 0.938 | 0.001 | 0.000 | 0.867 0.003 | 2.996 | 83.65 | 0.12 | 0.05 -0.78 | 0 |
| | the basis | LM3-2 54/71 R | 36.86 | 0.01 | 7.68 0.50 | 0.01 | 32.17 | 0.01 | 0.06 | 21.74 | 0.06 | 99.18 | 0.998 | 0.000 | 0.011 | 0.000 | 0.933 | 0.002 | 0.001 | 0.878 0.003 | 3.001 | 83 45 | 0.12 | 0.05 -0.84 | |
| | lated on | LM3-2 54/70 C | 37.58 | 0.02 | 5.91 0.42 | 0.01 | 33.06 2 | 0.04 | 00.00 | 22.54 | 0.03 | 99.68 | 1.004 | 0.001 | 0.009 | 0.000 | 0.947 | 0.001 | 0.000 | 0.898 0.002 | 2.996 | 87 17 | 0.12 | 0.04 0.22 | |
| | ula calcu | 53/69 C | 37.79 | 0.04 | 3.66 0.58 | 0.05 | 33.50 | 0.03 | 0.06 | 23.91 | 0.05 | 99.83 | 1.000 | 0.001 | 0.013 | 0.001 | 0.950 | 0.003 | 0.001 | 0.943 0.003 | 2.997 | 00 C0 | 0.12 | 0.03 1 80 | 00.4 |
| | ıral form | 52/68 C | 37.49 | 0.01 | 4.00 0.31 | 0.03 | 34.47 2.2. | 0.04 | 0.03 | 23.49 | 0.00 | 99.87 | 0.995 | 0.000 | 0.007 | 0.001 | 0.981 | 0.000 | 0.001 | 0.930 0.000 | 3.005 | 91 28 | 0.12 | 0.03 | |
| | s. Structi | LM3-2 51/67 C | 37.41 | 0.01 | 3.91 0.29 | 0.01 | 33.62 | 0.00 | 00.0 | 23.69 | 0.01 | 99.01 | 0.999 | 0.000 | 0.006 | 0.000 | 0.962 | 0.000 | 0.000 | 0.943 0.001 | 3.002 | 01 57 | 0.12 | 0.03 1 63 | 2014 |
| | ll sample | 50/66 C | 37.25 | 0.01 | 5.46 0.39 | 0.03 | 33.66 2 | 0.03 | 00.0 | 22.58 | 0.03 | 99.48 | 0.998 | 0.000 | 0.009 | 0.001 | 0.966 | 0.001 | 0.000 | 0.902 0.002 | 3.002 | 88 05 | 0.12 | 0.04 0.53 | 2 |
| | te from a | LM3-2 49/65 C | 36.54 | 0.01 | 7.76 | 0.02 | 33.12 | 0.07 | 0.01 | 21.54 | 0.04 | 69.66 | 0.989 | 0.000 | 0.012 | 0.000 | 0.960 | 0.001 | 0.000 | 0.869 0.002 | 3.012 | 83 18 | 0.12 | 0.05 -0.85 | 2000 |
| | nonticelli | LM3-1 48/64 C | 35.19 | 1.69 | 5.24 0.21 | 0.03 | 31.60 | 1.42 0.61 | 0.16 | 23.76 | 0.10 | 100.03 | 0.943 | 0.017 | 0.005 | 0.001 | 0.907 | 0.049 | 0.003 | 0.949 0.005 | 3.044 | 88 00 | 0.12 | 0.04 | 20.0 |
| | ation of n | LM3-1 46/61 R | 37.68 | 0.06 | 5.08 0.39 | 0.05 | 34.15 | 0.01 | 0.04 | 23.10 | 0.04 | 100.76 | 0.995 | 0.002 | 0.009 | 0.001 | 0.966 | 0.003 | 0.001 | 0.910 0.002 | 3.002 | 89.01 | 0.12 | 0.04 0.78 | 0 |
| ~ | oncentra concentra | LM3-1 46/60 C | 36.29 | 0.02 | 9.91 0.71 | 0.00 | 32.64 2 | 0.00 | 01.0 | 20.07 | 0.06 | 99.80 | 0.990 | 0.001 | 0.016 | 0.000 | 0.954 | 0.000 | 0.000 | 0.816 0.003 | 3.009 | 78 30 | 0.12 | 0.07 -2 20 | i |
| fatarial I | ialchal r element | LM3-1 45/59 C | 36.62 | 0.03 | 7.58 0.49 | 0.01 | 33.61 | 0.05 | 0.03 | 22.08 | 0.05 | 100.62 | 0.982 | 0.001 | 0.011 | 0.000 | 0.965 | 0.002 | 0.001 | 0.882 0.003 | 3.018 | 83 84 | 0.12 | 0.05 -0.71 | - |
| Sumlamonton, N | Supplementary Major TABLE B3. Major | Sample Grain/Analysis Location | SiO, | ${ m Al}_2 { m 	ilde O}_3$ | FeO MnO | NiO | CaO | K_2O | Cr,O, | MgO | Na_2O | Total: | Si | AI Fe | Mn | Ņ | Ca | 2 [] | Cr | Mg Na | Cations: | Mo# | XFeLiq | XFeMtc ANNO | |

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OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS

Bru Svi

Supplementary Material B **TABLE B3.** Major element concentration of monticellite from all samples. Structural formula calculated on the basis of 4 oxigens. C - core; R - rim; I - intermediate

| LM3-2 68/90 | С | 31.10 | 0.05 | 6.39 | 0.45 | 0.05 | 32.77 | 0.02 | 0.14 | 0.01 | 22.72 | 0.04 | 90.76 | 0.994 | 0.001 | 0.143 | 0.010 | 0.001 | 0.941 | 0.001 | 0.003 | 0.000 | 0.907 | 0.002 | 3.004 | 86.37 | 0.12 | 0.04 | -0.05 |
|--------------------------|----------|-------------------------|-----------|------|------|------|-------|-----------|---------|-----------|-------|---------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|-------|--------|--------|-------|
| LM3-2 67/89 | С | 51.08 | 0.02 | 5.98 | 0.43 | 0.03 | 33.31 | 0.01 | 0.05 | 0.03 | 22.43 | 0.03 | 99.40 | 0.996 | 0.000 | 0.134 | 0.010 | 0.001 | 0.959 | 0.000 | 0.001 | 0.001 | 0.899 | 0.001 | 3.003 | 86.98 | 0.12 | 0.04 | 0.21 |
| LM3-2 66/88 | С | 50.94 | 0.07 | 3.67 | 0.24 | 0.02 | 33.52 | 0.05 | 0.21 | 0.02 | 24.38 | 0.08 | 99.20 | 0.985 | 0.002 | 0.082 | 0.005 | 0.000 | 0.958 | 0.002 | 0.004 | 0.001 | 0.969 | 0.004 | 3.013 | 92.21 | 0.12 | 0.03 | 1.84 |
| LM3-2 65/87 | R | 50.91 | 00.00 | 6.99 | 0.49 | 0.04 | 32.47 | 0.03 | 0.07 | 0.01 | 22.60 | 0.04 | 99.64 | 0.992 | 0.000 | 0.157 | 0.011 | 0.001 | 0.935 | 0.001 | 0.001 | 0.000 | 0.906 | 0.002 | 3.008 | 85.21 | 0.12 | 0.05 | -0.40 |
| LM3-2 65/86 | С | 37.10 | 0.01 | 9.68 | 0.62 | 0.01 | 31.82 | 0.06 | 0.02 | 0.00 | 20.44 | 0.07 | 99.89 | 1.007 | 0.000 | 0.219 | 0.014 | 0.000 | 0.923 | 0.002 | 0.000 | 0.000 | 0.825 | 0.004 | 2.996 | 79.00 | 0.12 | 0.07 | -2.14 |
| LM3-2 64/85 | С | 50.35 | 0.07 | 6.55 | 0.45 | 0.05 | 31.35 | 0.02 | 0.07 | 0.07 | 23.94 | 0.03 | 98.95 | 0.981 | 0.002 | 0.148 | 0.010 | 0.001 | 0.906 | 0.001 | 0.001 | 0.001 | 0.963 | 0.001 | 3.017 | 86.69 | 0.12 | 0.05 | -0.10 |
| LM3-2 63/84 | R | 51.80 | 0.01 | 4.17 | 0.32 | 0.03 | 34.53 | 0.01 | 0.01 | 0.00 | 23.69 | 0.00 | 100.63 | 0.997 | 0.000 | 0.092 | 0.007 | 0.001 | 0.975 | 0.000 | 0.000 | 0.000 | 0.930 | 0.000 | 3.003 | 91.01 | 0.12 | 0.03 | 1.44 |
| LM3-2 63/83 | С | CZ.15 | 0.01 | 6.85 | 0.48 | 0.04 | 32.70 | 0.03 | 0.03 | 00.00 | 22.40 | 0.02 | 99.81 | 0.999 | 0.000 | 0.154 | 0.011 | 0.001 | 0.939 | 0.001 | 0.001 | 0.000 | 0.895 | 0.001 | 3.002 | 85.35 | 0.12 | 0.05 | -0.34 |
| Sample Grain/Analysis | Location | SIU ₂ | AI_2O_3 | FeO | MnO | NiO | CaO | $ m K_2O$ | TiO_2 | Cr_2O_3 | MgO | Na_2O | Total: | Si | AI | Fe | Mn | Ni | Ca | K | Ti | Cr | Mg | Na | Cations: | Mg# | XFeLiq | XFeMtc | ΔNNO |

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Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

| <i>C</i> - | core; R - | - rim; I - i | ntermedic | ite. | | | | | | | | | |
|-------------------|-----------|--------------|-----------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| Sample | TR-4 | TR-02 | TR-02 | TR-4 | TR-02 | TR-4 | TR-02 | TR-4 | TR-02 | TR-4 | TR-02 | TR-4 | TR-02 |
| Grain/ | 01/01 | 01/01 | 01/02 | 01/02 | 01/02 | 02/02 | 02/04 | 02/04 | 02/05 | 02/05 | 02/06 | 02/06 | 02/07 |
| Analysis | 01/01 | 01/01 | 01/02 | 01/02 | 01/03 | 02/03 | 02/04 | 02/04 | 02/03 | 03/03 | 03/00 | 03/00 | 03/07 |
| Location | C | С | Ι | R | R | С | С | R | R | С | С | R | R |
| SiO_2 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.21 | 1.45 | 1.50 | 1.21 | 1.67 | 1.72 | 1.34 | 1.94 | 1.49 | 1.47 | 1.03 | 1.49 | 1.25 |
| La_2O_3 | 2.77 | 3.55 | 3.07 | 2.37 | 2.58 | 3.27 | 3.29 | 3.07 | 2.56 | 3.22 | 1.97 | 3.30 | 0.99 |
| Sm_2O_3 | 0.20 | 0.31 | 0.28 | 0.17 | 0.24 | 0.21 | 0.30 | 0.20 | 0.22 | 0.20 | 0.19 | 0.21 | 0.10 |
| Pr_2O_3 | 0.65 | 0.80 | 0.61 | 0.50 | 0.48 | 0.77 | 0.77 | 0.69 | 0.42 | 0.76 | 0.40 | 0.75 | 0.13 |
| CaO | 30.11 | 25.14 | 29.61 | 32.62 | 32.12 | 28.06 | 28.06 | 29.21 | 32.12 | 27.35 | 33.93 | 27.50 | 37.95 |
| Nb_2O_5 | 0.99 | 2.36 | 1.70 | 0.92 | 1.67 | 1.57 | 1.86 | 1.18 | 1.50 | 2.73 | 0.78 | 2.62 | 1.00 |
| SrO | 0.74 | 0.78 | 0.74 | 0.74 | 0.79 | 0.73 | 0.76 | 0.75 | 0.78 | 0.78 | 0.62 | 0.80 | 0.67 |
| ZrO_2 | 0.07 | 0.25 | 0.23 | 0.09 | 0.24 | 0.17 | 0.18 | 0.10 | 0.16 | 0.24 | 0.09 | 0.22 | 0.14 |
| ThO_2 | 0.67 | 2.45 | 0.38 | 0.21 | 0.04 | 1.32 | 1.12 | 0.65 | 0.09 | 1.19 | 0.25 | 1.27 | 0.00 |
| TiO ₂ | 50.80 | 48.03 | 50.53 | 52.37 | 51.30 | 49.15 | 49.60 | 49.33 | 51.25 | 48.17 | 53.15 | 48.42 | 55.01 |
| BaO | 0.00 | 0.10 | 0.11 | 0.00 | 0.11 | 0.00 | 0.10 | 0.00 | 0.11 | 0.00 | 0.15 | 0.00 | 0.13 |
| Ce_2O_3 | 6.68 | 8.85 | 7.00 | 5.35 | 5.19 | 7.81 | 7.85 | 6.95 | 5.27 | 7.65 | 4.50 | 7.88 | 1.40 |
| Nd_2O_3 | 2.16 | 2.77 | 2.17 | 1.72 | 1.58 | 2.47 | 2.44 | 2.21 | 1.60 | 2.40 | 1.49 | 2.45 | 0.39 |
| Na ₂ O | 1.83 | 3.05 | 2.17 | 1.49 | 1.57 | 2.09 | 2.38 | 1.79 | 1.56 | 2.39 | 1.26 | 2.42 | 0.65 |
| MgO | 0.00 | 0.08 | 0.06 | 0.00 | 0.07 | 0.00 | 0.05 | 0.00 | 0.06 | 0.00 | 0.03 | 0.00 | 0.04 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.45 | 0.11 | 0.00 | 0.04 | 0.00 | 0.22 | 0.00 | 0.02 | 0.00 | 0.11 | 0.00 | 0.01 |
| Total | 98.89 | 100.43 | 100.27 | 99.76 | 99.70 | 99.35 | 100.30 | 98.07 | 99.23 | 98.55 | 99.94 | 99.33 | 99.83 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.023 | 0.028 | 0.031 | 0.022 | 0.025 | 0.033 | 0.027 | 0.037 | 0.019 | 0.028 | 0.022 | 0.028 | 0.024 |
| La | 0.025 | 0.028 | 0.023 | 0.021 | 0.030 | 0.030 | 0.023 | 0.029 | 0.017 | 0.030 | 0.008 | 0.031 | 0.031 |
| Sm | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 |
| Pr | 0.006 | 0.006 | 0.004 | 0.004 | 0.007 | 0.007 | 0.004 | 0.006 | 0.004 | 0.007 | 0.001 | 0.007 | 0.006 |
| Ca | 0.803 | 0.782 | 0.837 | 0.847 | 0.752 | 0.759 | 0.841 | 0.790 | 0.872 | 0.746 | 0.946 | 0.746 | 0.733 |
| Nb | 0.011 | 0.019 | 0.018 | 0.010 | 0.021 | 0.018 | 0.017 | 0.013 | 0.008 | 0.031 | 0.011 | 0.030 | 0.032 |
| Sr | 0.011 | 0.011 | 0.011 | 0.010 | 0.011 | 0.011 | 0.011 | 0.011 | 0.009 | 0.011 | 0.009 | 0.012 | 0.011 |
| Zr | 0.001 | 0.003 | 0.003 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.003 | 0.002 | 0.003 | 0.003 |
| Th | 0.004 | 0.002 | 0.000 | 0.001 | 0.006 | 0.008 | 0.001 | 0.004 | 0.001 | 0.007 | 0.000 | 0.007 | 0.007 |
| Ti | 0.951 | 0.937 | 0.939 | 0.955 | 0.933 | 0.933 | 0.942 | 0.937 | 0.960 | 0.922 | 0.963 | 0.922 | 0.921 |
| Ba | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Ce | 0.061 | 0.063 | 0.046 | 0.047 | 0.072 | 0.072 | 0.047 | 0.064 | 0.040 | 0.071 | 0.012 | 0.073 | 0.074 |
| Nd | 0.019 | 0.019 | 0.014 | 0.015 | 0.022 | 0.022 | 0.014 | 0.020 | 0.013 | 0.022 | 0.003 | 0.022 | 0.021 |
| Na | 0.088 | 0.104 | 0.074 | 0.070 | 0.115 | 0.102 | 0.074 | 0.088 | 0.058 | 0.118 | 0.029 | 0.119 | 0.129 |
| Mg | 0.000 | 0.002 | 0.003 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.002 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 |
| Cations | 2.004 | 2.007 | 2.007 | 2.007 | 2.003 | 1.998 | 2.009 | 2.003 | 2.007 | 1.999 | 2.010 | 2.001 | 2.001 |
| lueshite | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.03 | 0.01 | 0.03 | 0.01 |
| loparite | 0.16 | 0.25 | 0.17 | 0.12 | 0.11 | 0.17 | 0.19 | 0.15 | 0.12 | 0.18 | 0.10 | 0.18 | 0.04 |
| <i>REEFeO</i> ₃ | 0.02 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.02 | 0.03 | 0.01 |
| tausonite | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $REE_2Ti_2O_7$ | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.79 | 0.68 | 0.76 | 0.83 | 0.82 | 0.75 | 0.74 | 0.78 | 0.82 | 0.74 | 0.86 | 0.73 | 0.93 |
| Fe/Nb | 2.04 | 1.47 | 1.67 | 2.20 | 1.20 | 1.82 | 1.66 | 2.74 | 2.20 | 0.90 | 2.07 | 0.95 | 0.74 |
| ANNO | -3.21 | -2.91 | -2.14 | -3.22 | -3.83 | -1.57 | -2.71 | 0.03 | -3.91 | -4.39 | -3.36 | -4.15 | -5.60 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C_{-} core: R_{-} rim: L_{-} intermediate

| <u> </u> | $\frac{core, K}{TD}$ | $- r_{lm}, 1 - l$ | TD 4 | TD 02 | TD 4 | TD 07 | TD 4 | TD 07 | TD 4 | TD 07 | TD 4 | TD 07 | TD 4 |
|-----------------------|----------------------|-------------------|---------------|---------------|-------|-------|---------------|--------------|--------------|--------------|----------|----------|--------------|
| Sample | TR-4 | TR-02 | 1 R- 4 | TR-02 | TR-4 | TR-07 | 1 R- 4 | TR-07 | TR-4 | TR-07 | TR-4 | TR-07 | TR-4 |
| Grain/ | 04/07 | 04/08 | 04/08 | 04/09 | 05/09 | 05/10 | 05/10 | 05/11 | 06/11 | 06/12 | 06/12 | 06/13 | 07/13 |
| Location | C | C | D | D | C | C | D | D | C | C | D | D | C |
| SiO | | 0.00 | <u> </u> | <u> </u> | 0.00 | 0.00 | <u> </u> | <u> </u> | 0.00 | 0.00 | <u> </u> | <u> </u> | 0.00 |
| SIO_2 | 1.67 | 1.26 | 1.50 | 1.50 | 1.22 | 0.00 | 1.29 | 1.20 | 0.00 | 0.00 | 1.62 | 1.21 | 1.24 |
| Ic_2O_3 | 2.24 | 2.26 | 2.60 | 2 70 | 2 25 | 2 20 | 2.59 | 2.76 | 2 20 | 2.28 | 2.26 | 2.09 | 2 11 |
| La_2O_3 | 0.24 | 0.27 | 0.22 | 2.70 | 0.22 | 0.29 | 0.22 | 2.70 | 0.29 | 2.20 | 0.22 | 2.08 | 0.22 |
| $\operatorname{Br} O$ | 0.21 | 0.27 | 0.23 | 0.21 | 0.22 | 0.20 | 0.23 | 0.24 | 0.22 | 0.21 | 0.22 | 0.18 | 0.22 |
| Γ_2O_3 | 20.14 | 0.08 | 0.79 | 21.06 | 0.78 | 0.00 | 0.01 | 20.40 | 0.77 | 0.45 | 0.77 | 0.57 | 20.10 |
| CaO Nh O | 29.14 | 27.21 | 20.80 | 51.90 1.04 | 1.75 | 20.32 | 27.70 | 1.02 | 26.10 | 52.78 | 27.70 | 33.00 | 29.19 |
| NU_2O_5 | 0.77 | 2.83 | 0.78 | 0.85 | 0.77 | 2.10 | 0.86 | 0.70 | 0.78 | 0.90 | 0.75 | 0.97 | 0.77 |
| 310 7rO | 0.77 | 0.78 | 0.78 | 0.85 | 0.77 | 0.78 | 0.80 | 0.79 | 0.78 | 0.08 | 0.75 | 0.03 | 0.77 |
| ZIO_2 | 0.25 | 0.28 | 0.22 | 0.24 | 0.15 | 0.18 | 0.14 | 0.20 | 0.13 | 0.08 | 0.10 | 0.09 | 0.13 |
| TiO ₂ | 0.17 | 1.17 | 0.71 | 0.09 | 0.80 | 0.00 | 0.78 | 0.09 | 1.55 | 0.27 | 1.49 | 0.09 | 0.49 |
| IIO_2 | 49.05 | 40.75 | 40.70 | 0.11 | 49.91 | 49.79 | 0.00 | 49.03 | 49.20 | 0.00 | 48.00 | 0.14 | 49.88 |
| GaO | 0.00 | 0.12 | 0.00 | 0.11 5.40 | 0.00 | 0.12 | 0.00 | 0.08 | 0.00 | 5.20 | 0.00 | 0.14 | 0.00 |
| Ce_2O_3 | 0.64 | 8.07 2.20 | 0.20 2.54 | J.49 | 7.99 | 7.55 | 0.24 | J.70 | 7.01 | 5.20 1.74 | 7.90 | 4.50 | 7.09 |
| Na_2O_3 | 2.12 | 2.39 | 2.34 | 1.07 | 2.30 | 2.54 | 2.01 | 1.60 | 2.30 | 1./4 | 2.35 | 1.57 | 2.27 |
| MaQ | 2.13 | 2.04 | 2.32 | 1.4/ | 2.51 | 2.40 | 2.29 | 1.65 | 2.11 | 1.34 | 2.15 | 0.16 | 1.94 |
| ALO | 0.00 | 0.03 | 0.00 | 0.08 | 0.00 | 0.04 | 0.00 | 0.30 | 0.00 | 0.05 | 0.00 | 0.10 | 0.00 |
| AI_2O_3 Ta O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Ta_2O_5 | 0.00 | 0.55 | 0.00 | 0.00 | 0.00 | 0.13 | 100 40 | 0.07 | 0.00 | 0.15 | 0.00 | 100.05 | 0.00 |
| Si | 90.00 | 0.000 | 90.72 | 99.05 | 0.000 | 0.010 | 0.000 | 90.04 | 99.43 | 20.04 | 90.92 | 0.000 | 90.00 |
| Fe | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| I e | 0.031 | 0.029 | 0.030 | 0.022 | 0.023 | 0.020 | 0.020 | 0.020 | 0.030 | 0.022 | 0.031 | 0.029 | 0.023 |
| Sm | 0.030 | 0.024 | 0.034 | 0.030 | 0.031 | 0.023 | 0.033 | 0.021 | 0.031 | 0.018 | 0.031 | 0.010 | 0.029 |
| Dr | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 |
| | 0.000 | 0.004 | 0.007 | 0.000 | 0.007 | 0.004 | 0.007 | 0.004 | 0.007 | 0.003 | 0.007 | 0.002 | 0.000 |
| Nb | 0.782 | 0.021 | 0.732 | 0.701 | 0.740 | 0.011 | 0.742 | 0.001 | 0.701 | 0.002 | 0.750 | 0.009 | 0.785 |
| Sr | 0.020 | 0.021 | 0.022 | 0.024 | 0.018 | 0.021 | 0.019 | 0.011 | 0.017 | 0.010 | 0.019 | 0.010 | 0.019 |
| Zr | 0.011 | 0.012 | 0.012 | 0.011 | 0.011 | 0.011 | 0.012 | 0.010 | 0.011 | 0.009 | 0.011 | 0.009 | 0.011 |
| Th | 0.005 | 0.005 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 |
| Ti | 0.001 | 0.001 | 0.004 | 0.003 | 0.003 | 0.001 | 0.004 | 0.001 | 0.000 | 0.000 | 0.007 | 0.000 | 0.005 |
| Ba | 0.935 | 0.955 | 0.933 | 0.933 | 0.943 | 0.923 | 0.940 | 0.947 | 0.934 | 0.957 | 0.930 | 0.955 | 0.940 |
| Ce | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Nd | 0.005 | 0.049 | 0.070 | 0.009 | 0.073 | 0.052 | 0.073 | 0.047 | 0.072 | 0.038 | 0.074 | 0.032 | 0.000 |
| Na | 0.017 | 0.015 | 0.023 | 0.021 | 0.023 | 0.010 | 0.025 | 0.013 | 0.023 | 0.012 | 0.025 | 0.010 | 0.020 |
| Ma | 0.104 | 0.070 | 0.124 | 0.001 | 0.112 | 0.000 | 0.000 | 0.075 | 0.105 | 0.005 | 0.105 | 0.002 | 0.004 |
| Δ1 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.010 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2 008 | 2 004 | 2 003 | 2 006 | 1 999 | 2 013 | 1 997 | 2.016 | 2 001 | 2 007 | 1 999 | 2 000 | 2 000 |
| lueshite | 2.000 | 0.03 | 2.005 | 2.000 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | 2.000 |
| lonarite | 0.02 | 0.05 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.13 | 0.02 | 0.01 | 0.02 |
| REEFOO. | 0.03 | 0.20 | 0.03 | 0.10 | 0.03 | 0.12 | 0.17 | 0.03 | 0.13 | 0.13 | 0.13 | 0.02 | 0.13 |
| tausonite | 0.05 | 0.02 | 0.03 | 0.05 | 0.03 | 0.02 | 0.05 | 0.05 | 0.05 | 0.02 | 0.05 | 0.02 | 0.05 |
| REE_Ti_O_ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| lakaroiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| nerovskite | 0.76 | 0.72 | 0.72 | 0.82 | 0 74 | 0.00 | 0 74 | 0.79 | 0.00 | 0.83 | 0.00 | 0.85 | 0.78 |
| Fe/Nh | 1.58 | 1.37 | 1.39 | 0.91 | 1.36 | 1.20 | 1.36 | 1.85 | 1.78 | 2.08 | 1.61 | 2.94 | 1.29 |
| ANNO | -2.12 | -2.87 | -2.62 | -4.98 | -3.54 | -3.73 | -3.43 | -3.89 | -2.05 | -3.38 | -2.15 | -1.58 | -3.64 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C_{-} core: R_{-} rim: L_{-} intermediate

| <u> </u> | <i>core</i> , <i>K</i> - | <i>TIM, 1 - 1</i> | TD | TED 10 | TD 4 | TD 10 | TD 02 | TD 4 | TD 02 | TD 4 | TD 02 | TD 4 | TD 02 |
|---------------------------------------|--------------------------|-------------------|--------------|--------------|--------------|----------|--------------|----------|---------------------|---------------|--------|---------------|-------|
| Sample | TR-07 | TR-4 | TR-4 | TR-18 | TR-4 | TR-18 | TR-03 | TR-4 | TR-03 | TR-4 | TR-03 | TR-4 | TR-03 |
| Grain/ | 07/14 | 07/14 | 08/15 | 08/16 | 08/16 | 08/17 | 09/18 | 09/18 | 09/19 | 10/19 | 10/20 | 10/20 | 10/21 |
| Location | C | D | C | C | р | D | C | р | р | C | C | р | T |
| SiO | | <u> </u> | 0.00 | 0.00 | <u> </u> | <u> </u> | 0.00 | <u> </u> | <u> </u> | 0.00 | 0.00 | <u> </u> | 1 |
| SIO_2 | 0.00 | 1.25 | 1.10 | 1.59 | 1.22 | 1.71 | 0.00 | 1.47 | 0.05 | 0.00 | 1.27 | 1.20 | 1.25 |
| $\Gamma e_2 O_3$ | 1.30 | 2.01 | 2.76 | 1.30 | 1.23 2.10 | 1./1 | 2.26 | 1.47 | 2.24 | 1.37 | 2.12 | 1.29 | 2.60 |
| La_2O_3 | 1.60 | 0.21 | 2.70 | 5.27 0.29 | 2.19 | 0.29 | 5.20 | 5.40 | 2.54 | 0.11 | 5.12 | 1.01 | 2.09 |
| $SIII_2O_3$ | 0.15 | 0.21 | 0.18 | 0.28 | 0.10 | 0.28 | 0.28 | 0.22 | 0.21 | 0.11 | 0.27 | 0.09 | 0.24 |
| PI_2O_3 | 0.27 | 0.00 | 0.07 | 0.70 | 0.42 | 0.55 | 0.71 | 0.74 | 0.42 | 0.34 | 0.74 | 0.18 | 0.00 |
| CaO Nh O | 34.04 | 29.99 | 30.41 | 20.47 | 33.78 | 29.48 | 28.31 | 28.30 | 32.32 | 33.07 | 28.04 | 30.80 | 31.12 |
| NU ₂ O ₅ | 0.90 | 1.09 | 0.90 | 4.55 | 0.71 | 2.50 | 1.60 | 1.64 | 1.54 | 0.54 | 1.50 | 0.50 | 1.09 |
| 310 | 0.07 | 0.70 | 0.70 | 0.81 | 0.71 | 0.84 | 0.76 | 0.70 | 0.73 | 0.52 | 0.75 | 0.55 | 0.72 |
| ZIO_2 | 0.08 | 0.14 | 0.04 | 0.01 | 0.09 | 0.31 | 0.24 | 0.18 | 0.21 | 0.04 | 0.13 | 0.06 | 0.11 |
| TIO_2 | 0.07 | 0.30 | 0.78 | 1.70 | 0.08 | 0.24 | 1.30 | 0.50 | 0.07 | 0.21 | 1.17 | 0.05 | 0.57 |
| | 53.04 | 50.28 | 51.07 | 46./1 | 52.95 | 49.24 | 49.31 | 49.54 | 51.55 | 53.46 | 50.17 | 35.15 | 51.54 |
| BaO | 0.12 | 0.00 | 0.00 | 0.14 | 0.00 | 0.09 | 0.11 | 0.00 | 0.08 | 0.00 | 0.13 | 0.00 | 0.08 |
| Ce_2O_3 | 3.69 | 6.79 2.16 | 0.53 | 7.99 | 4.59 | 0.01 | 7.70 | 7.64 | 4.70 | 3.00 | 7.62 | 1.96 | 0.18 |
| Na_2O_3 | 1.14 | 2.10 | 2.15 | 2.34 | 1.46 | 1.98 | 2.47 | 2.39 | 1.46 | 1.05 | 2.44 | 0.66 | 1.97 |
| Na ₂ O | 1.12 | 1.80 | 1./3 | 2.78 | 1.10 | 1.88 | 2.29 | 2.19 | 1.62 | 0.87 | 2.21 | 0.73 | 1.80 |
| MgO | 0.05 | 0.00 | 0.00 | 0.06 | 0.00 | 0.74 | 0.08 | 0.00 | 0.16 | 0.00 | 0.05 | 0.00 | 0.05 |
| AI_2O_3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| $1a_2O_5$ | 0.04 | 0.00 | 0.00 | 0.60 | 0.00 | 0.01 | 0.31 | 0.00 | 0.08 | 0.00 | 0.22 | 0.00 | 0.09 |
| lotal | 99.34 | 99.14 | 99.18 | 100.46 | 99.84 | 99.96 | 100.34 | 99.30 | 99.04 | 98.47 | 100.28 | 99.05 | 99.96 |
| Si | 0.000 | 0.000 | 0.000 | 0.015 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.011 |
| Fe | 0.021 | 0.025 | 0.022 | 0.032 | 0.022 | 0.027 | 0.031 | 0.028 | 0.024 | 0.025 | 0.023 | 0.023 | 0.030 |
| La | 0.013 | 0.028 | 0.025 | 0.028 | 0.019 | 0.030 | 0.021 | 0.031 | 0.029 | 0.011 | 0.024 | 0.009 | 0.018 |
| Sm | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 |
| Pr | 0.002 | 0.006 | 0.006 | 0.005 | 0.004 | 0.007 | 0.004 | 0.007 | 0.00/ | 0.003 | 0.005 | 0.002 | 0.003 |
| | 0.915 | 0.799 | 0.807 | 0.776 | 0.869 | 0.759 | 0.849 | 0.763 | 0.765 | 0.915 | 0.816 | 0.928 | 0.861 |
| ND Su | 0.011 | 0.019 | 0.011 | 0.026 | 0.011 | 0.020 | 0.015 | 0.021 | 0.015 | 0.006 | 0.012 | 0.005 | 0.014 |
| Sr | 0.010 | 0.011 | 0.010 | 0.012 | 0.010 | 0.011 | 0.010 | 0.011 | 0.010 | 0.007 | 0.010 | 0.007 | 0.011 |
| Zr | 0.002 | 0.002 | 0.001 | 0.004 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.002 |
| In T: | 0.000 | 0.002 | 0.004 | 0.001 | 0.000 | 0.007 | 0.000 | 0.003 | 0.007 | 0.001 | 0.002 | 0.000 | 0.000 |
| 11 D- | 0.960 | 0.940 | 0.952 | 0.910 | 0.957 | 0.928 | 0.941 | 0.935 | 0.940 | 0.963 | 0.949 | 0.975 | 0.935 |
| Ва | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Ce | 0.023 | 0.062 | 0.059 | 0.059 | 0.040 | 0.070 | 0.042 | 0.070 | 0.070 | 0.026 | 0.055 | 0.01/ | 0.034 |
| ING No | 0.007 | 0.019 | 0.019 | 0.017 | 0.013 | 0.022 | 0.013 | 0.021 | 0.022 | 0.009 | 0.017 | 0.006 | 0.010 |
| INa Ma | 0.038 | 0.08/ | 0.083 | 0.090 | 0.054 | 0.111 | 0.077 | 0.107 | 0.107 | 0.040 | 0.088 | 0.033 | 0.055 |
| Mg | 0.001 | 0.000 | 0.000 | 0.027 | 0.000 | 0.003 | 0.006 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.024 |
| AI | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| | 2.000 | 2.001 | 2.002 | 2.005 | 2.002 | 2.004 | 2.014 | 2.001 | 2.005 | 2.009 | 2.009 | 2.005 | 2.010 |
| luesnite | 0.01 | 0.02 | 0.01 | 0.05 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 |
| DEEE | 0.09 | 0.14 | 0.15 | 0.18 | 0.09 | 0.13 | 0.19 | 0.18 | 0.13 | 0.07 | 0.19 | 0.06 | 0.10 |
| $KEEFeO_3$ | 0.02 | 0.03 | 0.02 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 |
| DEE T: O | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| lakarojita | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| narovskite | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskile F a/ N IL | U.8/ 1 00 | 0.79 | 0.80 2 AD | U./1 1 32 | 0.80 | U./8 | 0./4 2 00 | 0.75 | 0.82 1 <i>54</i> | 0.90 | 0.73 | 0.92 | 0.79 |
| ΔΝΝΟ | -3.56 | -3.58 | -3.27 | -2.80 | -3.30 | -3.29 | -1.69 | -3.17 | -3.48 | 4.24 -2.06 | -3.25 | 4.20 -2.45 | -1.87 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: L - intermediate

| <u> </u> | $\frac{core; K - I}{TD 02}$ | $\frac{rlm; I - ln}{TD 4 \ 1}$ | TD 4 1 | $\frac{10}{\text{TP}}$ | TD 02 | TD 4 1 | TD 4 1 | TD 02 | TD 02 | TD 4 1 | TD 4 1 | TD 4 1 | TD 02 |
|--------------------------------|-----------------------------|--------------------------------|--------|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Sample Grain/ | 1K-05 | 1K4-1 | 1K4-1 | 1K-05 | 1 K-03 | 1K4-1 | 1K4-1 | 1 K-03 | 1K-03 | 1K4-1 | 1K4-1 | 1 K4-1 | 1K-03 |
| Analysis | 10/22 | 11/21 | 11/22 | 11/23 | 11/24 | 12/23 | 12/24 | 12/25 | 12/26 | 13/25 | 13/25 | 13/26 | 13/27 |
| Location | R | С | R | С | R | С | R | С | R | С | С | R | С |
| SiO ₂ | 0.45 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 |
| Fe ₂ O ₃ | 1.66 | 1.75 | 1.68 | 1.49 | 1.94 | 1.76 | 1.73 | 1.96 | 1.65 | 1.39 | 1.39 | 1.48 | 1.75 |
| La_2O_3 | 2.09 | 2.83 | 3.20 | 2.69 | 2.33 | 3.43 | 3.60 | 2.84 | 2.91 | 3.26 | 3.26 | 3.31 | 3.02 |
| Sm ₂ O ₃ | 0.17 | 0.19 | 0.20 | 0.23 | 0.21 | 0.22 | 0.23 | 0.26 | 0.25 | 0.22 | 0.22 | 0.23 | 0.26 |
| Pr_2O_3 | 0.34 | 0.64 | 0.67 | 0.50 | 0.33 | 0.83 | 0.83 | 0.58 | 0.56 | 0.82 | 0.82 | 0.82 | 0.59 |
| CaO | 33.90 | 29.76 | 29.59 | 32.03 | 33.46 | 26.12 | 27.02 | 30.61 | 30.56 | 26.42 | 26.42 | 27.06 | 30.66 |
| Nb ₂ O ₅ | 1.32 | 2.38 | 1.72 | 1.29 | 1.54 | 2.75 | 2.25 | 1.45 | 1.67 | 1.58 | 1.58 | 2.05 | 1.97 |
| SrO | 0.80 | 0.82 | 0.82 | 0.76 | 0.81 | 0.82 | 0.78 | 0.77 | 0.82 | 0.72 | 0.72 | 0.73 | 0.82 |
| ZrO_2 | 0.21 | 0.27 | 0.16 | 0.15 | 0.24 | 0.35 | 0.28 | 0.18 | 0.19 | 0.14 | 0.14 | 0.20 | 0.32 |
| ThO ₂ | 0.03 | 0.28 | 0.15 | 0.20 | 0.04 | 2.21 | 1.34 | 0.40 | 0.64 | 2.60 | 2.60 | 2.11 | 0.15 |
| TiO ₂ | 52.44 | 49.57 | 50.19 | 51.66 | 51.72 | 47.58 | 48.19 | 50.80 | 50.61 | 48.88 | 48.88 | 48.94 | 50.55 |
| BaO | 0.10 | 0.00 | 0.00 | 0.11 | 0.13 | 0.00 | 0.00 | 0.12 | 0.12 | 0.00 | 0.00 | 0.00 | 0.11 |
| Ce_2O_3 | 3.88 | 6.42 | 6.96 | 5.74 | 4.22 | 8.45 | 8.40 | 6.42 | 6.39 | 8.38 | 8.38 | 8.40 | 6.33 |
| Nd_2O_3 | 1.13 | 2.02 | 2.17 | 1.76 | 1.33 | 2.65 | 2.59 | 1.95 | 2.01 | 2.76 | 2.76 | 2.70 | 1.95 |
| Na ₂ O | 1.19 | 2.00 | 2.01 | 1.74 | 1.29 | 2.54 | 2.44 | 1.80 | 1.80 | 2.64 | 2.64 | 2.52 | 1.79 |
| MgO | 0.68 | 0.00 | 0.00 | 0.04 | 0.11 | 0.00 | 0.00 | 0.14 | 0.06 | 0.00 | 0.00 | 0.00 | 0.14 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Ta_2O_5 | 0.03 | 0.00 | 0.00 | 0.09 | 0.04 | 0.00 | 0.00 | 0.12 | 0.15 | 0.00 | 0.00 | 0.00 | 0.06 |
| Total | 100.40 | 98.92 | 99.51 | 100.47 | 99.90 | 99.72 | 99.68 | 100.40 | 100.39 | 99.80 | 99.80 | 100.53 | 100.54 |
| Si | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.003 |
| Fe | 0.027 | 0.033 | 0.031 | 0.035 | 0.036 | 0.034 | 0.033 | 0.030 | 0.032 | 0.027 | 0.027 | 0.028 | 0.040 |
| La | 0.024 | 0.026 | 0.029 | 0.021 | 0.026 | 0.032 | 0.034 | 0.026 | 0.027 | 0.031 | 0.031 | 0.031 | 0.025 |
| Sm | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pr | 0.004 | 0.006 | 0.006 | 0.003 | 0.005 | 0.008 | 0.008 | 0.005 | 0.005 | 0.008 | 0.008 | 0.008 | 0.004 |
| Ca | 0.832 | 0.793 | 0.787 | 0.862 | 0.803 | 0.715 | 0.735 | 0.804 | 0.803 | 0.720 | 0.720 | 0.730 | 0.827 |
| Nb | 0.014 | 0.027 | 0.019 | 0.017 | 0.016 | 0.032 | 0.026 | 0.019 | 0.022 | 0.018 | 0.018 | 0.023 | 0.024 |
| Sr | 0.011 | 0.012 | 0.012 | 0.011 | 0.011 | 0.012 | 0.011 | 0.012 | 0.012 | 0.011 | 0.011 | 0.011 | 0.012 |
| Zr | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 | 0.004 | 0.003 | 0.002 | 0.004 | 0.002 | 0.002 | 0.002 | 0.006 |
| Th | 0.001 | 0.002 | 0.001 | 0.000 | 0.002 | 0.013 | 0.008 | 0.004 | 0.001 | 0.015 | 0.015 | 0.012 | 0.000 |
| Ti | 0.943 | 0.928 | 0.937 | 0.936 | 0.935 | 0.914 | 0.920 | 0.935 | 0.929 | 0.935 | 0.935 | 0.927 | 0.919 |
| Ba | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Ce | 0.051 | 0.058 | 0.063 | 0.037 | 0.058 | 0.079 | 0.078 | 0.057 | 0.057 | 0.078 | 0.078 | 0.077 | 0.047 |
| Nd | 0.015 | 0.018 | 0.019 | 0.011 | 0.017 | 0.024 | 0.023 | 0.018 | 0.017 | 0.025 | 0.025 | 0.024 | 0.014 |
| Na | 0.082 | 0.096 | 0.097 | 0.060 | 0.086 | 0.126 | 0.120 | 0.086 | 0.085 | 0.130 | 0.130 | 0.123 | 0.072 |
| Mg | 0.002 | 0.000 | 0.000 | 0.004 | 0.005 | 0.000 | 0.000 | 0.002 | 0.005 | 0.000 | 0.000 | 0.000 | 0.009 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.011 | 2.004 | 2.005 | 2.008 | 2.006 | 1.995 | 2.001 | 2.004 | 2.004 | 2.001 | 2.001 | 2.000 | 2.006 |
| lueshite | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| loparite | 0.08 | 0.14 | 0.16 | 0.14 | 0.09 | 0.19 | 0.19 | 0.14 | 0.14 | 0.23 | 0.20 | 0.19 | 0.13 |
| $REEFeO_3$ | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| tausonite | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.86 | 0.78 | 0.77 | 0.81 | 0.85 | 0.71 | 0.72 | 0.79 | 0.79 | 0.71 | 0.72 | 0.74 | 0.79 |
| Fe/Nb | 1.93 | 1.22 | 1.63 | 2.10 | 2.25 | 1.07 | 1.28 | 1.64 | 1.47 | 1.46 | 1.46 | 1.20 | 1.66 |
| <i>∆NNO</i> | -2.46 | -2.65 | -2.07 | -0.82 | -0.47 | -3.01 | -2.47 | -2.21 | -2.19 | -3.12 | -3.12 | -3.40 | -0.58 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

| <i>C</i> - | core; R - | rim; I - in | itermediate | 2. | | | | | | | | |
|-------------------|--------------|-------------|-------------|--------|--------|--------|--------|-------|-------|--------------|--------|--------|
| Sample | TR4-1 | TR4-1 | TR-04a | TR-04a | TR4-1 | TR-04a | TR-04a | TR4-1 | TR4-1 | TR-04b | TR-04b | TR-04b |
| Grain/ | 14/27 | 14/28 | 1//20 | 14/30 | 15/20 | 15/31 | 15/32 | 16/30 | 16/31 | 16/33 | 16/34 | 16/35 |
| Analysis | 14/2/ | 14/20 | 14/29 | 14/30 | 13/29 | 15/51 | 15/52 | 10/30 | 10/31 | 10/33 | 10/34 | 10/33 |
| Location | С | R | С | R | С | С | R | С | R | С | Ι | R |
| SiO_2 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.65 | 1.63 | 1.33 | 1.50 | 1.66 | 1.43 | 1.45 | 1.46 | 1.63 | 1.30 | 1.34 | 1.31 |
| La_2O_3 | 3.14 | 3.25 | 2.56 | 2.08 | 2.92 | 3.11 | 3.18 | 3.23 | 2.55 | 3.40 | 3.16 | 3.22 |
| Sm_2O_3 | 0.21 | 0.22 | 0.26 | 0.18 | 0.21 | 0.27 | 0.27 | 0.20 | 0.18 | 0.28 | 0.27 | 0.26 |
| Pr_2O_3 | 0.74 | 0.82 | 0.55 | 0.33 | 0.58 | 0.62 | 0.69 | 0.76 | 0.50 | 0.73 | 0.62 | 0.62 |
| CaO | 27.77 | 26.58 | 31.93 | 34.52 | 30.63 | 29.27 | 29.71 | 27.24 | 31.74 | 27.44 | 28.89 | 28.84 |
| Nb_2O_5 | 2.36 | 2.78 | 1.13 | 1.30 | 1.26 | 1.48 | 1.44 | 2.87 | 1.66 | 3.21 | 2.64 | 2.44 |
| SrO | 0.77 | 0.79 | 0.72 | 0.81 | 0.76 | 0.79 | 0.77 | 0.76 | 0.76 | 0.81 | 0.76 | 0.78 |
| ZrO_2 | 0.30 | 0.33 | 0.12 | 0.21 | 0.13 | 0.16 | 0.16 | 0.30 | 0.19 | 0.30 | 0.25 | 0.22 |
| ThO_2 | 0.99 | 1.90 | 0.20 | 0.02 | 0.25 | 0.76 | 0.62 | 1.45 | 0.11 | 1.27 | 0.63 | 0.63 |
| TiO ₂ | 48.49 | 47.89 | 52.38 | 52.60 | 51.37 | 49.90 | 49.11 | 48.88 | 50.73 | 47.65 | 49.32 | 49.11 |
| BaO | 0.00 | 0.00 | 0.12 | 0.13 | 0.00 | 0.11 | 0.14 | 0.00 | 0.00 | 0.11 | 0.11 | 0.09 |
| Ce_2O_3 | 7.51 | 8.06 | 5.53 | 3.68 | 6.44 | 7.22 | 7.14 | 7.87 | 5.36 | 7.84 | 7.14 | 7.18 |
| Nd_2O_3 | 2.37 | 2.56 | 1.78 | 1.16 | 2.03 | 2.37 | 2.32 | 2.46 | 1.69 | 2.45 | 2.24 | 2.23 |
| Na ₂ O | 2.41 | 2.61 | 1.59 | 1.09 | 1.78 | 2.17 | 2.03 | 2.52 | 1.55 | 2.62 | 2.27 | 2.28 |
| MgO | 0.00 | 0.00 | 0.03 | 0.05 | 0.00 | 0.05 | 0.05 | 0.00 | 0.00 | 0.06 | 0.05 | 0.05 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Ta_2O_5 | 0.00 | 0.00 | 0.10 | 0.01 | 0.00 | 0.22 | 0.13 | 0.00 | 0.00 | 0.32 | 0.17 | 0.14 |
| Total | 98.73 | 99.45 | 100.34 | 99.66 | 100.01 | 99.93 | 99.20 | 99.99 | 98.65 | 99.79 | 99.84 | 99.38 |
| Si | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.031 | 0.031 | 0.027 | 0.027 | 0.031 | 0.027 | 0.025 | 0.028 | 0.030 | 0.025 | 0.025 | 0.023 |
| La | 0.029 | 0.030 | 0.018 | 0.029 | 0.026 | 0.029 | 0.032 | 0.030 | 0.023 | 0.029 | 0.030 | 0.026 |
| Sm | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pr | 0.007 | 0.008 | 0.003 | 0.006 | 0.005 | 0.006 | 0.007 | 0.007 | 0.005 | 0.006 | 0.006 | 0.006 |
| Ca | 0.754 | 0.725 | 0.886 | 0.781 | 0.804 | 0.799 | 0.745 | 0.733 | 0.837 | 0.771 | 0.774 | 0.780 |
| Nb | 0.027 | 0.032 | 0.014 | 0.017 | 0.014 | 0.016 | 0.037 | 0.033 | 0.018 | 0.030 | 0.028 | 0.031 |
| Sr | 0.011 | 0.012 | 0.011 | 0.011 | 0.011 | 0.011 | 0.012 | 0.011 | 0.011 | 0.011 | 0.011 | 0.012 |
| Zr | 0.004 | 0.004 | 0.002 | 0.002 | 0.001 | 0.002 | 0.004 | 0.004 | 0.002 | 0.003 | 0.003 | 0.003 |
| Th | 0.006 | 0.011 | 0.000 | 0.004 | 0.001 | 0.004 | 0.007 | 0.008 | 0.001 | 0.004 | 0.004 | 0.003 |
| Ti | 0.924 | 0.917 | 0.948 | 0.935 | 0.947 | 0.927 | 0.908 | 0.924 | 0.940 | 0.925 | 0.925 | 0.927 |
| Ba | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Ce | 0.070 | 0.075 | 0.032 | 0.066 | 0.058 | 0.066 | 0.073 | 0.072 | 0.048 | 0.065 | 0.066 | 0.061 |
| Nd | 0.021 | 0.023 | 0.010 | 0.021 | 0.018 | 0.021 | 0.022 | 0.022 | 0.015 | 0.020 | 0.020 | 0.019 |
| Na | 0.118 | 0.129 | 0.051 | 0.105 | 0.085 | 0.099 | 0.129 | 0.123 | 0.074 | 0.109 | 0.111 | 0.110 |
| Mg | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Cations | 2.005 | 1.999 | 2.008 | 2.009 | 2.002 | 2.015 | 2.007 | 1.996 | 2.006 | 2.004 | 2.007 | 2.005 |
| lueshite | 0.03 | 0.01 | 0.01 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.03 | 0.03 |
| loparite | 0.20 | 0.14 | 0.13 | 0.07 | 0.18 | 0.18 | 0.17 | 0.11 | 0.20 | 0.19 | 0.16 | 0.17 |
| $REEFeO_3$ | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 |
| tausonite | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| $REE_2Ti_2O_7$ | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.72 | 0.80 | 0.82 | 0.87 | 0.73 | 0.76 | 0.76 | 0.82 | 0.72 | 0.72 | 0.76 | 0.75 |
| Fe/Nb | 1.16 | 0.98 | 1.92 | 1.61 | 2.18 | 1.68 | 0.67 | 0.85 | 1.63 | 0.84 | 0.89 | 0.74 |
| <i>∆NNO</i> | -3.01 | -3.70 | -2.48 | -2.87 | -1.60 | -2.67 | -5.92 | -4.67 | -2.26 | -4.96 | -4.80 | -5.68 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: I - intermediate.

| Sample IR4-1 IR4-1 <t< th=""><th><u>C-</u></th><th>TD 4 1</th><th>$\frac{1}{1}$ TD 041</th><th></th><th></th><th>TD 4 1</th><th>TD 07</th><th>TD 4 1</th><th>TD 4 1</th><th>TD 10</th><th>TD 10</th><th>TD 10</th><th>TD 4 0</th><th>TD 4 0</th></t<> | <u>C-</u> | TD 4 1 | $\frac{1}{1}$ TD 041 | | | TD 4 1 | TD 07 | TD 4 1 | TD 4 1 | TD 10 | TD 10 | TD 10 | TD 4 0 | TD 4 0 |
|---|---|--------|----------------------|----------------|--------------|----------|-------|--------|-------------|--------------|-------|---------------|--------|---------------|
| Grand 1732 1736 1737 1833 18/34 18/38 19/35 19/36 19/30 19/40 19/41 20/37 20/38 Location C C R R | Sample | 1K4-1 | 1 K-04b | 1 R- 0/ | 1K4-1 | 1 K4-1 | 1K-0/ | 1K4-1 | 1 K4-1 | 1K-18 | 1K-18 | 1K-18 | I K4-2 | I K4-2 |
| Houry and Location C R C R C R C I R C R SiO2 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 0.00 0.00 FeQ0, 3.51 2.80 1.80 3.15 2.83 2.87 3.13 3.17 3.14 3.27 0.29 0.22 0.22 0.22 0.22 0.22 0.23 0.22 0.18 0.04 0.07 0.61 0.31 0.77 0.63 0.56 0.76 0.76 0.69 0.63 0.48 0.79 0.49 Cad 2.642 2.92.8 3.469 2.809 30.55 31.02 28.14 28.58 2.50 2.31 1.81 1.81 Nb(0, 2.14 2.75 0.62 0.01 1.22 0.44 0.05 1.30 1.18 1.42 0.81 0.23 0.34 0.15 0.21 0.06 0.00 0.00 | Analysis | 17/32 | 17/36 | 17/37 | 18/33 | 18/34 | 18/38 | 19/35 | 19/36 | 19/39 | 19/40 | 19/41 | 20/37 | 20/38 |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | Location | C | C | р | C | р | C | C | р | C | т | р | C | D |
| Bio2 0.00 <th< td=""><td>SiO</td><td></td><td>0.00</td><td><u> </u></td><td>0.00</td><td><u> </u></td><td>0.00</td><td>0.00</td><td><u> </u></td><td>0.00</td><td>0.25</td><td><u> </u></td><td>0.00</td><td><u> </u></td></th<> | SiO | | 0.00 | <u> </u> | 0.00 | <u> </u> | 0.00 | 0.00 | <u> </u> | 0.00 | 0.25 | <u> </u> | 0.00 | <u> </u> |
| Tesp() 2.19 1.22 1.09 1.09 1.09 1.04 1.43 1.42 1.40 1.37 1.14 3.27 2.97 3.38 2.57 Sm,O, 0.24 0.27 0.16 0.21 0.20 0.25 0.22 0.21 0.27 0.25 0.26 0.83 0.84 0.83 0.26 0.27 0.83 0.47 0.83 0.47 0.83 0.47 0.83 0.47 0.85 0.97 0.45 0.81 0.82 <td< td=""><td>SIO_2</td><td>0.00</td><td>1.22</td><td>0.00</td><td>0.00</td><td>1.52</td><td>1.64</td><td>0.00</td><td>1.64</td><td>0.00</td><td>0.23</td><td>0.05</td><td>0.00</td><td>1.00</td></td<> | SIO_2 | 0.00 | 1.22 | 0.00 | 0.00 | 1.52 | 1.64 | 0.00 | 1.64 | 0.00 | 0.23 | 0.05 | 0.00 | 1.00 |
| Lacyol 3.11 2.03 2.03 2.03 3.13 3.13 3.14 3.12 2.97 3.38 2.97 Smi,O 0.77 0.61 0.31 0.77 0.63 0.56 0.76 0.69 0.63 0.48 0.79 0.49 CaO 2642 2928 34.69 28.09 30.58 1.02 2.14 28.58 7.57 2.82 30.49 2.63 1.31 1.65 1.46 SrO 0.80 0.81 0.77 0.72 0.73 0.79 0.78 0.81 0.82 0.77 0.83 0.15 1.20 CrO 0.26 0.27 0.16 0.03 0.15 1.14 0.88 0.23 0.34 0.15 0.20 ThO, 0.95 0.62 0.01 1.12 0.98 40.73 49.75 4.675 48.10 5.03 4.63 5.97 BaO 0.00 0.11 0.12 0.00 0.00 0.00 | $1e_2O_3$ | 2.19 | 2.80 | 1.50 | 2.15 | 2.92 | 2.04 | 2.12 | 2.17 | 2.14 | 2.27 | 2.07 | 2.29 | 1.62 |
| | La_2O_3 | 0.24 | 2.80 | 0.16 | 0.21 | 2.05 | 2.07 | 0.22 | 0.21 | 0.27 | 0.20 | 2.97 | 0.22 | 2.37 |
| F120 0.71 0.01 0.03 0.70 0.03 0.75 0.75 0.82 0.74 0.75 0.78 0.75 0.78 0.75 0.78 0.75 0.78 0.75 0.78 0.75 0.78 0.71 0.83 0.74 0.82 0.77 0.83 0.74 0.82 0.77 0.83 0.74 0.82 0.77 0.83 0.74 0.82 0.77 0.83 0.74 0.75 0.71 0.83 0.74 0.75 0.74 1.81 0.24 1.18 0.76 0.77 0.83 0.74 1.85 1.74 7.47 7.58 7.61 7.49 6.29 8.11 5.21 Nd.03 2.48 2.29 1.33 1.86 2.14 2.40 0.77 0 | $\operatorname{Sin}_2 \operatorname{O}_3$ | 0.24 | 0.27 | 0.10 | 0.21 | 0.20 | 0.23 | 0.22 | 0.21 | 0.27 | 0.29 | 0.23 | 0.22 | 0.18 |
| Lab 20.14 22.75 1.25 1.02 20.14 2.13 1.25 1.22 2.24 1.38 2.50 2.31 1.65 1.46 SrO 0.80 0.81 0.77 0.72 0.73 0.79 0.78 0.81 0.82 0.23 0.34 0.15 0.20 ThO 0.26 0.27 0.16 0.14 0.10 0.33 0.15 0.14 0.58 0.23 0.34 0.15 0.20 ThO 0.26 0.02 0.01 0.03 0.15 0.14 0.58 0.23 0.34 0.15 0.20 BaO 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.12 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | P_2O_3 | 0.77 | 0.01 | 0.51 | 0.77 | 0.05 | 0.50 | 0.70 | 0.70 | 0.69 | 0.03 | 0.48 | 0.79 | 0.49 |
| NBO3 2.14 2.73 1.27 1.33 1.02 2.02 1.48 1.30 4.38 2.30 2.31 1.63 0.43 SrO 0.80 0.81 0.77 0.72 0.73 0.71 0.81 0.74 0.82 0.77 0.83 0.74 0.83 0.74 0.83 0.74 0.83 0.74 0.83 0.74 0.83 0.74 0.83 0.74 0.82 0.77 0.83 0.74 0.82 0.77 0.83 0.74 0.82 0.75 1.40 0.82 0.74 4.81 0.24 1.18 0.24 1.18 0.73 0.74 0.89 9.73 9.75 7.61 7.49 6.29 8.11 5.21 Nd,O 2.48 2.29 1.33 1.86 2.14 2.07 2.75 2.26 1.31 1.81 2.17 1.75 1.76 1.76 1.76 1.76 1.76 1.76 1.76 1.76 1.76 1.76 1.76 </td <td>CaO Nh O</td> <td>20.42</td> <td>29.28</td> <td>34.09</td> <td>28.09</td> <td>30.38</td> <td>31.02</td> <td>28.14</td> <td>28.58</td> <td>4 20</td> <td>28.29</td> <td>30.94</td> <td>20.31</td> <td>31.81</td> | CaO Nh O | 20.42 | 29.28 | 34.09 | 28.09 | 30.38 | 31.02 | 28.14 | 28.58 | 4 20 | 28.29 | 30.94 | 20.31 | 31.81 |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | NU_2O_5 | 2.14 | 2.75 | 1.27 | 1.55 | 1.02 | 2.02 | 1.48 | 1.50 | 4.38 | 2.50 | 2.31 | 1.05 | 1.40 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 310 | 0.80 | 0.81 | 0.77 | 0.72 | 0.75 | 0.79 | 0.78 | 0.81 | 0.82 | 0.77 | 0.85 | 0.74 | 0.82 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | ZIO_2 | 0.20 | 0.27 | 0.10 | 0.14 | 0.10 | 0.55 | 0.15 | 0.14 | 0.58 | 0.23 | 0.34 | 0.15 | 0.20 |
| Intog 47.37 49.37 53.00 49.13 51.12 49.78 49.73 49.73 48.10 50.39 48.10 50.39 48.10 50.39 48.10 50.39 48.10 50.39 48.10 50.39 48.10 50.30 0.00 0.12 0.00 0.00 0.01 0.12 0.00 0.00 0.00 0.12 0.00 0.00 0.01 0.12 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.01 0.00 0.00 0.00 0.01 0.00 <t< td=""><td></td><td>0.95</td><td>0.02</td><td>0.01 52.00</td><td>1.22</td><td>0.34</td><td>0.03</td><td>1.50</td><td>1.10</td><td>1.42</td><td>0.81</td><td>0.24</td><td>1.10</td><td>0.00</td></t<> | | 0.95 | 0.02 | 0.01 52.00 | 1.22 | 0.34 | 0.03 | 1.50 | 1.10 | 1.42 | 0.81 | 0.24 | 1.10 | 0.00 |
| bad 0.00 0.11 0.12 0.00 0.12 0.10 0.11 0.12 0.10 0.11 0.12 0.10 0.11 0.12 0.10 0.11 0.12 0.10 0.11 0.10 0.00 1.13 1.14 2.11 1.17 2.50 2.45 2.23 1.31 0.00 | IIO_2 | 47.91 | 49.57 | 0.12 | 49.01 | 51.12 | 49.98 | 49.75 | 49.75 | 40.75 | 48.10 | 50.39 0.12 | 48.70 | 50.97 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | Ga O | 0.00 | 0.11 | 0.12 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.12 | 0.10 | 0.12 | 0.00 | 0.00 |
| NagO 2.48 2.29 2.31 2.47 2.31 2.43 2.29 2.31 1.91 2.60 1.60 MagO 0.00 0.04 0.03 0.00 0.00 0.04 0.00 0.00 0.06 0.35 0.10 0.00 0.00 0.01 TaJO 0.00 0.01 0.01 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00 0.01 0.01 0.00< | Ce_2O_3 | 8.20 | 0.00 | 5.59 | 7.04 | 0.49 | 5.95 | 7.74 | 7.58 | 7.01 | 7.49 | 0.29 | 8.11 | 5.21 |
| NgO 2.49 1.29 1.80 2.14 2.07 2.23 1.70 2.04 1.49 MgO 0.00 0.04 0.03 0.00 | Nu_2O_3 | 2.55 | 2.10 | 1.13 | 2.49 | 2.11 | 1.79 | 2.50 | 2.45 | 2.29 | 2.31 | 1.91 | 2.00 | 1.0/ |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | M_2O | 2.48 | 2.29 | 1.30 | 2.09 | 1.85 | 1.80 | 2.14 | 2.07 | 2.75 | 2.25 | 1.70 | 2.04 | 1.40 |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | MgO | 0.00 | 0.04 | 0.05 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.55 | 0.10 | 0.00 | 0.00 |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | AI_2O_3 Tr O | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| Initial 96.42 97.43 97.43 97.35 97.35 97.36 0.006 0.006 0.006 0.006 0.007 0.001 0.002 0.003 0.004 0.002 0.001 0.001 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 < | $1a_2O_5$ | 0.00 | 0.18 | 0.04 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.17 | 0.05 | 0.00 | 0.00 |
| Si 0.000 0.001 0.002 0.002 0.021 0.021 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.001 0.007 0.004 0.002 0.001 0.007 0.007 0.004 0.002 0.001 0.007 0.007 0.002 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0. | iotai Si | 90.42 | 99.50 | 99.74 | 99.00 | 99.09 | 99.30 | 99.75 | 99.03 | 99.00 | 99.22 | 0.000 | 96.10 | 96. 74 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | Ea | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| La 0.033 0.016 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.029 0.020 0.002 0.001 0.001 0.001 0.007 0.006 0.002 0.001 0.017 0.015 0.028 0.026 0.021 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.021 0.021 0.021 0.001 0.001 0.001 0.001 0.001 0.001 0. | re Le | 0.042 | 0.025 | 0.030 | 0.031 | 0.028 | 0.027 | 0.052 | 0.031 | 0.027 | 0.031 | 0.028 | 0.030 | 0.034 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | La Sm | 0.033 | 0.010 | 0.020 | 0.029 | 0.020 | 0.029 | 0.029 | 0.029 | 0.030 | 0.027 | 0.030 | 0.052 | 0.025 |
| F1 0.007 0.003 0.007 0.006 0.007 0.004 0.002 0.011 0.011 0.011 0.012 0.011 0.001 0.000 0.000 0.001 0.001 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0. | Dr | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 |
| Nb 0.25 0.837 0.837 0.637 0.743 0.745 0.765 0.765 0.765 0.744 0.722 0.837 Nb 0.025 0.011 0.012 0.011 0.011 0.011 0.010 0.011 0.011 0.011 0.012 0.001 0.002 0.002 0.003 0.004 0.003 0.002 0.002 0.003 0.004 0.003 0.002 0.002 0.001 0.003 0.007 0.003 0.001 0.001 0.000 0.001 0.001 0.001 0.000 0.001 0.001 0.001 0.000 0.001 0.001 0.001 0.001 0.000 0.001 <th< td=""><td></td><td>0.007</td><td>0.005</td><td>0.005</td><td>0.007</td><td>0.000</td><td>0.000</td><td>0.007</td><td>0.007</td><td>0.000</td><td>0.004</td><td>0.000</td><td>0.007</td><td>0.004</td></th<> | | 0.007 | 0.005 | 0.005 | 0.007 | 0.000 | 0.000 | 0.007 | 0.007 | 0.000 | 0.004 | 0.000 | 0.007 | 0.004 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | Ca | 0.725 | 0.007 | 0.820 | 0.739 | 0.807 | 0.740 | 0.730 | 0.707 | 0.703 | 0.809 | 0.774 | 0.722 | 0.037 |
| Si 0.012 0.011 0.011 0.010 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.011 0.012 0.012 0.012 0.012 0.012 0.012 0.012 0.012 0.012 0.001 0.001 0.002 0.002 0.002 0.002 0.002 0.001 0.001 0.000 0.000 Th 0.006 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.000 0.001 0.001 0.001 0.001 0.000 0.000 Th 0.023 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.000 0.000 Ce 0.077 0.031 0.054 0.071 0.059 0.071 0.022 0.022 0.021 0.017 0.001 0.001 0.000 0.000 Ce 0.077 0.031 0.054 0.071 0.059 0.071 0.022 0.022 0.021 0.017 0.020 0.024 0.021 Na 0.123 0.063 0.009 0.000 0.000 <t< td=""><td>NU Sr</td><td>0.023</td><td>0.014</td><td>0.025</td><td>0.013</td><td>0.011</td><td>0.030</td><td>0.017</td><td>0.013</td><td>0.028</td><td>0.020</td><td>0.027</td><td>0.019</td><td>0.010</td></t<> | NU Sr | 0.023 | 0.014 | 0.025 | 0.013 | 0.011 | 0.030 | 0.017 | 0.013 | 0.028 | 0.020 | 0.027 | 0.019 | 0.010 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 51 7r | 0.012 | 0.011 | 0.011 | 0.010 | 0.010 | 0.012 | 0.011 | 0.012 | 0.011 | 0.012 | 0.012 | 0.011 | 0.012 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | ZI | 0.005 | 0.002 | 0.004 | 0.002 | 0.001 | 0.007 | 0.002 | 0.002 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 |
| I1 0.923 0.922 0.924 0.947 0.947 0.990 0.938 0.938 0.938 0.911 0.923 0.922 0.940 0.942 Ba 0.000 0.001 0.000 <t< td=""><td>TII Ti</td><td>0.000</td><td>0.000</td><td>0.000</td><td>0.007</td><td>0.005</td><td>0.008</td><td>0.007</td><td>0.007</td><td>0.003</td><td>0.001</td><td>0.003</td><td>0.007</td><td>0.000</td></t<> | TII Ti | 0.000 | 0.000 | 0.000 | 0.007 | 0.005 | 0.008 | 0.007 | 0.007 | 0.003 | 0.001 | 0.003 | 0.007 | 0.000 |
| Ba 0.000 0.001 0.001 0.000 0.001 0.000 0.001 0.000 0 | II Pa | 0.925 | 0.932 | 0.928 | 0.941 | 0.947 | 0.890 | 0.938 | 0.938 | 0.911 | 0.923 | 0.922 | 0.940 | 0.942 |
| Ce 0.077 0.031 0.034 0.071 0.039 0.070 0.071 0.070 0.063 0.063 0.069 0.076 0.047 Nd 0.023 0.010 0.016 0.022 0.019 0.021 0.022 0.021 0.017 0.020 0.024 0.015 Na 0.123 0.063 0.089 0.102 0.087 0.135 0.104 0.101 0.110 0.017 0.020 0.024 0.015 Mg 0.000 0.001 0.001 0.000 | Ба | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| Na 0.023 0.010 0.016 0.022 0.017 0.021 0.021 0.021 0.021 0.017 0.020 0.024 0.013 Na 0.123 0.063 0.089 0.102 0.087 0.135 0.104 0.101 0.110 0.017 0.020 0.024 0.013 Mg 0.000 0.001 0.001 0.000 0.000 0.002 0.000 0.000 0.004 0.003 0.000 0.000 Al 0.000 | Nd | 0.077 | 0.031 | 0.034 | 0.071 | 0.039 | 0.070 | 0.071 | 0.070 | 0.009 | 0.030 | 0.009 | 0.070 | 0.047 |
| Na 0.123 0.003 0.003 0.002 0.007 0.133 0.104 0.101 0.110 0.003 0.103 0.131 0.070 Mg 0.000 0.001 0.001 0.000 <t< td=""><td>Na</td><td>0.025</td><td>0.010</td><td>0.010</td><td>0.022</td><td>0.019</td><td>0.021</td><td>0.022</td><td>0.022</td><td>0.021</td><td>0.017</td><td>0.020</td><td>0.024</td><td>0.013</td></t<> | Na | 0.025 | 0.010 | 0.010 | 0.022 | 0.019 | 0.021 | 0.022 | 0.022 | 0.021 | 0.017 | 0.020 | 0.024 | 0.013 |
| Mg 0.000 0.001 0.001 0.001 0.000 0.000 0.002 0.000 0.000 0.001 0.003 0.000 0.000 0.000 Al 0.000 0.001 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 | Ma | 0.123 | 0.003 | 0.069 | 0.102 | 0.087 | 0.133 | 0.104 | 0.101 | 0.110 | 0.085 | 0.103 | 0.131 | 0.070 |
| A1 0.000 0.001 0.01 <td>Ivig</td> <td>0.000</td> <td>0.001</td> <td>0.001</td> <td>0.000</td> <td>0.000</td> <td>0.002</td> <td>0.000</td> <td>0.000</td> <td>0.015</td> <td>0.004</td> <td>0.005</td> <td>0.000</td> <td>0.000</td> | Ivig | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.015 | 0.004 | 0.005 | 0.000 | 0.000 |
| Ia0.0000.0010.0010.0110.0110.01 <td>Ta</td> <td>0.000</td> | Ta | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Catolis2.0012.0121.9982.0002.0031.9982.0022.0032.0032.0032.0042.0032.004lueshite0.020.030.010.010.020.020.020.020.050.030.030.020.01loparite0.180.160.100.150.180.140.180.230.180.170.120.110.19REEFeO30.030.020.010.030.030.030.030.030.030.030.030.030.03tausonite0.010.010.010.010.010.010.010.010.010.010.010.01REE_2Ti_2O70.010.010.000.000.000.000.000.010.010.010.010.01Ree_Ti_2O70.010.010.000.000.010.010.010.010.010.010.01Ree_Ti_2O70.010.010.000.000.000.000.000.000.000.010.010.01Ree_Ti_2O70.010.010.000.000.000.000.000.000.000.000.000.00lakargiite0.000.000.000.000.000.000.000.000.000.000.000.00pervskite0.760.760.860.790.750.790.760.710.710.75 <th< td=""><td>Cations</td><td>2 001</td><td>0.000</td><td>2.012</td><td>1.000</td><td>2.000</td><td>2 000</td><td>1.000</td><td>2 002</td><td>2 0001</td><td>2 002</td><td>2.000</td><td>2 002</td><td>2 004</td></th<> | Cations | 2 001 | 0.000 | 2.012 | 1.000 | 2.000 | 2 000 | 1.000 | 2 002 | 2 0001 | 2 002 | 2.000 | 2 002 | 2 004 |
| lashle 0.02 0.03 0.01 0.01 0.02 0.02 0.02 0.03 0 | Lucshite | 2.001 | 2.013 | 2.012 | 0.01 | 2.000 | 2.008 | 0.02 | 2.002 | 2.000 | 2.003 | 2.000 | 2.003 | 2.004 |
| $ioparite0.180.160.100.130.130.140.180.230.180.170.120.110.19REEFeO_30.030.020.010.03$ | loparita | 0.02 | 0.05 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 |
| $talla co_3$ 0.05 0.02 0.01 0.03 0.05 | REFEAD | 0.10 | 0.10 | 0.10 | 0.13 | 0.10 | 0.14 | 0.10 | 0.23 | 0.10 | 0.17 | 0.12 | 0.11 | 0.19 |
| $REE_2Ti_2O_7$ 0.01 | tausovite | 0.05 | 0.02 | 0.01 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| $k_{LL_2}r_{15}o_7$ 0.01 0.00 0.00 0.01 0.00 0.01 0.00 <th< td=""><td>RFF T; O</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td><td>0.01</td></th<> | RFF T; O | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| managine 0.00 | lakaraiita | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| Fe/Nb 1.70 1.70 1.35 2.00 2.49 0.54 1.88 2.10 0.95 1.22 1.05 1.58 2.07 $ANNO$ $=0.05$ $=3.38$ $=2.71$ $=1.74$ $=1.87$ $=6.97$ $=1.72$ $=1.60$ $=4.31$ $=2.91$ $=3.76$ $=2.32$ $=1.12$ | nerovskite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| ANNO -0.05 -3.38 -2.71 -1.74 -1.87 -6.97 -1.72 -1.60 -4.31 -2.91 -3.76 -2.32 -1.12 | Fo/Nh | 1 70 | 1 70 | 1 35 | 0.79 2 AA | 2 10 | 0.79 | 1.89 | 7 10 | 0.71 | 1 22 | 1 05 | 1.65 | 0.75 2 07 |
| | ΔNNO | -0.05 | -3.38 | -2.71 | -1.74 | -1.87 | -6.97 | -1.72 | -1.60 | -4.31 | -2.91 | -3.76 | -2.32 | -1.12 |

Supplementary Material B

Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens. C = core: R = rim: L = intermediate

| <i>C</i> - | core; R - | rim; I - in | termedia | te. | | | | | | | | |
|-------------------|-----------|-------------|----------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| Sample | TR4-2 | TR4-2 | TR4-2 | TR4-2 | TR-18 | TR4-2 | TR4-2 | TR4-2 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 |
| Grain/ | 21/20 | 21/40 | 22/41 | 22/42 | 22/44 | 22/12 | 24/45 | 21/16 | 25/47 | 26/40 | 26/50 | 27/51 |
| Analysis | 21/39 | 21/40 | 22/41 | 22/42 | 22/44 | 23/43 | 24/43 | 24/40 | 23/47 | 20/49 | 20/30 | 27/31 |
| Location | C | R | С | R | С | С | С | R | С | С | R | С |
| SiO_2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Fe_2O_3 | 1.53 | 1.57 | 1.76 | 1.69 | 4.00 | 2.00 | 1.59 | 1.48 | 2.22 | 1.61 | 1.56 | 1.62 |
| La_2O_3 | 3.14 | 2.70 | 2.87 | 3.08 | 2.60 | 3.49 | 3.46 | 3.12 | 2.31 | 2.99 | 2.76 | 1.60 |
| Sm_2O_3 | 0.20 | 0.19 | 0.21 | 0.19 | 0.23 | 0.22 | 0.24 | 0.21 | 0.17 | 0.21 | 0.19 | 0.13 |
| Pr_2O_3 | 0.76 | 0.57 | 0.60 | 0.66 | 0.40 | 0.81 | 0.86 | 0.74 | 0.40 | 0.66 | 0.58 | 0.37 |
| CaO | 28.52 | 30.62 | 29.92 | 29.65 | 29.96 | 24.76 | 25.37 | 28.11 | 33.13 | 30.13 | 31.47 | 35.40 |
| Nb_2O_5 | 1.16 | 0.98 | 2.03 | 1.64 | 1.19 | 2.39 | 2.24 | 1.70 | 1.10 | 1.10 | 1.09 | 0.45 |
| SrO | 0.77 | 0.72 | 0.77 | 0.76 | 0.73 | 0.75 | 0.76 | 0.70 | 0.29 | 0.29 | 0.25 | 0.22 |
| ZrO_2 | 0.12 | 0.09 | 0.27 | 0.19 | 0.12 | 0.28 | 0.21 | 0.14 | 0.17 | 0.11 | 0.12 | 0.05 |
| ThO_2 | 1.13 | 0.30 | 0.14 | 0.13 | 0.20 | 2.07 | 2.46 | 0.79 | 0.03 | 0.21 | 0.14 | 0.30 |
| TiO ₂ | 50.65 | 50.89 | 50.34 | 50.21 | 49.87 | 47.47 | 47.91 | 49.51 | 52.12 | 51.27 | 52.31 | 53.85 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 7.55 | 5.83 | 6.55 | 6.80 | 5.58 | 8.48 | 8.56 | 7.41 | 4.45 | 6.69 | 6.18 | 3.38 |
| Nd_2O_3 | 2.42 | 1.85 | 2.08 | 2.16 | 1.80 | 2.66 | 2.72 | 2.38 | 1.33 | 2.05 | 1.87 | 1.20 |
| Na ₂ O | 2.20 | 1.77 | 2.08 | 1.99 | 1.86 | 2.78 | 2.84 | 2.16 | 1.36 | 1.88 | 1.77 | 0.88 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.15 | 98.09 | 99.61 | 99.14 | 98.90 | 98.75 | 99.22 | 98.46 | 99.09 | 99.21 | 100.29 | 99.45 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.029 | 0.029 | 0.033 | 0.032 | 0.028 | 0.039 | 0.031 | 0.028 | 0.040 | 0.030 | 0.028 | 0.029 |
| La | 0.029 | 0.025 | 0.026 | 0.028 | 0.031 | 0.033 | 0.033 | 0.029 | 0.021 | 0.027 | 0.025 | 0.014 |
| Sm | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 |
| Pr | 0.007 | 0.005 | 0.005 | 0.006 | 0.007 | 0.008 | 0.008 | 0.007 | 0.004 | 0.006 | 0.005 | 0.003 |
| Ca | 0.759 | 0.815 | 0.791 | 0.789 | 0.747 | 0.680 | 0.698 | 0.761 | 0.858 | 0.797 | 0.817 | 0.902 |
| Nb | 0.013 | 0.011 | 0.023 | 0.018 | 0.019 | 0.028 | 0.026 | 0.019 | 0.012 | 0.012 | 0.012 | 0.005 |
| Sr | 0.011 | 0.010 | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.010 | 0.004 | 0.004 | 0.004 | 0.003 |
| Zr | 0.002 | 0.001 | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |
| Th | 0.006 | 0.002 | 0.001 | 0.001 | 0.004 | 0.012 | 0.014 | 0.005 | 0.000 | 0.001 | 0.001 | 0.002 |
| Ti | 0.947 | 0.951 | 0.934 | 0.939 | 0.935 | 0.916 | 0.926 | 0.941 | 0.948 | 0.952 | 0.954 | 0.964 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.069 | 0.053 | 0.059 | 0.062 | 0.069 | 0.080 | 0.081 | 0.069 | 0.039 | 0.060 | 0.055 | 0.029 |
| Nd | 0.021 | 0.016 | 0.018 | 0.019 | 0.022 | 0.024 | 0.025 | 0.021 | 0.011 | 0.018 | 0.016 | 0.010 |
| Na | 0.106 | 0.085 | 0.099 | 0.096 | 0.126 | 0.138 | 0.141 | 0.106 | 0.064 | 0.090 | 0.083 | 0.040 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.001 | 2.007 | 2.006 | 2.005 | 2.010 | 1.989 | 1.999 | 1.999 | 2.01 | 2.001 | 2.002 | 2.004 |
| lueshite | 0.01 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.03 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 |
| loparite | 0.15 | 0.15 | 0.16 | 0.22 | 0.12 | 0.15 | 0.23 | 0.18 | 0.10 | 0.16 | 0.14 | 0.07 |
| $REEFeO_3$ | 0.03 | 0.03 | 0.03 | 0.04 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| tausonite | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.80 | 0.77 | 0.78 | 0.69 | 0.82 | 0.77 | 0.69 | 0.76 | 0.85 | 0.79 | 0.81 | 0.90 |
| Fe/Nb | 2.19 | 2.68 | 1.44 | 1.72 | 1.42 | 1.39 | 1.18 | 1.45 | 3.36 | 2.43 | 2.39 | 6.00 |
| <i>∆NNO</i> | -1.98 | -1.53 | -2.16 | -1.90 | -3.02 | -1.32 | -3.07 | -2.89 | 1.09 | -1.57 | -1.87 | -0.85 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: L - intermediate

| Sample | $\frac{COPE}{TRIV-5}$ | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 | TRIV-5 |
|-------------------|-----------------------|----------|---------|---------|--------|--------|--------|--------|--------|--------|---------|
| Grain/ | 11(1)-5 | 1101 V-5 | 1101 -5 | 11(1)-5 | | | | | | | 11(1)-5 |
| Analysis | 27/52 | 28/53 | 29/55 | 30/56 | 31/58 | 31/59 | 32/60 | 32/61 | 33/62 | 33/63 | 34/64 |
| Location | R | С | R | С | С | R | С | R | С | R | R |
| SiO ₂ | 0.00 | 0.00 | 1.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.62 | 1.78 | 2.72 | 1.79 | 1.57 | 1.99 | 1.58 | 1.74 | 1.81 | 1.97 | 1.85 |
| La_2O_3 | 1.52 | 2.65 | 2.51 | 3.51 | 2.92 | 2.36 | 2.66 | 2.38 | 2.53 | 2.45 | 2.90 |
| Sm_2O_3 | 0.12 | 0.18 | 0.15 | 0.23 | 0.19 | 0.16 | 0.18 | 0.16 | 0.18 | 0.17 | 0.19 |
| Pr_2O_3 | 0.33 | 0.54 | 0.43 | 0.80 | 0.62 | 0.43 | 0.58 | 0.45 | 0.50 | 0.46 | 0.62 |
| CaO | 34.86 | 31.26 | 32.53 | 27.31 | 30.52 | 33.47 | 31.43 | 32.71 | 32.37 | 32.75 | 29.79 |
| Nb_2O_5 | 0.43 | 1.07 | 1.68 | 1.65 | 1.00 | 1.11 | 0.86 | 0.87 | 1.00 | 1.08 | 1.19 |
| SrO | 0.21 | 0.27 | 0.36 | 0.28 | 0.29 | 0.32 | 0.29 | 0.28 | 0.30 | 0.30 | 0.29 |
| ZrO_2 | 0.03 | 0.16 | 0.59 | 0.19 | 0.10 | 0.16 | 0.09 | 0.09 | 0.12 | 0.14 | 0.15 |
| ThO ₂ | 0.27 | 0.05 | 0.04 | 0.87 | 0.34 | 0.04 | 0.19 | 0.04 | 0.13 | 0.04 | 0.13 |
| TiO ₂ | 53.52 | 51.74 | 50.57 | 49.48 | 51.46 | 52.44 | 52.18 | 52.15 | 52.50 | 51.95 | 51.03 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 3.31 | 5.65 | 4.56 | 8.21 | 6.47 | 4.68 | 5.87 | 4.88 | 5.40 | 4.90 | 6.51 |
| Nd_2O_3 | 1.16 | 1.78 | 1.34 | 2.59 | 2.08 | 1.43 | 1.87 | 1.52 | 1.69 | 1.54 | 2.03 |
| Na ₂ O | 0.96 | 1.69 | 1.29 | 2.38 | 1.78 | 1.28 | 1.68 | 1.40 | 1.54 | 1.39 | 1.91 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.33 | 98.83 | 99.99 | 99.28 | 99.33 | 99.86 | 99.45 | 98.66 | 100.07 | 99.14 | 98.57 |
| Si | 0.000 | 0.000 | 0.029 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.029 | 0.033 | 0.049 | 0.034 | 0.029 | 0.036 | 0.029 | 0.032 | 0.033 | 0.036 | 0.034 |
| La | 0.013 | 0.024 | 0.022 | 0.033 | 0.027 | 0.021 | 0.024 | 0.021 | 0.023 | 0.022 | 0.027 |
| Sm | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 |
| Pr | 0.003 | 0.005 | 0.004 | 0.007 | 0.006 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.006 |
| Ca | 0.897 | 0.821 | 0.835 | 0.737 | 0.805 | 0.862 | 0.821 | 0.853 | 0.837 | 0.852 | 0.791 |
| Nb | 0.005 | 0.012 | 0.018 | 0.019 | 0.011 | 0.012 | 0.009 | 0.010 | 0.011 | 0.012 | 0.013 |
| Sr | 0.003 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| Zr | 0.000 | 0.002 | 0.007 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 |
| Th | 0.001 | 0.000 | 0.000 | 0.005 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Ti | 0.967 | 0.954 | 0.911 | 0.938 | 0.953 | 0.948 | 0.957 | 0.955 | 0.953 | 0.949 | 0.951 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.029 | 0.051 | 0.040 | 0.076 | 0.058 | 0.041 | 0.052 | 0.043 | 0.048 | 0.044 | 0.059 |
| Nd | 0.010 | 0.016 | 0.011 | 0.023 | 0.018 | 0.012 | 0.016 | 0.013 | 0.015 | 0.013 | 0.018 |
| Na | 0.045 | 0.080 | 0.060 | 0.116 | 0.085 | 0.060 | 0.079 | 0.066 | 0.072 | 0.065 | 0.092 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.004 | 2.002 | 1.992 | 1.997 | 2.000 | 2.004 | 2.002 | 2.005 | 2.003 | 2.004 | 1.999 |
| lueshite | 0.00 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| loparite | 0.08 | 0.14 | 0.09 | 0.20 | 0.15 | 0.10 | 0.14 | 0.11 | 0.12 | 0.11 | 0.16 |
| REEFeO3 | 0.02 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| tausonite | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.89 | 0.82 | 0.85 | 0.74 | 0.80 | 0.85 | 0.82 | 0.84 | 0.83 | 0.84 | 0.79 |
| Fe/Nb | 6.33 | 2.76 | 2.69 | 1.81 | 2.62 | 2.99 | 3.07 | 3.32 | 3.01 | 3.03 | 2.59 |
| <i>∆NNO</i> | -0.76 | -0.78 | 2.48 | -1.36 | -1.62 | -0.01 | -1.43 | -0.73 | -0.65 | 0.01 | -0.54 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: L - intermediate

| Sample | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 |
|----------------------------|-----------|----------|--------------|------------|--------------|--------------|--------------|--------------|--------------|
| Grain/ | 110 / 5 5 | | 11(1 + 5 - 5 | 1111 0 5 5 | 11(1 + 5 - 5 | 11(1 + 5 - 5 | 11(1 + 5 - 5 | 11(1 + 5 - 5 | 11(1 + 5 - 5 |
| Analysis | 35/65 | 35/66 | 36/67 | 36/68 | 37/69 | 37/70 | 38/71 | 38/72 | 39/73 |
| Location | С | R | С | R | С | R | С | R | R |
| SiO ₂ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| Fe_2O_3 | 1.79 | 1.85 | 1.53 | 1.81 | 1.39 | 1.55 | 1.90 | 1.78 | 1.69 |
| La_2O_3 | 3.51 | 3.20 | 3.41 | 2.65 | 2.76 | 2.15 | 2.46 | 2.52 | 3.70 |
| Sm_2O_3 | 0.23 | 0.20 | 0.23 | 0.17 | 0.19 | 0.15 | 0.16 | 0.18 | 0.24 |
| Pr_2O_3 | 0.79 | 0.69 | 0.78 | 0.53 | 0.66 | 0.41 | 0.45 | 0.47 | 0.84 |
| CaO | 27.53 | 29.41 | 27.46 | 32.57 | 30.25 | 33.45 | 32.91 | 32.71 | 26.00 |
| Nb_2O_5 | 1.46 | 1.33 | 1.34 | 1.11 | 0.86 | 0.84 | 1.17 | 1.09 | 1.80 |
| SrO | 0.26 | 0.30 | 0.29 | 0.28 | 0.26 | 0.27 | 0.28 | 0.31 | 0.30 |
| ZrO_2 | 0.17 | 0.18 | 0.14 | 0.17 | 0.09 | 0.10 | 0.16 | 0.13 | 0.24 |
| ThO ₂ | 0.57 | 0.21 | 1.11 | 0.03 | 0.63 | 0.03 | 0.02 | 0.04 | 1.51 |
| TiO ₂ | 49.56 | 50.88 | 49.87 | 51.92 | 51.74 | 52.80 | 52.01 | 52.49 | 48.38 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 7.97 | 7.12 | 8.06 | 5.21 | 6.71 | 4.47 | 4.90 | 5.18 | 8.61 |
| Nd_2O_3 | 2.48 | 2.23 | 2.53 | 1.61 | 2.15 | 1.41 | 1.50 | 1.65 | 2.55 |
| Na_2O | 2.23 | 2.07 | 2.34 | 1.44 | 1.88 | 1.29 | 1.24 | 1.45 | 2.45 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.55 | 99.67 | 99.08 | 99.50 | 99.58 | 98.93 | 99.23 | 99.99 | 98.30 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Fe | 0.034 | 0.034 | 0.029 | 0.033 | 0.026 | 0.028 | 0.035 | 0.032 | 0.033 |
| La | 0.033 | 0.029 | 0.032 | 0.024 | 0.025 | 0.019 | 0.022 | 0.022 | 0.035 |
| Sm | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 |
| Pr | 0.007 | 0.006 | 0.007 | 0.005 | 0.006 | 0.004 | 0.004 | 0.004 | 0.008 |
| Ca | 0.746 | 0.778 | 0.742 | 0.847 | 0.797 | 0.866 | 0.854 | 0.845 | 0.716 |
| Nb | 0.017 | 0.015 | 0.015 | 0.012 | 0.010 | 0.009 | 0.013 | 0.012 | 0.021 |
| Sr | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.005 |
| Zr | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 |
| Th | 0.003 | 0.001 | 0.006 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.009 |
| Ti | 0.943 | 0.945 | 0.946 | 0.948 | 0.957 | 0.959 | 0.948 | 0.952 | 0.935 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.074 | 0.064 | 0.074 | 0.046 | 0.060 | 0.040 | 0.043 | 0.046 | 0.081 |
| Nd | 0.022 | 0.020 | 0.023 | 0.014 | 0.019 | 0.012 | 0.013 | 0.014 | 0.023 |
| Na | 0.109 | 0.099 | 0.114 | 0.068 | 0.090 | 0.060 | 0.058 | 0.068 | 0.122 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 1.996 | 2.001 | 1.997 | 2.004 | 2.000 | 2.004 | 1.999 | 2.002 | 1.992 |
| lueshite | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| loparite | 0.19 | 0.17 | 0.20 | 0.11 | 0.16 | 0.10 | 0.09 | 0.11 | 0.21 |
| <i>REEFeO</i> ₃ | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 |
| tausonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.75 | 0.77 | 0.74 | 0.84 | 0.79 | 0.86 | 0.85 | 0.84 | 0.72 |
| Fe/Nb | 2.04 | 2.31 | 1.90 | 2.70 | 2.70 | 3.08 | 2.69 | 2.71 | 1.56 |
| <i>∆NNO</i> | -1.07 | -0.76 | -2.16 | -0.77 | -2.27 | -1.60 | -0.45 | -0.92 | -1.95 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: I - intermediate.

| Sample | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 | TRIV-5-3 |
|------------------|----------|---------------|----------|----------|----------|----------|----------|----------|----------|
| Grain/ | 39/7/ | <i>A</i> 1/77 | 12/78 | 12/79 | 13/80 | 15/83 | 16/81 | 17/86 | 17/87 |
| Analysis | 37/14 | 41/// | 42/70 | 72/17 | HJ/00 | -J/0J | +0/0+ | +7/00 | +//0/ |
| Location | C | С | С | R | С | R | С | С | R |
| SiO_2 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.16 | 1.96 | 1.62 | 1.60 | 1.64 | 1.41 | 1.53 | 1.19 | 1.37 |
| La_2O_3 | 1.44 | 3.04 | 3.45 | 3.21 | 3.20 | 2.62 | 3.27 | 2.54 | 1.79 |
| Sm_2O_3 | 0.12 | 0.19 | 0.23 | 0.21 | 0.22 | 0.17 | 0.21 | 0.19 | 0.14 |
| Pr_2O_3 | 0.32 | 0.59 | 0.77 | 0.68 | 0.69 | 0.59 | 0.73 | 0.65 | 0.33 |
| CaO | 35.44 | 30.76 | 27.75 | 28.90 | 29.05 | 32.31 | 28.41 | 30.55 | 34.34 |
| Nb_2O_5 | 0.66 | 1.54 | 1.51 | 1.30 | 1.13 | 0.78 | 1.12 | 0.78 | 0.75 |
| SrO | 0.24 | 0.36 | 0.30 | 0.30 | 0.28 | 0.31 | 0.31 | 0.27 | 0.26 |
| ZrO_2 | 0.05 | 0.29 | 0.13 | 0.13 | 0.13 | 0.08 | 0.10 | 0.07 | 0.06 |
| ThO ₂ | 0.12 | 0.07 | 0.76 | 0.33 | 0.27 | 0.40 | 0.89 | 0.99 | 0.04 |
| TiO ₂ | 55.05 | 50.35 | 49.82 | 50.88 | 50.48 | 52.09 | 50.15 | 52.34 | 53.14 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 3.08 | 6.26 | 7.89 | 7.33 | 7.12 | 5.97 | 7.65 | 6.51 | 3.54 |
| Nd_2O_3 | 0.99 | 1.90 | 2.43 | 2.30 | 2.23 | 1.94 | 2.37 | 2.16 | 1.10 |
| Na_2O | 1.21 | 1.52 | 2.23 | 2.23 | 2.00 | 1.48 | 2.17 | 1.92 | 1.16 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.86 | 98.83 | 98.93 | 99.40 | 98.43 | 100.16 | 98.90 | 100.16 | 98.00 |
| Si | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.020 | 0.037 | 0.031 | 0.030 | 0.031 | 0.026 | 0.029 | 0.022 | 0.025 |
| La | 0.012 | 0.028 | 0.032 | 0.029 | 0.030 | 0.023 | 0.030 | 0.023 | 0.016 |
| Sm | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 |
| Pr | 0.003 | 0.005 | 0.007 | 0.006 | 0.006 | 0.005 | 0.007 | 0.006 | 0.003 |
| Ca | 0.893 | 0.816 | 0.748 | 0.768 | 0.779 | 0.841 | 0.764 | 0.799 | 0.888 |
| Nb | 0.007 | 0.017 | 0.017 | 0.015 | 0.013 | 0.009 | 0.013 | 0.009 | 0.008 |
| Sr | 0.003 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| Zr | 0.001 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| Th | 0.001 | 0.000 | 0.004 | 0.002 | 0.002 | 0.002 | 0.005 | 0.005 | 0.000 |
| Ti D | 0.974 | 0.937 | 0.943 | 0.950 | 0.950 | 0.952 | 0.947 | 0.962 | 0.965 |
| Ва | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.027 | 0.057 | 0.073 | 0.067 | 0.065 | 0.053 | 0.070 | 0.058 | 0.031 |
| Nd | 0.008 | 0.017 | 0.022 | 0.020 | 0.020 | 0.017 | 0.021 | 0.019 | 0.009 |
| Na | 0.055 | 0.073 | 0.109 | 0.107 | 0.097 | 0.070 | 0.106 | 0.091 | 0.054 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.006 | 1.997 | 1.995 | 2.002 | 1.999 | 2.004 | 2.000 | 2.000 | 2.006 |
| lueshite | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| <i>ioparite</i> | 0.10 | 0.11 | 0.19 | 0.19 | 0.17 | 0.12 | 0.19 | 0.17 | 0.09 |
| REEFeO3 | 0.00 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 |
| tausonite | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $KEE_2II_2O_7$ | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.89 | 0.82 | 0.75 | 0.76 | 0.78 | 0.83 | 0.76 | 0.80 | 0.88 |
| 1 e/IND | 2.95 | 2.12 | 1.79 | 2.04 | 2.42 | 5.05 | 2.27 | 2.55 | 3.05 |
| <i>DIVINU</i> | -3.20 | -0.53 | -1.98 | -1.80 | -1.3/ | -2.12 | -1.80 | -3.09 | -2.30 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C
 core: P
 rim: L
 intermediate

| <i>C</i> - | core; R - rim | ; I - intermed | liate. | | | | | | | | | - | |
|----------------------------|---------------|-----------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Sample | TRIV-5-3 | TRIV-5-3 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 |
| Grain/ | 10/80 | /0/00 | 01/01 | 01/02 | 02/03 | 02/04 | 03/05 | 03/06 | 04/07 | 04/08 | 05/09 | 05/10 | 06/11 |
| Analysis | 47/07 | ч <i>)/)</i> 0 | 01/01 | 01/02 | 02/03 | 02/04 | 05/05 | 03/00 | 04/07 | 04/00 | 05/07 | 05/10 | 00/11 |
| Location | С | R | R | С | С | R | С | R | С | R | С | R | С |
| SiO_2 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.59 | 1.97 | 2.07 | 1.97 | 2.05 | 2.10 | 1.93 | 1.93 | 1.46 | 1.33 | 1.82 | 1.81 | 1.49 |
| La_2O_3 | 2.86 | 2.51 | 1.21 | 1.05 | 0.93 | 0.90 | 1.24 | 1.20 | 1.49 | 1.34 | 1.59 | 1.51 | 1.27 |
| Sm_2O_3 | 0.18 | 0.17 | 0.16 | 0.13 | 0.11 | 0.10 | 0.16 | 0.16 | 0.24 | 0.18 | 0.21 | 0.21 | 0.18 |
| Pr_2O_3 | 0.58 | 0.47 | 0.37 | 0.31 | 0.24 | 0.24 | 0.40 | 0.39 | 0.59 | 0.39 | 0.51 | 0.47 | 0.39 |
| CaO | 31.08 | 32.44 | 35.99 | 36.91 | 37.84 | 37.95 | 35.87 | 36.14 | 33.14 | 35.43 | 34.19 | 34.52 | 35.34 |
| Nb_2O_5 | 1.13 | 1.28 | 0.44 | 0.35 | 0.42 | 0.45 | 0.45 | 0.42 | 1.21 | 1.06 | 1.28 | 1.15 | 1.12 |
| SrO | 0.30 | 0.31 | 0.41 | 0.43 | 0.49 | 0.46 | 0.41 | 0.43 | 0.35 | 0.38 | 0.39 | 0.37 | 0.37 |
| ZrO_2 | 0.13 | 0.20 | 0.09 | 0.08 | 0.09 | 0.11 | 0.08 | 0.09 | 0.15 | 0.16 | 0.28 | 0.25 | 0.18 |
| ThO_2 | 0.22 | 0.05 | 0.35 | 0.21 | 0.07 | 0.09 | 0.45 | 0.39 | 0.97 | 0.05 | 0.21 | 0.30 | 0.08 |
| TiO ₂ | 51.95 | 50.94 | 52.48 | 53.17 | 53.76 | 53.86 | 52.98 | 53.14 | 52.12 | 53.36 | 52.26 | 52.13 | 53.20 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 6.11 | 4.85 | 3.29 | 2.85 | 2.16 | 2.11 | 3.46 | 3.38 | 4.86 | 3.63 | 4.46 | 4.18 | 3.50 |
| Nd_2O_3 | 1.97 | 1.49 | 1.41 | 1.22 | 0.87 | 0.83 | 1.52 | 1.50 | 2.22 | 1.48 | 1.90 | 1.82 | 1.49 |
| Na ₂ O | 1.72 | 1.34 | 0.48 | 0.40 | 0.27 | 0.28 | 0.52 | 0.52 | 1.08 | 0.81 | 0.83 | 0.76 | 0.80 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.82 | 98.09 | 98.75 | 99.06 | 99.32 | 99.49 | 99.47 | 99.69 | 99.87 | 99.61 | 99.93 | 99.48 | 99.40 |
| Si | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.029 | 0.036 | 0.037 | 0.035 | 0.036 | 0.037 | 0.035 | 0.035 | 0.027 | 0.024 | 0.033 | 0.033 | 0.027 |
| La | 0.026 | 0.023 | 0.011 | 0.009 | 0.008 | 0.008 | 0.011 | 0.011 | 0.013 | 0.012 | 0.014 | 0.013 | 0.011 |
| Sm | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pr | 0.005 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.005 | 0.003 | 0.005 | 0.004 | 0.003 |
| Ca | 0.812 | 0.854 | 0.927 | 0.941 | 0.956 | 0.956 | 0.918 | 0.922 | 0.860 | 0.904 | 0.880 | 0.891 | 0.903 |
| Nb | 0.012 | 0.014 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.004 | 0.013 | 0.011 | 0.014 | 0.012 | 0.012 |
| Sr | 0.004 | 0.004 | 0.006 | 0.006 | 0.007 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| Zr | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 |
| Th | 0.001 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.005 | 0.000 | 0.001 | 0.002 | 0.000 |
| Ti | 0.953 | 0.942 | 0.949 | 0.952 | 0.953 | 0.953 | 0.952 | 0.952 | 0.949 | 0.956 | 0.944 | 0.944 | 0.955 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.055 | 0.044 | 0.029 | 0.025 | 0.019 | 0.018 | 0.030 | 0.029 | 0.043 | 0.032 | 0.039 | 0.037 | 0.031 |
| Nd | 0.017 | 0.013 | 0.012 | 0.010 | 0.007 | 0.007 | 0.013 | 0.013 | 0.019 | 0.013 | 0.016 | 0.016 | 0.013 |
| Na | 0.081 | 0.064 | 0.022 | 0.019 | 0.013 | 0.013 | 0.024 | 0.024 | 0.051 | 0.037 | 0.039 | 0.036 | 0.037 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 1.999 | 2.004 | 2.005 | 2.008 | 2.008 | 2.008 | 2.002 | 2.004 | 1.994 | 2.001 | 1.995 | 1.998 | 2.000 |
| lueshite | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | -0.01 | 0.00 | -0.01 | 0.01 | -0.01 | 0.01 | -0.01 | 0.01 |
| loparite | 0.14 | 0.10 | 0.04 | 0.03 | 0.02 | 0.02 | 0.04 | 0.04 | 0.08 | 0.05 | 0.05 | 0.05 | 0.05 |
| <i>REEFeO</i> ₃ | 0.03 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 |
| tausonite | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.81 | 0.84 | 0.91 | 0.93 | 0.94 | 0.94 | 0.91 | 0.91 | 0.87 | 0.90 | 0.88 | 0.89 | 0.90 |
| Fe/Nb | 2.35 | 2.57 | 7.83 | 9.30 | 8.07 | 7.74 | 7.17 | 7.69 | 2.01 | 2.09 | 2.37 | 2.63 | 2.22 |
| <i>∆NNO</i> | -1.76 | -0.17 | 1.26 | 0.85 | 1.03 | 1.19 | 0.57 | 0.59 | -2.50 | -2.95 | -1.01 | -0.86 | -2.32 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

| <i>C</i> - | core; R · | - rim; I - | interme | diate. | | | | | | | | | |
|--------------------------------|-----------|------------|---------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Sample | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM-2 | LM3-1 | LM3-1 | LM3-1 | LM3-1 |
| Grain/ | 06/12 | 07/13 | 07/14 | 08/15 | 08/16 | 09/17 | 09/18 | 10/19 | 10/20 | 11/21 | 11/22 | 12/23 | 12/24 |
| Location | R | С | R | С | R | С | R | С | R | С | R | С | R |
| SiO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe ₂ O ₂ | 1.76 | 1.28 | 1 38 | 1.58 | 1 48 | 1.96 | 1.96 | 1.92 | 1.91 | 1 24 | 1 24 | 1.98 | 2.01 |
| La_2O_3 | 1.70 | 1.20 | 0.94 | 1.56 | 1.10 | 1.50 | 1.50 | 1.52 | 1.09 | 1.21 | 1.21 | 1.50 | 1.07 |
| Sm ₂ O ₂ | 0.21 | 0.21 | 0.12 | 0.21 | 0.17 | 0.14 | 0.14 | 0.15 | 0.14 | 0.24 | 0.20 | 0.17 | 0.14 |
| Pr ₂ O ₂ | 0.21 | 0.21 | 0.12 | 0.21 | 0.17 | 0.14 | 0.14 | 0.15 | 0.14 | 0.24 | 0.20 | 0.17 | 0.14 |
| | 32 72 | 35 13 | 36.99 | 33.86 | 35 52 | 36 71 | 36.55 | 36.50 | 36.86 | 32.98 | 34 55 | 36.15 | 36.48 |
| Nh ₂ O ₄ | 1 32 | 0.67 | 0.56 | 1.56 | 1.03 | 0.43 | 0.42 | 0.42 | 0.42 | 1 29 | 0.97 | 0.41 | 0.42 |
| SrO | 0.35 | 0.34 | 0.35 | 0.39 | 0.30 | 0.42 | 0.12 | 0.12 | 0.42 | 0.37 | 0.38 | 0.43 | 0.12 |
| ZrO. | 1 29 | 0.31 | 0.55 | 0.59 | 0.20 | 0.02 | 0.17 | 0.12 | 0.12 | 0.13 | 0.11 | 0.10 | 0.08 |
| | 0.33 | 0.15 | 0.10 | 0.10 | 0.20 | 0.00 | 0.10 | 0.10 | 0.10 | 0.13 | 0.53 | 0.10 | 0.00 |
| TiO ₂ | 51.27 | 52.96 | 54 10 | 51 78 | 53 13 | 53.00 | 53.01 | 53.07 | 53 11 | 51 64 | 52 43 | 52 78 | 53.06 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CeoO | 4.12 | 3.82 | 2 41 | 0.00 4 44 | 3 21 | 2.90 | 3.08 | 2.91 | 2.83 | 4.93 | 3.96 | 3 23 | 2.84 |
| Nd ₂ O ₃ | 1.12 | 1 79 | 1.00 | 1.81 | 1.27 | 1.25 | 1 30 | 1.23 | 1.21 | 2.23 | 1 78 | 1 42 | 1 21 |
| Na ₂ O | 1.01 | 0.74 | 0.52 | 0.99 | 0.78 | 0.41 | 0.46 | 0.42 | 0.44 | 1.07 | 0.87 | 0.49 | 0.42 |
| MgO | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al ₂ O ₂ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta ₂ O ₅ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.04 | 99.18 | 98.82 | 98.97 | 98.74 | 99.02 | 99.30 | 98.82 | 99.03 | 99.10 | 98.80 | 99.09 | 98.72 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.032 | 0.023 | 0.025 | 0.029 | 0.027 | 0.035 | 0.035 | 0.035 | 0.034 | 0.000 | 0.023 | 0.036 | 0.036 |
| La | 0.032 | 0.011 | 0.008 | 0.015 | 0.011 | 0.010 | 0.010 | 0.010 | 0.010 | 0.023 | 0.012 | 0.010 | 0.009 |
| Sm | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 |
| Pr | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.005 | 0.002 | 0.003 | 0.003 |
| Са | 0.858 | 0.001 | 0.939 | 0.879 | 0.000 | 0.938 | 0.003 | 0.003 | 0.002 | 0.863 | 0.895 | 0.005 | 0.005 |
| Nb | 0.015 | 0.007 | 0.006 | 0.017 | 0.011 | 0.005 | 0.005 | 0.005 | 0.004 | 0.014 | 0.011 | 0.004 | 0.004 |
| Sr | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.006 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 | 0.006 | 0.006 |
| Zr | 0.015 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 |
| Th | 0.002 | 0.003 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 | 0.001 | 0.005 | 0.003 | 0.002 | 0.001 |
| Ti | 0.944 | 0.957 | 0.964 | 0.944 | 0.956 | 0.951 | 0.951 | 0.954 | 0.952 | 0.949 | 0.954 | 0.951 | 0.954 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.037 | 0.034 | 0.021 | 0.039 | 0.028 | 0.025 | 0.027 | 0.025 | 0.025 | 0.044 | 0.035 | 0.028 | 0.025 |
| Nd | 0.015 | 0.015 | 0.008 | 0.016 | 0.011 | 0.011 | 0.011 | 0.010 | 0.010 | 0.019 | 0.015 | 0.012 | 0.010 |
| Na | 0.048 | 0.035 | 0.024 | 0.047 | 0.036 | 0.019 | 0.021 | 0.019 | 0.020 | 0.051 | 0.041 | 0.023 | 0.020 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 1.989 | 2.001 | 2.004 | 1.999 | 2.002 | 2.007 | 2.007 | 2.004 | 2.008 | 1.995 | 2.001 | 2.006 | 2.005 |
| lueshite | -0.02 | 0.01 | -0.02 | 0.02 | -0.02 | 0.00 | -0.03 | 0.00 | -0.03 | 0.01 | -0.03 | 0.00 | -0.04 |
| loparite | 0.07 | 0.06 | 0.04 | 0.06 | 0.05 | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 | 0.06 | 0.04 | 0.03 |
| REEFeO₃ | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 | 0.03 | 0.02 | 0.02 | 0.04 | 0.03 |
| tausonite | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| REE,Ti,O7 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 |
| lakargiite | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.86 | 0.90 | 0.93 | 0.88 | 0.90 | 0.92 | 0.92 | 0.92 | 0.92 | 0.87 | 0.89 | 0.91 | 0.92 |
| Fe/Nb | 2.23 | 3.14 | 4.08 | 1.69 | 2.40 | 7.63 | 7.73 | 7.54 | 7.65 | 1.60 | 2.15 | 8.08 | 8.06 |
| ANNO | -1.22 | -2.65 | -2.10 | -2.43 | -2.23 | 0.72 | 0.72 | 0.56 | 0.50 | -3.58 | -3.15 | 0.87 | 0.97 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

| <u> </u> | <i>core; R</i> - <i>i</i> | rim; I - ini | termediate | 2. | * > /2 / | | * > /2 / | * * * * * | * > /2 0 | * > /2 0 | * > /2 0 | |
|--------------------------------|---------------------------|--------------|------------|-------|----------|-------|----------|-----------|----------|----------|----------|-------|
| Sample | LM3-1 | LM3-1 | LM3-1 | LM3-1 | LM3-1 | LM3-1 | LM3-1 | LM3-2 | LM3-2 | LM3-2 | LM3-2 | LM3-2 |
| Grain/ | 13/26 | 14/27 | 15/28 | 16/29 | 16/30 | 17/31 | 17/32 | 18/33 | 18/34 | 18/35 | 19/36 | 19/37 |
| Location | R | R | C | C | R | C | R | C | I | R | C | I |
| SiO | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe ₂ O ₂ | 1 47 | 1 53 | 1 40 | 1 48 | 1.50 | 2.37 | 2.27 | 1 44 | 1 51 | 1 73 | 1 41 | 1 32 |
| La_2O_2 | 1.17 | 1.33 | 1.10 | 1.10 | 1.20 | 1.04 | 1.04 | 1 30 | 1.37 | 0.95 | 1.11 | 1.02 |
| Sm_2O_2 | 0.17 | 0.12 | 0.17 | 0.22 | 0.21 | 0.13 | 0.12 | 0.20 | 0.22 | 0.14 | 0.20 | 0.16 |
| Pr_2O_2 | 0.38 | 0.21 | 0.39 | 0.49 | 0.21 | 0.13 | 0.32 | 0.46 | 0.51 | 0.25 | 0.46 | 0.33 |
| CaO | 35.66 | 36 71 | 35.89 | 34 32 | 34.09 | 36 58 | 36.63 | 34 79 | 34.06 | 37.18 | 34 47 | 36.25 |
| Nh ₂ O ₆ | 0.73 | 1 22 | 1.08 | 0.75 | 0.92 | 0.33 | 0.42 | 0.88 | 0.91 | 0.65 | 0.92 | 0.64 |
| SrO | 0.75 | 0.37 | 0.34 | 0.36 | 0.35 | 0.35 | 0.47 | 0.36 | 0.36 | 0.37 | 0.33 | 0.34 |
| ZrO ₂ | 0.19 | 0.28 | 0.14 | 0.18 | 0.55 | 0.08 | 0.11 | 0.17 | 0.18 | 0.21 | 0.14 | 0.12 |
| ThO_2 | 0.17 | 0.00 | 0.11 | 0.77 | 0.79 | 0.00 | 0.20 | 0.32 | 0.72 | 0.03 | 0.75 | 0.12 |
| TiO | 52.85 | 53 73 | 53 48 | 52.40 | 52.37 | 52.87 | 52.89 | 53 10 | 52.82 | 54 04 | 52.64 | 54 07 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce ₂ O ₂ | 3 22 | 2.19 | 3 33 | 4 17 | 3 99 | 2.91 | 2.67 | 3 95 | 4 36 | 2.33 | 3.89 | 3.00 |
| Nd_2O_2 | 1 43 | 0.78 | 1 45 | 1 91 | 1.88 | 1.23 | 1.08 | 1 78 | 2.01 | 0.96 | 1 79 | 1 35 |
| Na ₂ O | 0.72 | 0.61 | 0.65 | 0.85 | 0.79 | 0.36 | 0.34 | 0.87 | 0.96 | 0.54 | 0.87 | 0.68 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta ₂ O ₅ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.50 | 98.84 | 99.85 | 99.25 | 98.81 | 98.96 | 98.57 | 99.62 | 99.99 | 99.39 | 99.10 | 99.46 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.027 | 0.027 | 0.025 | 0.027 | 0.027 | 0.043 | 0.041 | 0.026 | 0.027 | 0.031 | 0.026 | 0.024 |
| La | 0.010 | 0.010 | 0.011 | 0.012 | 0.011 | 0.009 | 0.009 | 0.011 | 0.012 | 0.008 | 0.011 | 0.009 |
| Sm | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 |
| Pr | 0.003 | 0.002 | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 | 0.005 | 0.002 | 0.004 | 0.003 |
| Ca | 0.918 | 0.931 | 0.913 | 0.889 | 0.885 | 0.935 | 0.938 | 0.892 | 0.876 | 0.939 | 0.891 | 0.920 |
| Nb | 0.008 | 0.013 | 0.012 | 0.008 | 0.010 | 0.004 | 0.005 | 0.010 | 0.010 | 0.007 | 0.010 | 0.007 |
| Sr | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.007 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| Zr | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 |
| Th | 0.001 | 0.000 | 0.002 | 0.004 | 0.004 | 0.002 | 0.001 | 0.002 | 0.004 | 0.000 | 0.004 | 0.001 |
| Ti | 0.955 | 0.957 | 0.955 | 0.953 | 0.955 | 0.949 | 0.951 | 0.956 | 0.954 | 0.958 | 0.955 | 0.963 |
| Ва | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.028 | 0.019 | 0.029 | 0.037 | 0.035 | 0.025 | 0.023 | 0.035 | 0.038 | 0.020 | 0.034 | 0.026 |
| Nd | 0.012 | 0.007 | 0.012 | 0.016 | 0.016 | 0.010 | 0.009 | 0.015 | 0.017 | 0.008 | 0.015 | 0.011 |
| Na | 0.034 | 0.028 | 0.030 | 0.040 | 0.037 | 0.017 | 0.016 | 0.040 | 0.045 | 0.025 | 0.041 | 0.031 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.005 | 2.002 | 1.998 | 1.999 | 1.994 | 2.005 | 2.005 | 2.000 | 1.997 | 2.006 | 1.999 | 2.003 |
| lueshite | -0.04 | -0.04 | 0.01 | 0.01 | -0.05 | 0.00 | -0.05 | 0.01 | 0.01 | -0.05 | 0.01 | 0.01 |
| loparite | 0.05 | 0.03 | 0.04 | 0.06 | 0.05 | 0.03 | 0.02 | 0.06 | 0.07 | 0.04 | 0.06 | 0.05 |
| <i>REEFeO</i> ₃ | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.02 |
| tausonite | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.90 | 0.93 | 0.91 | 0.89 | 0.89 | 0.93 | 0.93 | 0.89 | 0.88 | 0.93 | 0.89 | 0.91 |
| Fe/Nb | 3.37 | 2.08 | 2.15 | 3.30 | 2.70 | 11.80 | 9.07 | 2.72 | 2.77 | 4.40 | 2.55 | 3.45 |
| ANNO | -1.84 | -2.32 | -2.72 | -1.79 | -1.93 | 2.69 | 2.14 | -2.21 | -1.91 | -0.70 | -2.36 | -2.45 |

Supplementary Material B

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: L - intermediate

| <u> </u> | $\frac{core}{1 M_2 2}$ | $\frac{r_{lm}; 1 - ln_l}{1 M_2 2}$ | I M3 2 | <u>.</u> 1 M3 2 | I M3 2 | I M3 2 | I M3 2 | I MIC1 |
|---------------------|------------------------|------------------------------------|---------|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| Grain/ | LIV13-2 | L1v13-2 | LIV13-2 | LIVIJ-2 | LIV13-2 | LIVI3-2 | LIVI3-2 | LIVITCI | LIVITCI | LIVILUI | LIVITCI | LIVITCI |
| Analysis | 19/38 | 19/39 | 19/40 | 20/41 | 20/42 | 21/45 | 21/46 | 29/58 | 30/60 | 30/61 | 31/62 | 31/63 |
| Location | Ι | Ι | R | С | R | С | R | С | С | R | R | С |
| SiO ₂ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.32 | 1.39 | 1.55 | 2.41 | 1.39 | 1.54 | 1.89 | 1.39 | 2.04 | 1.22 | 1.36 | 1.31 |
| La_2O_3 | 1.11 | 1.17 | 0.92 | 1.31 | 1.26 | 1.25 | 0.94 | 1.69 | 1.52 | 1.00 | 1.27 | 1.40 |
| Sm_2O_3 | 0.19 | 0.18 | 0.13 | 0.18 | 0.18 | 0.18 | 0.11 | 0.22 | 0.23 | 0.12 | 0.21 | 0.24 |
| Pr_2O_3 | 0.38 | 0.38 | 0.25 | 0.39 | 0.41 | 0.37 | 0.21 | 0.59 | 0.51 | 0.25 | 0.50 | 0.53 |
| CaO | 36.02 | 36.00 | 37.42 | 34.93 | 35.52 | 35.78 | 37.18 | 33.53 | 34.17 | 37.16 | 34.90 | 33.92 |
| Nb_2O_5 | 0.62 | 0.63 | 0.60 | 1.02 | 1.10 | 1.11 | 0.71 | 1.11 | 1.50 | 0.63 | 0.63 | 0.72 |
| SrO | 0.35 | 0.32 | 0.35 | 0.35 | 0.36 | 0.36 | 0.38 | 0.14 | 0.12 | 0.13 | 0.12 | 0.13 |
| ZrO_2 | 0.11 | 0.12 | 0.19 | 0.14 | 0.16 | 0.26 | 0.24 | 0.14 | 0.34 | 0.16 | 0.15 | 0.14 |
| ThO ₂ | 0.23 | 0.28 | 0.02 | 0.05 | 0.17 | 0.08 | 0.01 | 0.28 | 0.42 | 0.09 | 0.57 | 1.09 |
| TiO ₂ | 53.87 | 53.87 | 55.10 | 53.22 | 54.02 | 53.36 | 54.66 | 52.57 | 51.79 | 54.51 | 53.90 | 52.71 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 3.26 | 3.38 | 2.27 | 3.51 | 3.63 | 3.39 | 2.11 | 4.99 | 4.43 | 2.25 | 4.10 | 4.45 |
| Nd_2O_3 | 1.50 | 1.54 | 0.92 | 1.53 | 1.58 | 1.45 | 0.81 | 2.17 | 1.88 | 0.83 | 1.90 | 2.09 |
| Na_2O | 0.68 | 0.75 | 0.50 | 0.89 | 0.88 | 0.78 | 0.56 | 0.99 | 0.83 | 0.58 | 0.81 | 0.92 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.65 | 100.00 | 100.22 | 99.92 | 100.68 | 99.92 | 99.79 | 99.81 | 99.78 | 98.94 | 100.41 | 99.65 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.024 | 0.025 | 0.027 | 0.043 | 0.025 | 0.027 | 0.033 | 0.025 | 0.037 | 0.022 | 0.024 | 0.024 |
| La | 0.010 | 0.010 | 0.008 | 0.011 | 0.011 | 0.011 | 0.008 | 0.015 | 0.013 | 0.009 | 0.011 | 0.012 |
| Sm | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 |
| Pr | 0.003 | 0.003 | 0.002 | 0.003 | 0.004 | 0.003 | 0.002 | 0.005 | 0.005 | 0.002 | 0.004 | 0.005 |
| Ca | 0.916 | 0.913 | 0.934 | 0.888 | 0.897 | 0.909 | 0.932 | 0.866 | 0.881 | 0.939 | 0.888 | 0.877 |
| Nb | 0.007 | 0.007 | 0.006 | 0.011 | 0.012 | 0.012 | 0.007 | 0.012 | 0.016 | 0.007 | 0.007 | 0.008 |
| Sr | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Zr | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.004 | 0.002 | 0.002 | 0.002 |
| Th | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.003 | 0.006 |
| Ti | 0.962 | 0.960 | 0.966 | 0.950 | 0.958 | 0.952 | 0.962 | 0.954 | 0.938 | 0.967 | 0.963 | 0.957 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.028 | 0.029 | 0.019 | 0.031 | 0.031 | 0.029 | 0.018 | 0.044 | 0.039 | 0.019 | 0.036 | 0.039 |
| Nd | 0.013 | 0.013 | 0.008 | 0.013 | 0.013 | 0.012 | 0.007 | 0.019 | 0.016 | 0.007 | 0.016 | 0.018 |
| Na | 0.031 | 0.034 | 0.023 | 0.041 | 0.040 | 0.036 | 0.025 | 0.046 | 0.039 | 0.027 | 0.037 | 0.043 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.002 | 2.004 | 2.001 | 2.000 | 2.000 | 2.002 | 2.003 | 1.993 | 1.995 | 2.004 | 1.994 | 1.995 |
| lueshite | 0.00 | 0.00 | -0.05 | 0.01 | -0.06 | 0.01 | -0.06 | 0.01 | 0.02 | -0.06 | -0.07 | 0.01 |
| loparite | 0.05 | 0.06 | 0.03 | 0.06 | 0.06 | 0.05 | 0.04 | 0.07 | 0.05 | 0.04 | 0.06 | 0.07 |
| REEFeO ₃ | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.03 | 0.02 | 0.03 | 0.04 | 0.02 | 0.02 | 0.02 |
| tausonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.91 | 0.90 | 0.93 | 0.89 | 0.90 | 0.90 | 0.93 | 0.88 | 0.89 | 0.93 | 0.90 | 0.88 |
| Fe/Nb | 3.54 | 3.69 | 4.31 | 3.94 | 2.10 | 2.31 | 4.46 | 2.09 | 2.26 | 3.23 | 3.59 | 3.02 |
| ANNO | -2.43 | -2.16 | -1.49 | 1.90 | -2.79 | -2.12 | -0.12 | -2.69 | -0.30 | -2.91 | -2.27 | -2.53 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: I - intermediate.

| Sample | LMIC2 |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Grain/ | 11/00 | 11/00 | 12/80 | 12/00 | 42/01 | 44/02 | 44/04 | 45/05 | 15/06 | 45/07 | 15/08 |
| Analysis | 41/00 | 41/00 | 42/09 | 42/90 | 42/91 | 44/93 | 44/94 | 43/93 | 43/90 | 43/97 | 43/90 |
| Location | С | R | С | R | R | С | R | С | R | С | R |
| SiO_2 | 0.00 | 0.01 | 0.01 | 0.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Fe_2O_3 | 1.36 | 1.71 | 1.48 | 1.57 | 1.63 | 1.43 | 1.38 | 1.55 | 1.56 | 1.32 | 1.53 |
| La_2O_3 | 1.16 | 0.91 | 0.87 | 0.90 | 0.90 | 1.46 | 1.22 | 1.78 | 1.71 | 1.54 | 1.67 |
| Sm_2O_3 | 0.17 | 0.10 | 0.11 | 0.12 | 0.10 | 0.23 | 0.20 | 0.25 | 0.22 | 0.22 | 0.20 |
| Pr_2O_3 | 0.37 | 0.19 | 0.24 | 0.23 | 0.21 | 0.56 | 0.45 | 0.64 | 0.50 | 0.54 | 0.48 |
| CaO | 36.18 | 38.10 | 37.71 | 36.68 | 38.29 | 34.02 | 35.11 | 33.01 | 33.85 | 34.08 | 34.41 |
| Nb_2O_5 | 0.52 | 0.60 | 0.43 | 0.48 | 0.51 | 0.64 | 0.56 | 1.40 | 1.13 | 1.09 | 1.09 |
| SrO | 0.15 | 0.13 | 0.15 | 0.10 | 0.13 | 0.15 | 0.13 | 0.16 | 0.14 | 0.13 | 0.16 |
| ZrO_2 | 0.11 | 0.32 | 0.14 | 0.15 | 0.19 | 0.12 | 0.11 | 0.14 | 0.17 | 0.11 | 0.16 |
| ThO_2 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 1.13 | 0.43 | 0.37 | 0.03 | 0.36 | 0.01 |
| TiO ₂ | 54.14 | 54.47 | 54.61 | 53.89 | 55.43 | 53.04 | 53.43 | 52.12 | 52.05 | 53.02 | 52.61 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 3.29 | 1.95 | 2.00 | 2.16 | 1.98 | 4.64 | 3.82 | 5.30 | 4.58 | 4.53 | 4.43 |
| Nd_2O_3 | 1.45 | 0.75 | 0.81 | 0.85 | 0.74 | 2.12 | 1.72 | 2.27 | 1.82 | 1.91 | 1.79 |
| Na ₂ O | 0.67 | 0.40 | 0.39 | 0.44 | 0.40 | 0.98 | 0.81 | 1.08 | 1.01 | 1.06 | 0.99 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.73 | 99.63 | 98.96 | 98.13 | 100.51 | 100.54 | 99.38 | 100.08 | 98. 77 | 99.91 | 99.52 |
| Si | 0.000 | 0.000 | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.024 | 0.030 | 0.026 | 0.028 | 0.028 | 0.026 | 0.025 | 0.028 | 0.028 | 0.024 | 0.028 |
| La | 0.010 | 0.008 | 0.008 | 0.008 | 0.008 | 0.013 | 0.011 | 0.016 | 0.015 | 0.014 | 0.015 |
| Sm | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pr | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.004 | 0.006 | 0.004 | 0.005 | 0.004 |
| Ca | 0.917 | 0.954 | 0.950 | 0.930 | 0.949 | 0.874 | 0.900 | 0.855 | 0.880 | 0.875 | 0.886 |
| Nb | 0.006 | 0.006 | 0.005 | 0.005 | 0.005 | 0.007 | 0.006 | 0.015 | 0.012 | 0.012 | 0.012 |
| Sr | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Zr | 0.001 | 0.004 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 |
| Th | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.002 | 0.002 | 0.000 | 0.002 | 0.000 |
| Ti | 0.964 | 0.958 | 0.966 | 0.959 | 0.965 | 0.956 | 0.962 | 0.947 | 0.950 | 0.956 | 0.951 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.029 | 0.017 | 0.017 | 0.019 | 0.017 | 0.041 | 0.033 | 0.047 | 0.041 | 0.040 | 0.039 |
| Nd | 0.012 | 0.006 | 0.007 | 0.007 | 0.006 | 0.018 | 0.015 | 0.020 | 0.016 | 0.016 | 0.015 |
| Na | 0.031 | 0.018 | 0.018 | 0.020 | 0.018 | 0.045 | 0.038 | 0.051 | 0.047 | 0.049 | 0.046 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.001 | 2.006 | 2.004 | 1.996 | 2.003 | 1.996 | 2.000 | 1.992 | 2.000 | 1.998 | 2.001 |
| lueshite | 0.01 | -0.07 | 0.00 | -0.07 | -0.08 | 0.01 | -0.08 | 0.02 | -0.08 | 0.01 | -0.09 |
| loparite | 0.05 | 0.02 | 0.03 | 0.03 | 0.03 | 0.08 | 0.06 | 0.07 | 0.07 | 0.08 | 0.07 |
| REEFeO₃ | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 |
| tausonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.91 | 0.94 | 0.94 | 0.94 | 0.94 | 0.88 | 0.90 | 0.87 | 0.88 | 0.88 | 0.88 |
| Fe/Nb ANNO | 4.30 -2.17 | 4.72 -0.78 | 5.69 -1.53 | 5.44 -1.15 | 5.35 -1.07 | 3.71 -1.92 | 4.11 -2.05 | 1.84 -2.37 | 2.30 -1.93 | 2.02 -3.03 | 2.34 -2.06 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: I - intermediate.

| Sample | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 |
|--------------------------------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Grain/ | 46/100 | 16/00 | 47/101 | 47/102 | /8/103 | 48/104 | /0/105 | /0/106 | 50/107 | 50/108 | 51/109 |
| Analysis | 40/100 | 40/99 | 4//101 | 4//102 | 40/105 | +0/10+ | 47/105 | 49/100 | 50/107 | 50/100 | 51/107 |
| Location | R | С | С | R | С | R | С | R | С | R | С |
| S1O ₂ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.09 | 0.04 | 0.00 |
| Fe_2O_3 | 1.41 | 1.31 | 1.62 | 1.95 | 1.50 | 1.50 | 1.59 | 1.77 | 1.69 | 1.75 | 1.34 |
| La_2O_3 | 0.98 | 1.27 | 1.30 | 1.15 | 1.37 | 1.10 | 1.21 | 0.85 | 1.26 | 0.98 | 1.22 |
| Sm_2O_3 | 0.15 | 0.21 | 0.18 | 0.15 | 0.22 | 0.17 | 0.20 | 0.09 | 0.21 | 0.12 | 0.19 |
| Pr_2O_3 | 0.31 | 0.48 | 0.43 | 0.30 | 0.49 | 0.37 | 0.46 | 0.18 | 0.49 | 0.27 | 0.45 |
| CaO | 37.06 | 34.54 | 35.37 | 36.39 | 34.94 | 36.73 | 35.07 | 38.22 | 34.38 | 37.20 | 35.65 |
| Nb ₂ O ₅ | 0.43 | 0.53 | 0.85 | 0.83 | 0.65 | 0.56 | 0.86 | 0.51 | 0.65 | 0.54 | 0.55 |
| SrO | 0.14 | 0.13 | 0.14 | 0.12 | 0.13 | 0.13 | 0.13 | 0.13 | 0.18 | 0.14 | 0.12 |
| ZrO_2 | 0.12 | 0.09 | 0.17 | 0.34 | 0.15 | 0.16 | 0.19 | 0.31 | 0.27 | 0.26 | 0.14 |
| ThO ₂ | 0.07 | 0.66 | 0.04 | 0.10 | 0.49 | 0.06 | 0.53 | 0.01 | 0.90 | 0.07 | 0.19 |
| T_1O_2 | 54.98 | 53.52 | 53.08 | 52.98 | 53.40 | 54.61 | 52.76 | 54.40 | 52.37 | 54.02 | 53.92 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 2.69 | 3.97 | 3.54 | 2.79 | 4.21 | 3.09 | 3.67 | 1.68 | 4.19 | 2.40 | 3.54 |
| Nd_2O_3 | 1.15 | 1.85 | 1.48 | 1.06 | 1.85 | 1.31 | 1.68 | 0.63 | 1.88 | 1.00 | 1.59 |
| Na_2O | 0.57 | 0.82 | 0.68 | 0.53 | 0.83 | 0.64 | 0.77 | 0.35 | 0.90 | 0.57 | 0.73 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta ₂ O ₅ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.06 | 99.37 | 98.89 | 98.69 | 100.23 | 100.42 | 99.13 | 99.18 | 99.47 | 99.36 | 99.63 |
| Si | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 |
| Fe | 0.025 | 0.024 | 0.029 | 0.035 | 0.027 | 0.026 | 0.029 | 0.031 | 0.031 | 0.031 | 0.024 |
| La | 0.008 | 0.011 | 0.011 | 0.010 | 0.012 | 0.009 | 0.011 | 0.007 | 0.011 | 0.009 | 0.011 |
| Sm | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 |
| Pr | 0.003 | 0.004 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.002 | 0.004 | 0.002 | 0.004 |
| Ca | 0.929 | 0.887 | 0.908 | 0.930 | 0.892 | 0.922 | 0.902 | 0.959 | 0.888 | 0.939 | 0.907 |
| Nb | 0.005 | 0.006 | 0.009 | 0.009 | 0.007 | 0.006 | 0.009 | 0.005 | 0.007 | 0.006 | 0.006 |
| Sr | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| Zr | 0.001 | 0.001 | 0.002 | 0.004 | 0.002 | 0.002 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 |
| Th | 0.000 | 0.004 | 0.000 | 0.001 | 0.003 | 0.000 | 0.003 | 0.000 | 0.005 | 0.000 | 0.001 |
| Ti | 0.968 | 0.965 | 0.956 | 0.951 | 0.957 | 0.963 | 0.953 | 0.959 | 0.949 | 0.957 | 0.964 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.023 | 0.035 | 0.031 | 0.024 | 0.037 | 0.027 | 0.032 | 0.014 | 0.037 | 0.021 | 0.031 |
| Nd | 0.010 | 0.016 | 0.013 | 0.009 | 0.016 | 0.011 | 0.014 | 0.005 | 0.016 | 0.008 | 0.013 |
| Na | 0.026 | 0.038 | 0.032 | 0.024 | 0.038 | 0.029 | 0.036 | 0.016 | 0.042 | 0.026 | 0.034 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Та | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cations | 2.001 | 1.995 | 1.999 | 2.002 | 1.998 | 2.002 | 2.000 | 2.006 | 2.000 | 2.007 | 1.999 |
| lueshite | -0.09 | 0.01 | 0.01 | -0.09 | 0.01 | -0.09 | 0.01 | -0.10 | 0.01 | -0.10 | 0.01 |
| loparite | 0.04 | 0.07 | 0.05 | 0.03 | 0.06 | 0.05 | 0.05 | 0.02 | 0.07 | 0.04 | 0.06 |
| REEFeO₃ | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.02 | 0.02 |
| tausonite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $REE_2Ti_2O_7$ | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| lakargiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskite | 0.93 | 0.90 | 0.91 | 0.92 | 0.89 | 0.92 | 0.90 | 0.95 | 0.88 | 0.93 | 0.91 |
| Fe/Nb | 5.46 | 4.16 | 3.18 | 3.89 | 3.82 | 4.49 | 3.09 | 5.73 | 4.30 | 5.42 | 4.08 |
| ∆NNO | -1.88 | -2.28 | -1.35 | 0.13 | -1.66 | -1.62 | -1.48 | -0.38 | -0.73 | -0.46 | -2.25 |

 Table B4. Major element compositions of perovskite from TR-IV LM-I. Structural formula calculated on the basis of 4 oxigens.

 C - core: R - rim: I - intermediate

| Sample | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 | LMIC2 |
|---------------------|----------------|---------------|---------------|---------------|---------------|----------------|----------------|---------------|---------------|---------------|
| Grain/ | 51/110 | 52/111 | 52/112 | 52/112 | 52/11/ | 54/116 | 54/117 | 54/110 | 55/120 | 57/100 |
| Analysis | 51/110 | 32/111 | 32/112 | 33/113 | 33/114 | 54/110 | 34/11/ | 34/119 | 55/120 | 57/122 |
| Location | R | С | R | С | R | R | С | С | С | С |
| SiO_2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 |
| Fe_2O_3 | 1.34 | 1.38 | 1.34 | 1.54 | 1.60 | 1.44 | 1.46 | 1.62 | 1.57 | 1.56 |
| La_2O_3 | 1.16 | 1.19 | 1.03 | 1.18 | 1.21 | 1.33 | 1.49 | 1.49 | 1.28 | 1.34 |
| Sm_2O_3 | 0.17 | 0.20 | 0.16 | 0.19 | 0.18 | 0.19 | 0.23 | 0.24 | 0.19 | 0.23 |
| Pr_2O_3 | 0.39 | 0.42 | 0.34 | 0.39 | 0.39 | 0.44 | 0.48 | 0.57 | 0.40 | 0.51 |
| CaO | 36.28 | 35.77 | 36.55 | 35.63 | 35.56 | 35.52 | 34.53 | 33.63 | 35.62 | 33.81 |
| Nb_2O_5 | 0.54 | 0.55 | 0.47 | 0.87 | 0.87 | 0.87 | 1.15 | 1.01 | 0.58 | 0.61 |
| SrO | 0.11 | 0.16 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 | 0.14 | 0.14 | 0.15 |
| ZrO ₂ | 0.13 | 0.12 | 0.13 | 0.17 | 0.18 | 0.15 | 0.17 | 0.11 | 0.12 | 0.12 |
| ThO ₂ | 0.09 | 0.33 | 0.08 | 0.02 | 0.01 | 0.36 | 0.13 | 0.83 | 0.14 | 0.96 |
| TiO ₂ | 54.51 | 53.62 | 54.78 | 53.36 | 53.18 | 54.29 | 53.42 | 52.03 | 53.54 | 52.57 |
| BaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ce_2O_3 | 3.19 | 3.57 | 2.86 | 3.47 | 3.49 | 3.75 | 4.32 | 4.58 | 3.40 | 4.32 |
| Nd_2O_3 | 1.42 | 1.62 | 1.29 | 1.49 | 1.44 | 1.66 | 1.83 | 2.11 | 1.46 | 2.01 |
| Na ₂ O | 0.65 | 0.74 | 0.61 | 0.71 | 0.72 | 0.78 | 0.84 | 0.93 | 0.64 | 0.89 |
| MgO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Al_2O_3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ta_2O_5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.99 | 99.68 | 99. 77 | 99.15 | 98.98 | 100.92 | 100.20 | 99.31 | 99.08 | 99.14 |
| S1 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Fe | 0.024 | 0.025 | 0.024 | 0.028 | 0.029 | 0.025 | 0.026 | 0.030 | 0.028 | 0.028 |
| La | 0.010 | 0.010 | 0.009 | 0.010 | 0.011 | 0.012 | 0.013 | 0.013 | 0.011 | 0.012 |
| Sm | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pr | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.003 | 0.004 |
| Ca | 0.916 | 0.912 | 0.921 | 0.911 | 0.911 | 0.895 | 0.881 | 0.874 | 0.911 | 0.877 |
| Nb | 0.006 | 0.006 | 0.005 | 0.009 | 0.009 | 0.009 | 0.012 | 0.011 | 0.006 | 0.007 |
| Sr | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Zr Th | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |
| In Ti | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.005 | 0.001 | 0.005 |
| 11 D- | 0.966 | 0.960 | 0.969 | 0.957 | 0.956 | 0.961 | 0.957 | 0.950 | 0.961 | 0.957 |
| Ва | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ce | 0.028 | 0.031 | 0.025 | 0.030 | 0.031 | 0.032 | 0.038 | 0.041 | 0.030 | 0.038 |
| Na Na | 0.012 | 0.014 | 0.011 | 0.013 | 0.012 | 0.014 | 0.016 | 0.018 | 0.012 | 0.017 |
| INa | 0.030 | 0.034 | 0.028 | 0.033 | 0.034 | 0.035 | 0.039 | 0.044 | 0.030 | 0.042 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ta | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Id Cations | 0.000 1.000 | 0.000 | 1.000 | 2.000 | 0.000 | 1.005 | 1.000 | 1.005 | 1.000 | 1.005 |
| | 0.10 | 2.005 | 0.11 | 2.000 | 2.001 | 0.12 | 0.01 | 0.01 | 0.01 | 0.01 |
| longwite | -0.10 | 0.01 | -0.11 | 0.01 | -0.11 | -0.12 | 0.01 | 0.01 | 0.01 | 0.01 |
| DEEE ₂ O | 0.03 | 0.00 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 | 0.03 | 0.07 |
| $KEEFeO_3$ | 0.02 | 0.02 | 0.02 | 0.05 | 0.05 | 0.05 | 0.03 | 0.03 | 0.03 | 0.05 |
| DEE T: O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lakarraiite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 |
| narouskite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| perovskile Earth | 0.92 | 0.90 | 0.92 | 0.91 | 0.91 | 0.90 | 0.89 | 0.88 | 0.91 | 0.88 |
| ΔΝΝΟ | 4.15 -2.27 | 4.14 -2.08 | -2.18 | 2.90 -1.76 | 5.00 -1.48 | -2.75 -2.29 | -2.11 -2.51 | 2.07 -1.49 | 4.50 -1.23 | 4.27 -1.23 |

Table B5. Major element compositions of ilmenite from LMI all samples. Structural formula calculated on the basis of 6 oxigens. C - core; R - rim; I - intermediate.

| | ,, | |
|--------------------------------------|---|--|
| LM3-1 11/22 R | $\begin{array}{c} 0.02\\ 38.56\\ 0.51\\ 0.51\\ 0.10\\ 0.10\\ 0.11\\ 0.40\\ 0.11\\ 0.11\\ 0.11\\ 0.00\\ 0.00\\ 0.00\\ 0.01\end{array}$ | 98.47 0.003 0.001 0.000 0.004 0.000 0.000 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.002 0.002 0.0001 0.002 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0000 0.0001 0.0000 0.0001 0.0000 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0000 0.0001 0.0001 0.0001 0.0001 0.0001 0.0000 0.0001 0.0000 0.0001 0.0000 0.0001 0.00000 0.0000 0.0000 0.00000 0.00000 0.00000 0.000000 |
| LM3-1 11/21 C | $\begin{array}{c} 0.02\\ 39.09\\ 0.46\\ 0.03\\ 0.03\\ 0.03\\ 0.39\\ 0.39\\ 2.68\\ 0.00\\ 0.00\\ 0.00\\ 0.00\end{array}$ | 97.92 0.003 0.001 0.000 0.0018 0.0018 0.0010 0.0010 0.0010 0.0010 0.000 0.000 0.000 0.000 0.000 0.000 |
| LM3-1 10/20 R | $\begin{array}{c} 0.03\\ 32.08\\ 0.69\\ 0.11\\ 0.07\\ 0.07\\ 0.24\\ 51.57\\ 1.77\\ 1.77\\ 0.01\\ 12.85\\ 0.02\end{array}$ | 99.52 0.004 0.001 0.000 1.231 0.002 0.004 0.006 0.006 0.006 0.006 0.006 0.006 0.000 0.002 0.002 0.002 0.002 |
| LM3-1 10/19 C | $\begin{array}{c} 0.00\\ 33.83\\ 0.58\\ 0.14\\ 0.01\\ 0.05\\ 0.32\\ 50.70\\ 1.75\\ 0.01\\ 1.75\\ 0.02\\ 0.02\end{array}$ | 99.48 0.003 0.000 0.000 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.002 0.002 0.002 0.002 0.002 |
| LM-2 09/18 R | $\begin{array}{c} 0.03\\ 31.17\\ 0.43\\ 0.18\\ 0.00\\ 0.05\\ 0.11\\ 50.86\\ 3.84\\ 3.84\\ 0.00\\ 0.00\\ 0.00\\ 0.00\end{array}$ | 99.36 0.003 0.001 0.007 0.007 0.007 0.003 0.003 0.003 0.003 0.000 0.000 0.000 0.000 0.000 |
| LM-2 09/17 C | $\begin{array}{c} 0.02\\ 31.95\\ 0.38\\ 0.20\\ 0.03\\ 0.15\\ 3.85\\ 3.85\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.02\\ 0.00\end{array}$ | 99.28 0.006 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.000 0.000 |
| LM-2 08/16 R | $\begin{array}{c} 0.03\\ 29.62\\ 0.78\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.13\\ 0.04\\ 0.03\end{array}$ | 98.35 98.35 0.001 0.001 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.001 0.0117 0.001 0.001 0.001 0.003 |
| LM-2 08/15 C | $\begin{array}{c} 0.02\\ 0.80\\ 0.80\\ 0.15\\ 0.05\\ 0.05\\ 0.02\\ 3.10\\ 0.01\\ 0.01\\ 0.01\end{array}$ | 98.25 0.001 0.001 0.000 0.003 0.005 0.000 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.001 |
| LM-2 07/14 R | $\begin{array}{c} 0.03\\ 31.44\\ 0.51\\ 0.16\\ 0.02\\ 0.02\\ 0.19\\ 49.65\\ 4.22\\ 4.22\\ 0.03\\ 0.03\\ 0.01\end{array}$ | 98.51 98.51 0.003 0.001 0.000 0.001 0.001 0.001 0.001 0.844 0.001 0.844 0.001 0.844 0.001 |
| LM-2] 07/13 C C | $\begin{array}{c} 0.01\\ 32.01\\ 0.44\\ 0.16\\ 0.01\\ 0.02\\ 0.17\\ 4.13\\ 4.13\\ 0.05\\ 0.02\\ 0.02\\ 0.02\end{array}$ | 98.54 98.54 0.003 0.000 0.001 1.251 0.001 0.001 0.001 0.001 0.002 0.153 0.002 0.815 0.002 0.815 0.002 |
| LM-2 06/12 R | $\begin{array}{c} 0.04\\ 28.45\\ 0.72\\ 0.15\\ 0.16\\ 0.16\\ 0.16\\ 14.19\\ 0.07\\ 14.07\\ 0.04\end{array}$ | 99.31 0.005 0.002 0.000 0.005 0.006 0.006 0.006 0.006 0.006 0.005 0.002 0.005 0.002 0.005 0.002 0.005 0.002 0.005 0005 0005 0005 0005 0005 0005 000000 |
| LM-2 06/11 C | $\begin{array}{c} 0.02\\ 28.63\\ 0.71\\ 0.16\\ 0.02\\ 0.06\\ 0.15\\ 3.79\\ 3.79\\ 0.03\\ 0.03\\ 0.05\end{array}$ | 97.94 97.94 0.003 0.001 0.000 0.002 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.005 0.005 |
| LM-2 05/10 R | $\begin{array}{c} 0.06\\ 37.85\\ 0.56\\ 0.07\\ 0.01\\ 0.11\\ 0.34\\ 1.15\\ 1.15\\ 1.15\\ 0.01\\ 0.03\\ 0.03\end{array}$ | 97.72 0.001 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.004 0.003 0.003 0.003 0.003 |
| LM-2 05/09 C | $\begin{array}{c} 0.02\\ 39.73\\ 0.45\\ 0.07\\ 0.01\\ 0.01\\ 0.40\\ 0.01\\ 1.10\\ 0.00\\ 8.61\\ 0.01\\ 0.01\end{array}$ | 97.18 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.000 |
| LM-2 04/08 R | $\begin{array}{c} 0.03\\ 34.46\\ 0.59\\ 0.10\\ 0.10\\ 0.12\\ 0.12\\ 0.12\\ 0.12\\ 0.12\\ 0.12\\ 0.00\\ 11.49\\ 0.00\end{array}$ | 97.82 0.004 0.001 0.000 1.355 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.004 |
| LM-2 04/07 C | $\begin{array}{c} 0.02\\ 37.03\\ 0.47\\ 0.08\\ 0.06\\ 0.04\\ 0.15\\ 0.08\\ 0.15\\ 1.55\\ 1.55\\ 0.00\\ 0.00\\ 0.02\\ 0.02\end{array}$ | 97.64 0.005 0.001 0.003 0.003 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 |
| LM-2 03/06 R | $\begin{array}{c} 0.02\\ 30.87\\ 0.45\\ 0.20\\ 0.02\\ 0.02\\ 0.02\\ 3.85\\ 3.85\\ 0.00\\ 0.00\\ 0.00\end{array}$ | $\begin{array}{c} 97.99\\ 0.004\\ 0.001\\ 0.000\\ 0.008\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.002\\ 0.000\\ 0.859\\ 0.000\\ 0.859\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.869\\ 0.000\\ 0.$ |
| LM-2 03/05 C | $\begin{array}{c} 0.01\\ 31.70\\ 0.34\\ 0.22\\ 0.01\\ 0.01\\ 0.09\\ 3.94\\ 3.94\\ 0.01\\ 11.96\\ 0.00\\ 0.00 \end{array}$ | 98.45 98.45 0.004 0.000 0.008 0.0145 0.001 0.001 0.002 0.145 0.000 0.832 0.000 0.832 0.000 |
| LM-2 02/04 R | $\begin{array}{c} 0.00\\ 30.48\\ 0.43\\ 0.22\\ 0.03\\ 0.00\\ 0.20\\ 0.20\\ 0.12\\ 0.00\\ 0.00\\ 0.02\\ 0.00\\ 0.02$ | 98.21 0.003 0.000 0.000 0.008 0.002 0.000 0.002 0.002 0.002 0.002 0.002 0.002 0.002 |
| LM-2 02/03 C | $\begin{array}{c} 0.05\\ 31.54\\ 0.32\\ 0.19\\ 0.01\\ 0.01\\ 0.20\\ 0.03\\ 11.86\\ 0.03\\ 0.00\\ 0.00\end{array}$ | 98.12 0.005 0.002 0.000 0.001 0.001 0.001 0.001 0.001 0.001 0.154 0.001 0.828 0.000 0.154 0.000 |
| LM-2 01/02 R | $\begin{array}{c} 0.02\\ 29.87\\ 0.44\\ 0.21\\ 0.01\\ 0.05\\ 0.15\\ 0.15\\ 3.73\\ 3.73\\ 0.01\\ 0.01\\ 0.04\end{array}$ | 97.97 0.005 0.001 0.008 0.008 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 |
| LM-2 01/01 C | $\begin{array}{c} 0.02\\ 31.17\\ 0.39\\ 0.21\\ 0.00\\ 0.00\\ 0.17\\ 50.01\\ 4.02\\ 12.29\\ 0.03\\ 0.03\end{array}$ | $\begin{array}{c} 98.50\\ 0.009\\ 0.001\\ 0.000\\ 0.015\\ 0.015\\ 0.002\\ 0.004\\ 0.001\\ 0.001\\ 0.002\\ 0.$ |
| Sample Grain/Analysis Location | $\begin{array}{c} \mathrm{SiO}_2 \\ \mathrm{FeO} \\ \mathrm{MnO} \\ \mathrm{MnO} \\ \mathrm{NiO} \\ \mathrm{K}_2 \\ \mathrm{CaO} \\ \mathrm{K}_2 \\ \mathrm{CaO} \\ \mathrm{Nb}_2 \\ \mathrm{O}_5 \\ \mathrm{Cr}_2 \\ \mathrm{O}_3 \\ \mathrm{MgO} \\ \mathrm{Na}_2 \\ \mathrm{O} \end{array}$ | Total: Al Si Fe ³⁺ Fe ²⁺ Ti Ca N N N N Sn N Sn Total Total |

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

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| LM3-2 20/38 R | 0.02 | 33.33 | 0.56 | 0.12 | 0.00 | 0.12 | 0.16 | 49.12 | 3.97 | 0.00 | 11.73 | 0.00 | 99.20 | 0.003 | 0.001 | 0.000 | 1.292 | 0.022 | 0.004 | 0.000 | 0.006 | 0.004 | 1.713 | 0.145 | 0.000 | 0.811 | 0.000 | 4.001 |
|--------------------------------------|------|-------|------|------|--------|------|-----------|---------|-----------|------|-------|---------|--------|-------|-------|------------------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| LM3-2 20/37 C | 00.0 | 35.63 | 0.37 | 0.15 | 0.00 | 0.01 | 0.27 | 48.25 | 3.94 | 0.03 | 10.36 | 0.00 | 90.06 | 0.003 | 0.000 | 0.000 | 1.398 | 0.015 | 0.006 | 0.000 | 0.000 | 0.007 | 1.702 | 0.146 | 0.001 | 0.724 | 0.000 | 4.002 |
| LM3-2 19/36 R | 0.04 | 34.95 | 0.56 | 0.12 | 0.03 | 1.00 | 0.10 | 49.13 | 1.58 | 0.03 | 11.03 | 0.02 | 98.65 | 0.003 | 0.002 | 0.000 | 1.364 | 0.022 | 0.004 | 0.002 | 0.050 | 0.002 | 1.725 | 0.058 | 0.001 | 0.767 | 0.002 | 4.004 |
| LM3-2 19/35 C | 0.03 | 36.72 | 0.52 | 0.12 | 0.01 | 0.02 | 0.16 | 50.31 | 1.38 | 0.01 | 10.31 | 0.02 | 99.66 | 0.003 | 0.001 | 0.000 | 1.433 | 0.021 | 0.004 | 0.001 | 0.001 | 0.004 | 1.766 | 0.051 | 0.000 | 0.717 | 0.002 | 4.004 |
| LM3-2 18/33 C | 0.02 | 33.38 | 0.57 | 0.11 | 0.00 | 0.22 | 0.19 | 50.56 | 1.85 | 0.02 | 12.02 | 0.02 | 90.06 | 0.006 | 0.001 | 0.000 | 1.293 | 0.022 | 0.004 | 0.000 | 0.011 | 0.005 | 1.761 | 0.068 | 0.001 | 0.830 | 0.002 | 4.003 |
| LM3-2 17/32 C | 00.0 | 32.24 | 0.39 | 0.23 | 0.01 | 0.02 | 0.38 | 50.82 | 4.00 | 0.00 | 11.95 | 0.02 | 100.15 | 0.005 | 0.000 | 0.000 | 1.240 | 0.015 | 0.009 | 0.001 | 0.001 | 0.009 | 1.759 | 0.145 | 0.000 | 0.819 | 0.002 | 4.005 |
| LM3-2 16/31 C | 00.0 | 42.81 | 0.34 | 0.10 | 0.03 | 0.00 | 0.56 | 45.91 | 1.75 | 0.01 | 7.45 | 0.02 | 99.02 | 0.002 | 0.000 | 0.000 | 1.714 | 0.014 | 0.004 | 0.002 | 0.000 | 0.014 | 1.654 | 0.066 | 0.000 | 0.532 | 0.002 | 4.004 |
| LM3-1 15/30 R | 0.03 | 17.83 | 1.70 | 0.08 | 0.00 | 0.36 | 0.12 | 58.26 | 0.00 | 0.00 | 20.30 | 0.00 | 98.67 | 0.000 | 0.001 | 0.000 | 0.656 | 0.063 | 0.003 | 0.000 | 0.017 | 0.003 | 1.927 | 0.000 | 0.000 | 1.331 | 0.000 | 4.001 |
| LM3-1 15/29 C | 0.02 | 17.78 | 1.70 | 0.07 | 0.02 | 0.21 | 0.08 | 58.29 | 0.02 | 0.00 | 20.54 | 0.05 | 98.77 | 0.000 | 0.001 | 0.000 | 0.652 | 0.063 | 0.002 | 0.001 | 0.010 | 0.002 | 1.924 | 0.001 | 0.000 | 1.344 | 0.004 | 4.004 |
| LM3-1 14/28 R | 0.02 | 30.09 | 0.55 | 0.17 | 0.00 | 0.05 | 0.13 | 49.93 | 5.11 | 0.02 | 12.61 | 0.06 | 98.89 | 0.008 | 0.001 | 0.000 | 1.164 | 0.022 | 0.006 | 0.000 | 0.002 | 0.003 | 1.737 | 0.187 | 0.001 | 0.869 | 0.006 | 4.006 |
| LM3-1 14/27 C | 0.02 | 32.29 | 0.36 | 0.22 | 0.00 | 0.03 | 0.13 | 49.27 | 4.25 | 0.02 | 11.71 | 0.00 | 98.34 | 0.002 | 0.001 | 0.000 | 1.263 | 0.014 | 0.008 | 0.000 | 0.001 | 0.003 | 1.734 | 0.157 | 0.001 | 0.817 | 0.000 | 4.003 |
| LM3-1 13/26 R | 0.03 | 31.54 | 0.37 | 0.21 | 0.00 | 0.02 | 0.14 | 50.25 | 4.41 | 0.00 | 12.43 | 0.01 | 99.48 | 0.003 | 0.001 | 0.000 | 1.215 | 0.014 | 0.008 | 0.000 | 0.001 | 0.003 | 1.742 | 0.161 | 0.000 | 0.854 | 0.001 | 4.003 |
| LM3-1 13/25 C | 0.02 | 31.02 | 0.36 | 0.21 | 0.00 | 0.02 | 0.11 | 49.90 | 4.26 | 0.08 | 12.23 | 0.00 | 98.30 | 0.005 | 0.001 | 0.000 | 1.210 | 0.014 | 0.008 | 0.000 | 0.001 | 0.003 | 1.751 | 0.157 | 0.003 | 0.850 | 0.000 | 4.003 |
| LM3-1 12/24 R | 0.03 | 31.29 | 0.62 | 0.13 | 0.01 | 0.06 | 0.11 | 50.22 | 3.32 | 0.02 | 12.43 | 0.05 | 98.34 | 0.003 | 0.001 | 0.000 | 1.218 | 0.025 | 0.005 | 0.001 | 0.003 | 0.003 | 1.758 | 0.122 | 0.001 | 0.862 | 0.005 | 4.005 |
| LM3-1 12/23 C | 0.01 | 32.04 | 0.55 | 0.16 | 0.00 | 0.04 | 0.16 | 51.07 | 3.40 | 0.02 | 11.69 | 0.04 | 99.25 | 0.004 | 0.000 | 0.000 | 1.244 | 0.022 | 0.006 | 0.000 | 0.002 | 0.004 | 1.784 | 0.125 | 0.001 | 0.809 | 0.003 | 4.004 |
| Sample Grain/Analysis Location | SiO, | FeO | MnO | NiO | K_2O | CaO | Nb_2O_5 | TiO_2 | Cr_2O_3 | ZnO | MgO | Na_2O | Total: | AI | Si | Fe ³⁺ | Fe^{2+} | Mn | Ni | K | Са | Nb | Τi | Cr | Zn | Mg | Na | Total |

TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY:

Table B6. Major element compositions of clinopyroxene from TR-IV and LM-I.Structural formula calculated on the basis of 6 oxigens, following Morimoto (1988).

| Struct | ural formu | la calculat | ted on the nediated n | 0asis 01 (nt - matr | o oxigen ix: mega | s, Iollow | ng Mor rvst | imoto (1 | 988). | |
|-------------------|------------|-------------|-----------------------|-------------------------|----------------------|-----------|----------------|----------|-------|--------|
| Sample | TR-02A | TR-02A | TR-02A | TR-07 | TR-07 | TR-07 | TR-07 | TR-07 | TR-07 | LMI-B2 |
| Grain/Analysis | 01/01 | 02/03 | 03/04 | 04/05 | 04/06 | 05/07 | 11/13 | 12/16 | 13/17 | 01/01 |
| Location | C | С | С | С | R | С | С | R | С | С |
| Crystal type | mt | mt | mt | mt | mt | mt | mt | mt | mt | mega |
| SiO ₂ | 51.72 | 51.76 | 51.76 | 52.92 | 51.30 | 51.25 | 51.01 | 52.09 | 53.34 | 52.73 |
| TiO ₂ | 0.93 | 0.63 | 0.63 | 0.73 | 0.79 | 1.98 | 2.12 | 0.85 | 0.57 | 0.32 |
| Al_2O_3 | 0.13 | 0.16 | 0.16 | 0.13 | 0.15 | 0.41 | 0.31 | 0.09 | 0.09 | 0.10 |
| FeO | 4.86 | 3.27 | 3.27 | 4.77 | 3.00 | 4.51 | 4.33 | 3.49 | 3.49 | 3.22 |
| MnO | 0.11 | 0.07 | 0.07 | 0.13 | 0.07 | 0.11 | 0.08 | 0.15 | 0.15 | 0.09 |
| MgO | 15.47 | 16.81 | 16.81 | 15.84 | 17.45 | 15.63 | 15.54 | 16.45 | 16.45 | 20.80 |
| CaO | 22.91 | 24.10 | 24.10 | 23.58 | 24.88 | 23.02 | 22.67 | 23.76 | 23.76 | 21.87 |
| Na ₂ O | 1.34 | 0.87 | 0.87 | 1.01 | 0.67 | 1.31 | 1.35 | 0.93 | 0.93 | 0.57 |
| K_2O | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.03 | 0.03 | 0.21 |
| Cr_2O_3 | 0.44 | 0.16 | 0.16 | 0.10 | 0.03 | 0.23 | 0.28 | 0.39 | 0.39 | 0.10 |
| Total | 97.91 | 97.83 | 97.83 | 99.22 | 98.36 | 98.45 | 97.69 | 98.23 | 99.20 | 100.00 |
| Si (T) | 1.928 | 1.919 | 1.919 | 1.948 | 1.889 | 1.902 | 1.908 | 1.929 | 1.956 | 1.887 |
| Al (T) | 0.006 | 0.007 | 0.007 | 0.005 | 0.007 | 0.018 | 0.014 | 0.004 | 0.004 | 0.004 |
| Fe3 (T) | 0.066 | 0.074 | 0.074 | 0.046 | 0.092 | 0.080 | 0.079 | 0.067 | 0.040 | 0.096 |
| Σ(Τ) | 2.000 | 2.000 | 2.000 | 2.000 | 1.988 | 2.000 | 2.000 | 2.000 | 2.000 | 1.988 |
| Al (M1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ti (M1) | 0.026 | 0.018 | 0.018 | 0.020 | 0.022 | 0.055 | 0.060 | 0.024 | 0.016 | 0.009 |
| Fe3+ (M1) | 0.085 | 0.027 | 0.027 | 0.081 | 0.000 | 0.060 | 0.057 | 0.041 | 0.067 | 0.000 |
| Cr (M1) | 0.013 | 0.005 | 0.005 | 0.003 | 0.001 | 0.007 | 0.008 | 0.012 | 0.011 | 0.003 |
| Mg (M1) | 0.860 | 0.929 | 0.929 | 0.870 | 0.957 | 0.865 | 0.866 | 0.908 | 0.899 | 0.989 |
| Fe2+ (M1) | 0.000 | 0.000 | 0.000 | 0.019 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn (M1) | 0.004 | 0.002 | 0.002 | 0.004 | 0.002 | 0.003 | 0.002 | 0.005 | 0.005 | 0.000 |
| Σ (M1) | 0.988 | 0.980 | 0.980 | 0.997 | 0.982 | 0.991 | 0.993 | 0.989 | 0.999 | 1.000 |
| Mg (M2) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.121 |
| Fe2+ (M2) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn (M2) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 |
| Ca (M2) | 0.915 | 0.957 | 0.957 | 0.930 | 0.981 | 0.915 | 0.908 | 0.943 | 0.934 | 0.839 |
| Na (M2) | 0.097 | 0.062 | 0.062 | 0.072 | 0.048 | 0.094 | 0.098 | 0.067 | 0.066 | 0.040 |
| K (M2) | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.010 |
| Σ (M2) | 1.012 | 1.020 | 1.020 | 1.003 | 1.030 | 1.009 | 1.007 | 1.011 | 1.001 | 1.012 |
| Cations | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 |
| Sum | 90.54 | 93.90 | 93.90 | 92.19 | 94.27 | 89.60 | 89.60 | 93.16 | 93.56 | 94.75 |
| Xen | 0.51 | 0.51 | 0.51 | 0.50 | 0.51 | 0.51 | 0.52 | 0.51 | 0.50 | 0.59 |
| Xwo | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.48 | 0.48 | 0.49 | 0.49 | 0.41 |
| Xfs | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table B6. Major element compositions of clinopyroxene from TR-IV and LM-I.Structural formula calculated on the basis of 6 oxigens, following Morimoto (1988).

| Struct | ural formu | Ia calculat | ted on the | basis of 6 (| oxigens, to | llowing M | lorimoto (19 |
|-------------------|------------|------------------|------------|--------------|-------------------------------|--------------------|--------------|
| Samula | I M P D | $I M I_R \gamma$ | I MI_A 1 | $I MI_A 1$ | <u>, ποga - Π</u> Ι ΜΙ_Λ 1 | $I MI_{\Lambda} 1$ | I MI_A1 |
| Grain/Analysis | 01/02 | 01/04 | 02/05 | 02/06 | 02/07 | 02/08 | 02/09 |
| L ocation | R 01/02 | 01/04 R | 02/03 C | 02/00 R | 02/07 R | 02/08 C | 02/09 C |
| Crystal type | mega | mega | mega | macro | macro | macro | macro |
| SiO | 53.21 | 50.56 | 54 31 | 54 29 | 54 29 | 54.07 | 53.90 |
| TiO ₂ | 0.36 | 0.26 | 0.15 | 0.14 | 0.23 | 0.18 | 0.21 |
| | 0.05 | 0.20 | 0.15 | 0.14 | 0.25 | 0.10 | 0.19 |
| FeO | 2.78 | 4 17 | 3.09 | 3.19 | 3 36 | 3.16 | 3.09 |
| MnO | 0.07 | 0.13 | 0.12 | 0.10 | 0.12 | 0.12 | 0.11 |
| MgO | 18.59 | 24 02 | 17.60 | 17 43 | 17.54 | 17.57 | 17 55 |
| CaO | 23.79 | 19.30 | 22.66 | 22.92 | 22.16 | 23.01 | 23.07 |
| Na ₂ O | 0.62 | 0.40 | 0.81 | 0.79 | 0.79 | 0.81 | 0.81 |
| K ₂ O | 0.10 | 0.14 | 0.00 | 0.00 | 0.01 | 0.01 | 0.03 |
| Cr_2O_3 | 0.16 | 0.13 | 0.88 | 0.92 | 1.02 | 0.97 | 1.08 |
| Total | 99.72 | 99.44 | 99.82 | 100.02 | 99.85 | 100.11 | 100.02 |
| Si(T) | 1.925 | 1.801 | 1.973 | 1.970 | 1.974 | 1.959 | 1.955 |
| Al (T) | 0.002 | 0.015 | 0.009 | 0.010 | 0.014 | 0.009 | 0.008 |
| Fe3 (T) | 0.073 | 0.124 | 0.018 | 0.020 | 0.012 | 0.032 | 0.037 |
| Σ(Τ) | 2.000 | 1.940 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| Al (M1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ti (M1) | 0.010 | 0.007 | 0.004 | 0.004 | 0.006 | 0.005 | 0.006 |
| Fe3+ (M1) | 0.011 | 0.000 | 0.051 | 0.051 | 0.040 | 0.061 | 0.056 |
| Cr (M1) | 0.005 | 0.004 | 0.025 | 0.027 | 0.029 | 0.028 | 0.031 |
| Mg (M1) | 0.975 | 0.989 | 0.920 | 0.919 | 0.924 | 0.907 | 0.907 |
| Fe2+ (M1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn (M1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Σ (M1) | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Mg (M2) | 0.028 | 0.286 | 0.033 | 0.024 | 0.027 | 0.042 | 0.042 |
| Fe2+(M2) | 0.000 | 0.000 | 0.025 | 0.026 | 0.050 | 0.003 | 0.000 |
| Mn (M2) | 0.002 | 0.004 | 0.004 | 0.003 | 0.004 | 0.004 | 0.003 |
| Ca (M2) | 0.922 | 0.737 | 0.882 | 0.891 | 0.863 | 0.893 | 0.896 |
| Na (M2) | 0.043 | 0.027 | 0.057 | 0.055 | 0.056 | 0.057 | 0.057 |
| K (M2) | 0.005 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Σ (M2) | 1.000 | 1.060 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Cations | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 |
| Sum | 95.25 | 93.60 | 96.19 | 96.09 | 96.73 | 94.90 | 94.79 |
| Xen | 0.53 | 0.66 | 0.52 | 0.51 | 0.51 | 0.52 | 0.52 |
| Xwo | 0.47 | 0.33 | 0.47 | 0.47 | 0.46 | 0.47 | 0.47 |
| Xts | 1 0 00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.00 | 0.00 |

| Sample | TR-04A | TR-04A | TR-04A | TR-04A | TR-04A | TR-04B | TR-07 241 | TR-07 241 |
|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------|-----------|
| Grain/Analysis | 01/01 | 01/02 | 01/03 | 02/04 | 02/06 | 03/07 | 03/08 | 03/09 | 04/10 | 04/11 | 04/12 | 05/13 | 05/14 | 05/15 | 06/16 | 07/17 |
| Location | С | Ι | R | С | R | С | Ι | R | С | Ι | R | С | Ι | R | С | С |
| SiO_2 | 42.06 | 42.19 | 41.58 | 42.08 | 42.56 | 42.52 | 42.54 | 42.17 | 42.44 | 42.68 | 42.25 | 42.53 | 42.17 | 42.74 | 41.91 | 41.51 |
| TiO_2 | 0.22 | 0.21 | 0.22 | 0.26 | 0.12 | 0.06 | 0.09 | 0.05 | 0.23 | 0.20 | 0.20 | 0.02 | 0.08 | 0.05 | 0.03 | 0.08 |
| Al_2O_3 | 20.94 | 21.14 | 20.65 | 22.87 | 23.03 | 20.63 | 20.72 | 20.58 | 22.20 | 22.38 | 22.32 | 20.59 | 20.55 | 20.66 | 21.24 | 21.08 |
| Cr_2O_3 | 2.90 | 2.78 | 3.31 | 0.91 | 0.67 | 4.25 | 4.02 | 4.30 | 1.49 | 1.34 | 1.37 | 4.26 | 4.34 | 4.39 | 2.86 | 2.95 |
| FeO_T | 9.22 | 9.44 | 8.99 | 9.38 | 9.20 | 7.49 | 7.34 | 7.63 | 9.56 | 9.44 | 9.74 | 7.62 | 7.48 | 7.55 | 8.79 | 8.42 |
| MnO | 0.40 | 0.39 | 0.41 | 0.35 | 0.32 | 0.39 | 0.37 | 0.43 | 0.42 | 0.42 | 0.36 | 0.38 | 0.37 | 0.43 | 0.42 | 0.41 |
| MgO | 19.38 | 19.34 | 19.15 | 20.26 | 19.43 | 21.19 | 21.04 | 20.07 | 19.62 | 19.68 | 19.71 | 20.71 | 20.81 | 20.55 | 19.97 | 19.78 |
| CaO | 4.81 | 4.82 | 4.81 | 3.99 | 4.05 | 4.41 | 4.66 | 5.16 | 4.59 | 4.50 | 4.59 | 4.72 | 4.68 | 4.80 | 4.78 | 4.76 |
| Na_2O | 0.04 | 0.03 | 0.07 | 0.04 | 0.04 | 0.05 | 0.02 | 0.04 | 0.08 | 0.07 | 0.05 | 0.03 | 0.02 | 0.04 | 0.02 | 0.02 |
| Total | 99.98 | 100.33 | 99.20 | 100.14 | 99.42 | 100.99 | 100.79 | 100.42 | 100.63 | 100.70 | 100.59 | 100.86 | 100.49 | 101.22 | 100.01 | 99.01 |
| Si | 3.000 | 3.000 | 3.000 | 2.988 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 2.998 | 3.000 | 2.997 | 2.998 |
| $\mathbf{Al}^{\mathrm{IV}}$ | 0.000 | 0.000 | 0.000 | 0.012 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.003 | 0.002 |
| ΣT | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 |
| Si | 0.021 | 0.021 | 0.013 | 0.000 | 0.049 | 0.004 | 0.011 | 0.009 | 0.014 | 0.027 | 0.001 | 0.015 | 0.000 | 0.022 | 0.000 | 0.000 |
| Τi | 0.012 | 0.011 | 0.012 | 0.014 | 0.006 | 0.003 | 0.005 | 0.003 | 0.012 | 0.011 | 0.011 | 0.001 | 0.004 | 0.003 | 0.002 | 0.004 |
| $\mathbf{Al}^{\mathrm{VI}}$ | 1.772 | 1.784 | 1.764 | 1.903 | 1.944 | 1.718 | 1.728 | 1.730 | 1.859 | 1.870 | 1.868 | 1.720 | 1.720 | 1.721 | 1.788 | 1.792 |
| Cr | 0.165 | 0.157 | 0.190 | 0.051 | 0.038 | 0.238 | 0.225 | 0.243 | 0.084 | 0.075 | 0.077 | 0.239 | 0.244 | 0.246 | 0.162 | 0.169 |
| Fe^{2+} | 0.006 | 0.006 | 0.003 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe^{3+} | 0.002 | 0.000 | 0.006 | 0.034 | 0.000 | 0.037 | 0.019 | 0.009 | 0.015 | 0.000 | 0.038 | 0.013 | 0.032 | 0.000 | 0.052 | 0.034 |
| Mg | 0.021 | 0.021 | 0.013 | 0.000 | 0.000 | 0.001 | 0.011 | 0.006 | 0.014 | 0.017 | 0.001 | 0.012 | 0.000 | 0.008 | 0.000 | 0.000 |
| ΣA | 2.000 | 2.000 | 2.000 | 2.002 | 2.038 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.003 | 2.000 |
| Fe^{2+} | 0.545 | 0.560 | 0.536 | 0.523 | 0.551 | 0.406 | 0.413 | 0.446 | 0.551 | 0.560 | 0.536 | 0.439 | 0.413 | 0.446 | 0.474 | 0.474 |
| Mg | 2.054 | 2.043 | 2.056 | 2.145 | 2.075 | 2.231 | 2.209 | 2.129 | 2.064 | 2.063 | 2.086 | 2.176 | 2.205 | 2.158 | 2.129 | 2.130 |
| Mn | 0.025 | 0.023 | 0.025 | 0.021 | 0.020 | 0.023 | 0.022 | 0.026 | 0.025 | 0.025 | 0.022 | 0.023 | 0.022 | 0.026 | 0.026 | 0.025 |
| Ca | 0.370 | 0.370 | 0.374 | 0.304 | 0.311 | 0.334 | 0.353 | 0.394 | 0.349 | 0.342 | 0.350 | 0.359 | 0.356 | 0.364 | 0.366 | 0.368 |
| Na | 0.006 | 0.004 | 0.009 | 0.005 | 0.006 | 0.007 | 0.003 | 0.005 | 0.011 | 0.010 | 0.006 | 0.004 | 0.003 | 0.006 | 0.002 | 0.002 |
| ΣB | 3.000 | 3.000 | 3.000 | 2.998 | 2.962 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 2.997 | 3.000 |
| Uvarovite | 0.08 | 0.08 | 0.09 | 0.03 | 0.02 | 0.11 | 0.11 | 0.12 | 0.04 | 0.04 | 0.04 | 0.12 | 0.12 | 0.12 | 0.08 | 0.08 |
| Spessartine | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Pyrope | 0.66 | 0.66 | 0.67 | 0.72 | 0.69 | 0.73 | 0.73 | 0.70 | 0.67 | 0.67 | 0.69 | 0.71 | 0.73 | 0.71 | 0.71 | 0.71 |
| Almandine | 0.18 | 0.19 | 0.18 | 0.17 | 0.18 | 0.12 | 0.13 | 0.15 | 0.18 | 0.19 | 0.18 | 0.14 | 0.12 | 0.14 | 0.16 | 0.16 |
| Grossular | 0.03 | 0.04 | 0.02 | 0.06 | 0.08 | 0.00 | 0.00 | 0.00 | 0.06 | 0.07 | 0.05 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 |
| Andradite | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 00.00 | 0.00 | 0.00 | 0.01 | 00.00 | 0.02 | 0.00 | 0.00 | 00.00 | 0.02 | 0.02 |

Table B7. Major element compostions of garnet from TR-IV . Structural formula calculated on the basis of 8 cations and 12 anions. Supplementary Material B

OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY:

TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS

DOI: 10.1590/2317-4889202020190087

Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

| Endm | embers ca | lculated fo | llowing L | ocock, (20 | 08). C - c | ore; R - 1 | rim; I - in | itermediate. | |
|-----------------------------|-----------|-------------|-----------|------------|------------|------------|-------------|--------------|--|
| Sample | TR-07 241 | TR-07 241 | TR-07 241 | TR-07 241 | TRIV-5-2 | TRIV-5-2 | TRIV-5-2 | TRIV-5-2 | |
| Grain/Analysis | 07/18 | 07/18 | 08/19 | 08/20 | 09/21 | 09/22 | 10/23 | 11/24 | |
| Location | R | Я | C | R | C | R | C | R | |
| SiO_2 | 43.23 | 43.23 | 41.94 | 41.79 | 40.70 | 40.99 | 40.72 | 40.68 | |
| TiO_2 | 0.09 | 0.09 | 0.05 | 0.06 | 0.13 | 0.04 | 0.10 | 0.06 | |
| Al_2O_3 | 21.80 | 21.80 | 21.30 | 21.23 | 17.98 | 18.11 | 18.12 | 18.06 | |
| $Cr_{2}O_{3}$ | 2.92 | 2.92 | 3.01 | 2.91 | 6.94 | 6.97 | 7.04 | 7.20 | |
| FeO_T | 8.61 | 8.61 | 8.76 | 8.60 | 7.81 | 7.93 | 8.15 | 8.05 | |
| MnO | 0.40 | 0.40 | 0.47 | 0.49 | 0.43 | 0.46 | 0.44 | 0.45 | |
| MgO | 18.83 | 18.83 | 20.06 | 20.47 | 19.08 | 18.97 | 18.91 | 18.86 | |
| CaO | 4.86 | 4.86 | 4.69 | 4.68 | 5.67 | 5.67 | 5.57 | 5.58 | |
| Na_2O | 0.01 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Total | 100.75 | 100.75 | 100.30 | 100.22 | 98.75 | 99.15 | 90.06 | 98.94 | |
| Si | 3.000 | 3.000 | 2.992 | 2.977 | 2.990 | 3.000 | 2.987 | 2.988 | |
| $\mathbf{Al}^{\mathrm{IV}}$ | 0.000 | 0.000 | 0.008 | 0.023 | 0.010 | 0.000 | 0.013 | 0.012 | |
| ΣT | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | 3.000 | |
| Si | 0.084 | 0.084 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | |
| Ti | 0.005 | 0.005 | 0.003 | 0.003 | 0.007 | 0.002 | 0.006 | 0.003 | |
| AI^{VI} | 1.833 | 1.833 | 1.782 | 1.760 | 1.547 | 1.563 | 1.553 | 1.552 | |
| Cr | 0.165 | 0.165 | 0.170 | 0.164 | 0.403 | 0.404 | 0.408 | 0.418 | |
| Fe^{2+} | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | |
| Fe^{3+} | 0.000 | 0.000 | 0.054 | 0.093 | 0.045 | 0.026 | 0.040 | 0.035 | |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | |
| ΣA | 2.087 | 2.087 | 2.009 | 2.020 | 2.003 | 2.000 | 2.007 | 2.008 | |
| Fe^{2+} | 0.514 | 0.514 | 0.468 | 0.419 | 0.434 | 0.457 | 0.460 | 0.459 | |
| Mg | 2.003 | 2.003 | 2.133 | 2.174 | 2.090 | 2.069 | 2.068 | 2.065 | |
| Mn | 0.024 | 0.024 | 0.028 | 0.029 | 0.027 | 0.029 | 0.027 | 0.028 | |
| Са | 0.371 | 0.371 | 0.359 | 0.357 | 0.446 | 0.445 | 0.438 | 0.439 | |
| Na | 0.001 | 0.001 | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | |
| ΣB | 2.913 | 2.913 | 2.991 | 2.980 | 2.997 | 3.000 | 2.993 | 2.992 | |
| Uvarovite | 0.08 | 0.08 | 0.08 | 0.08 | 0.15 | 0.15 | 0.14 | 0.14 | |
| Spessartine | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | |
| Pyrope | 0.67 | 0.67 | 0.71 | 0.72 | 0.64 | 0.63 | 0.63 | 0.62 | |
| Almandine | 0.17 | 0.17 | 0.16 | 0.14 | 0.12 | 0.14 | 0.14 | 0.14 | |
| Grossular | 0.04 | 0.04 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Andradite | 0 00 | 0.00 | 0 00 | 0.03 | 0 00 | 0 00 | 0.00 | 0 00 | |

ulated on the basis of 8 cations and 12 anions. -5 ż VI GT ę ¢ • Supplementary Material B Table R7 Major element

TRÊS RANCHOS IV AND LIMEIRA I INTRUSIONS Bruna Coldebella, Rogério Guitarrari Azzone, Luanna Chmyz, Excelso Ruberti, Darcy P. Svisero

DOI: 10.1590/2317-4889202020190087 OXYGEN FUGACITY OF THE ALTO PARANAÍBA KIMBERLITES AND DIAMOND INSTABILITY: