

## Supplementary material

Supplementary material 1: Lithology of the Boucheville basin. a: Thin section of Hornfels of Vira, Northeast of Sournia. b: Thin section of Boucheville calcschists, thin upper series, North of Pezilla de Conflent. c and d (thin section): Boucheville calcschists, coarser lower series, flat and wavy laminations in carbonate alternations, northern limit of cross-section B-B'. e: Slopes breccias and slumps in the Jurassic series in the southeast of Caramany. f: Section of the slump visible on image e.

Supplementary material 2: Deformations in the Boucheville basin. a: Boudinage of calc-quartz veins in calcschist to the south of Vivier. b: Diopside with rotation and a pressure shadow in the Southeast of the Caramany marbles. c and d: Sigmoidal deformations affecting marbles in the village of Sournia. e and f: Isoclinal folds synchronous with boudinaged calc-quartz veins in calcschist in South of Vivier. g: Thin section of boudinaged magmatic vein in the northeast of Sournia.

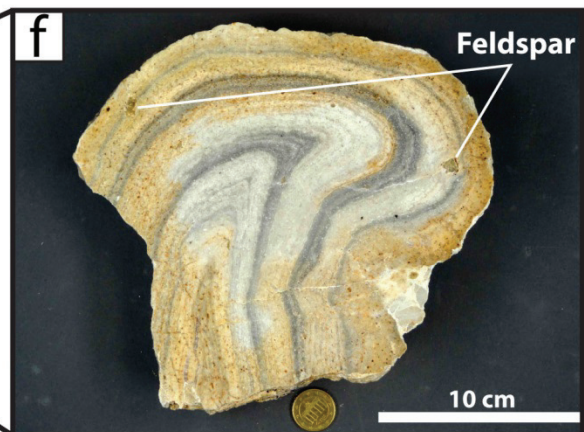
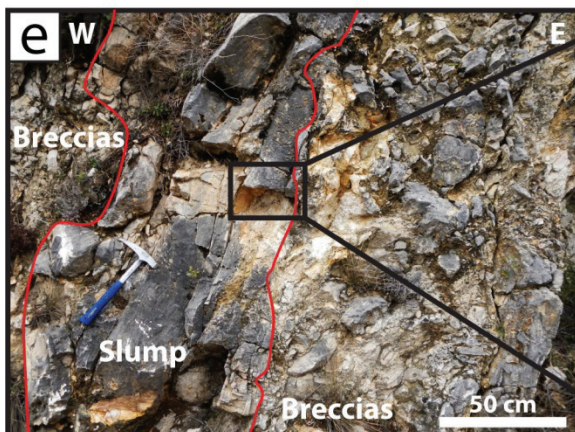
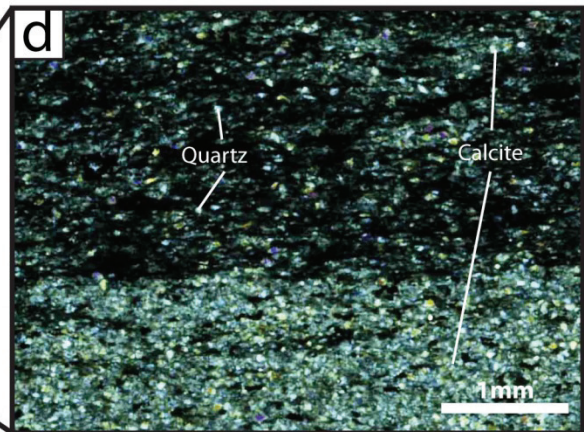
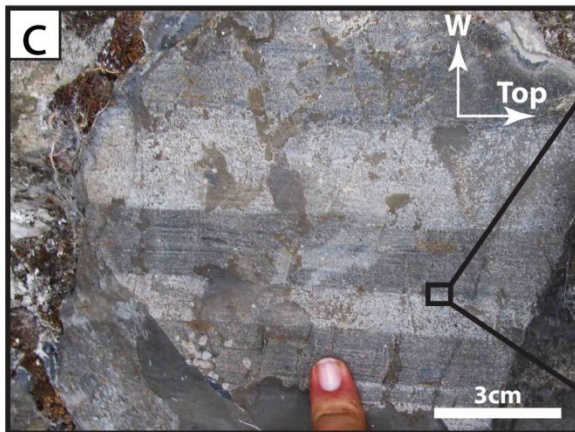
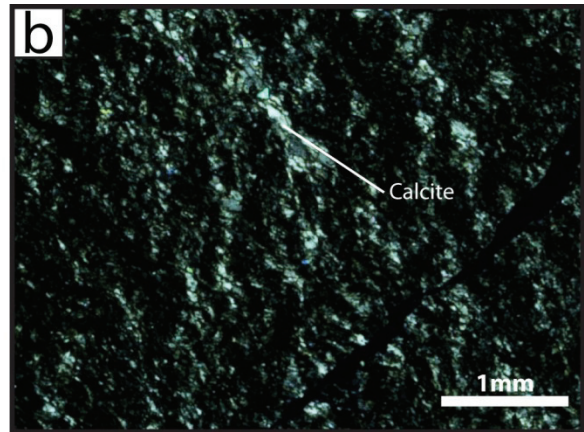
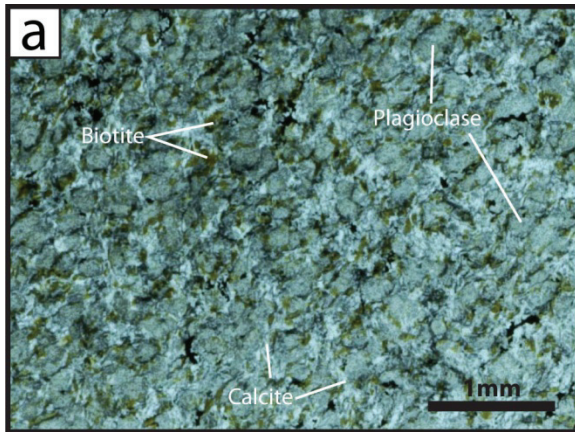
Supplementary material 3: Value of RSCM analyses and samples coordinates.

Supplementary material 4: PT estimations for diopside-bearing metacarbonates of the Boucheville basin (sample B01363). a: SEM image of the metamorphic minerals: a1) Peak-temperature mineral assemblage composed of Diopside-rich Clinopyroxene (CPx)-Anorthite (An)-Biotite (Bt)-Orthoclase (Kfd)-Calcite-Pyrite. a2) Retrograde assemblage in which Quartz (Qz) is stable. b: Stability field of the studied mineralogical assemblage is large, with a T-range of at least 200°C. This assemblage can be stable up to 0.8 GPa. c: Quantitative models for isobaric metamorphism for the sample B01363 (T-X<sub>CO<sub>2</sub>-H<sub>2</sub>O</sub> diagram) at 0.35 GPa and at 0.2 GPa. d: Quantitative models for isothermal metamorphism for the sample B01363 (P-X<sub>CO<sub>2</sub>-H<sub>2</sub>O</sub> diagram) at 580°C. At this temperature, the pressure can be limited at 0.35 GPa for this sample. Data are detailed in supplementary materials 5.

Supplementary material 5: Representative chemical composition for each mineral that composed the magmatic sill (apatite composition is not shown but the presence of chlorine in the mineral (200 to 300 ppm) allow us to consider it as chlorapatite).

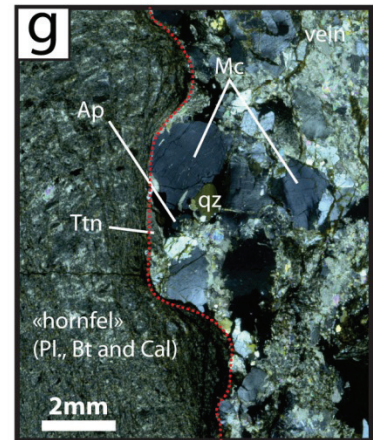
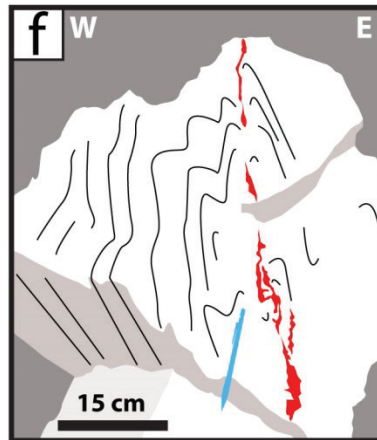
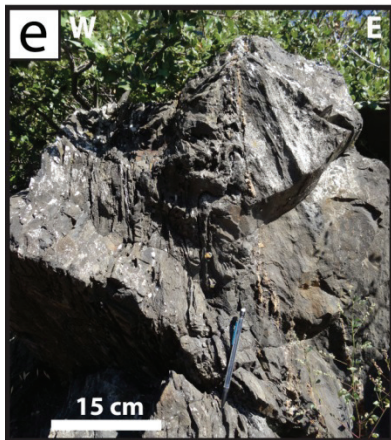
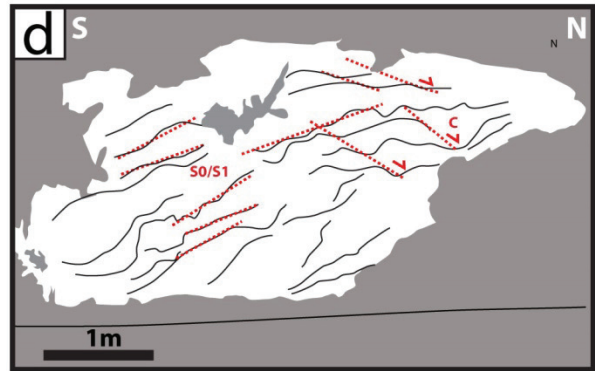
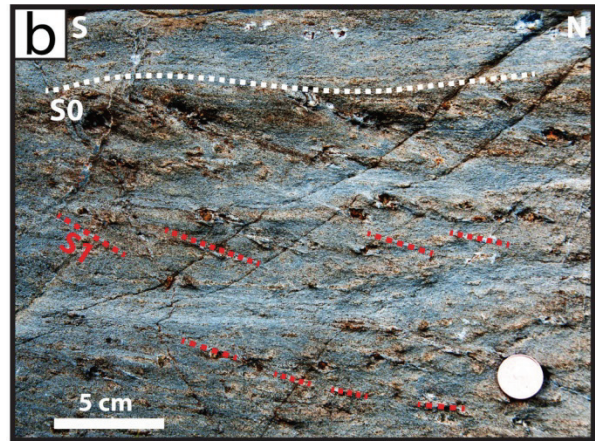
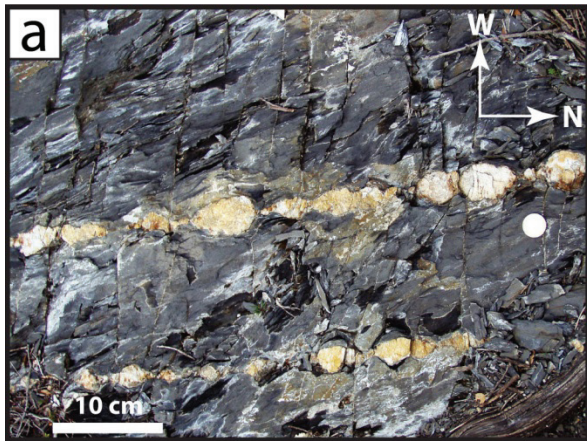
Supplementary material 6: Titanite grains used to date the magmatic sill (titanite grain 4 is out of the picture). b: LA-ICP-MS U-Pb results plotted in a Tera-Wasserburg diagram. Errors are listed at 1 sigma. Data are detailed in supplementary materials 7.

Supplementary material 7: Results of LA-ICP-MS U-Pb dating performed on titanite grains from the magmatic sill. Errors are listed at 1 sigma.



Supplementary material 1



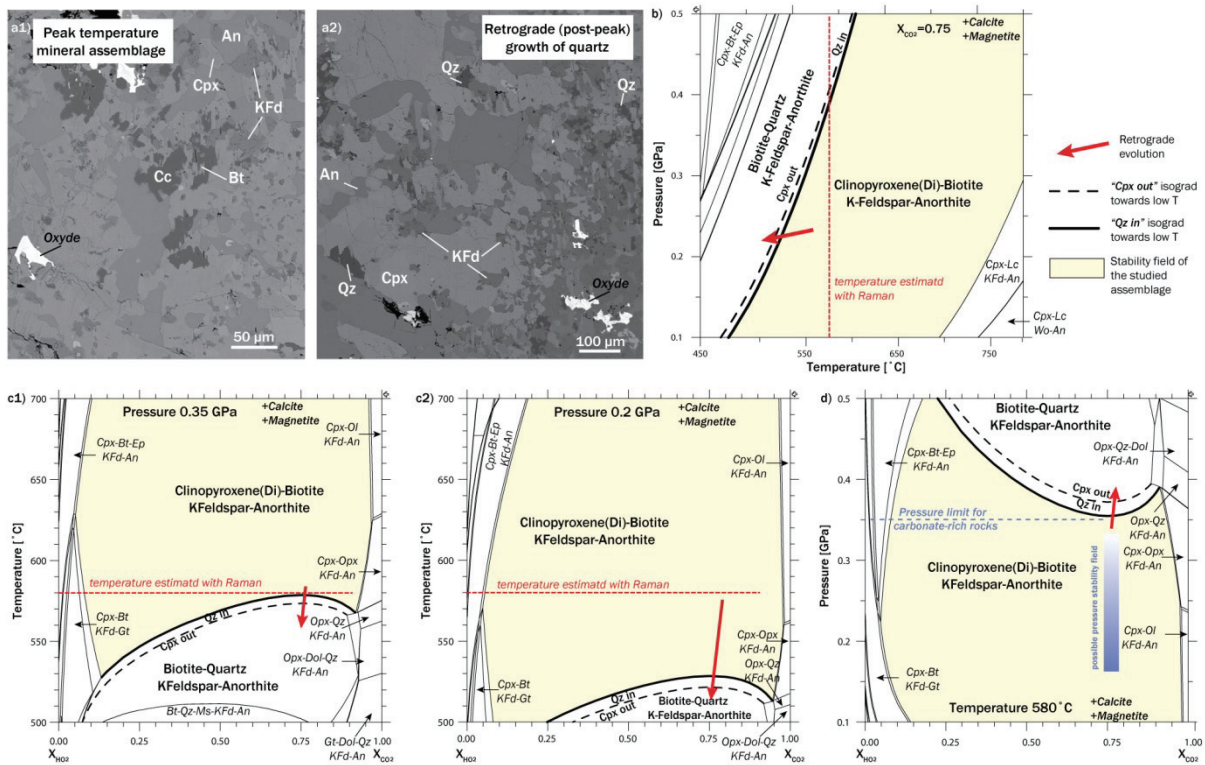


Supplementary material 2

| Sample        | Longitude | Latitude  | R <sup>2</sup> (Avg) | Ecart type | T°C (Avg) | Standard deviation | Nb of spectra |
|---------------|-----------|-----------|----------------------|------------|-----------|--------------------|---------------|
| <b>Bo1310</b> | 2,491396  | 42,751101 | 0,23                 | 0,05       | 538       | 24                 | 11            |
| <b>Bo1311</b> | 2,492631  | 42,750569 | 0,23                 | 0,06       | 540       | 27                 | 10            |
| <b>Bo1312</b> | 2,493895  | 42,748960 | 0,23                 | 0,03       | 576       | 26                 | 10            |
| <b>Bo1313</b> | 2,493752  | 42,745533 | 0,22                 | 0,01       | 573       | 26                 | 10            |
| <b>Bo1314</b> | 2,490040  | 42,746247 | 0,14                 | 0,06       | 577       | 28                 | 10            |
| <b>Bo1315</b> | 2,485971  | 42,745033 | 0,24                 | 0,06       | 532       | 28                 | 10            |
| <b>Bo1316</b> | 2,485971  | 42,742821 | 0,18                 | 0,06       | 560       | 25                 | 11            |
| <b>Bo1317</b> | 2,483972  | 42,739537 | 0,19                 | 0,08       | 554       | 33                 | 10            |
| <b>Bo1318</b> | 2,482188  | 42,738252 | 0,19                 | 0,07       | 555       | 30                 | 10            |
| <b>Bo1319</b> | 2,482759  | 42,733398 | 0,15                 | 0,08       | 574       | 37                 | 15            |
| <b>Bo1320</b> | 2,487470  | 42,732970 | 0,14                 | 0,06       | 578       | 28                 | 10            |
| <b>Bo1321</b> | 2,483972  | 42,729258 | 0,19                 | 0,07       | 575       | 26                 | 10            |
| <b>Bo1322</b> | 2,481688  | 42,725831 | 0,22                 | 0,09       | 576       | 26                 | 10            |
| <b>Bo1323</b> | 2,479475  | 42,721477 | 0,15                 | 0,06       | 575       | 26                 | 11            |
| <b>Bo1324</b> | 2,478904  | 42,720549 | 0,32                 | 0,04       | 498       | 20                 | 10            |
| <b>Bo1325</b> | 2,474335  | 42,721049 | 0,22                 | 0,09       | 546       | 30                 | 10            |
| <b>Bo1328</b> | 2,460378  | 42,726240 | 0,23                 | 0,08       | 547       | 25                 | 9             |
| <b>Bo1329</b> | 2,447340  | 42,728353 | 0,22                 | 0,07       | 544       | 33                 | 10            |
| <b>Bo1330</b> | 2,447578  | 42,728806 | 0,14                 | 0,07       | 578       | 30                 | 11            |
| <b>Bo1331</b> | 2,451671  | 42,729567 | 0,20                 | 0,09       | 556       | 35                 | 10            |
| <b>Bo1332</b> | 2,463449  | 42,727663 | 0,14                 | 0,05       | 577       | 20                 | 13            |
| <b>Bo1333</b> | 2,466781  | 42,731530 | 0,14                 | 0,03       | 579       | 14                 | 10            |
| <b>Bo1334</b> | 2,461129  | 42,737479 | 0,14                 | 0,06       | 580       | 25                 | 10            |
| <b>Bo1335</b> | 2,458096  | 42,740037 | 0,19                 | 0,06       | 555       | 27                 | 10            |
| <b>Bo1336</b> | 2,456668  | 42,743487 | 0,18                 | 0,06       | 561       | 25                 | 10            |
| <b>Bo1337</b> | 2,458988  | 42,748389 | 0,17                 | 0,09       | 569       | 36                 | 12            |
| <b>Bo1338</b> | 2,455490  | 42,750030 | 0,22                 | 0,06       | 545       | 27                 | 11            |
| <b>Bo1339</b> | 2,460987  | 42,753028 | 0,19                 | 0,05       | 557       | 24                 | 12            |
| <b>Bo1340</b> | 2,463271  | 42,755812 | 0,26                 | 0,05       | 529       | 25                 | 12            |
| <b>Bo1342</b> | 2,465698  | 42,763094 | 0,17                 | 0,08       | 566       | 35                 | 10            |
| <b>Bo1345</b> | 2,466483  | 42,763807 | 0,22                 | 0,08       | 552       | 28                 | 11            |
| <b>Bo1353</b> | 2,538424  | 42,710684 | 0,54                 | 0,04       | 401       | 16                 | 11            |

|               |          |           |      |      |     |    |    |
|---------------|----------|-----------|------|------|-----|----|----|
| <b>Bo1354</b> | 2,536868 | 42,715766 | 0,13 | 0,05 | 583 | 21 | 11 |
| <b>Bo1355</b> | 2,542436 | 42,715052 | 0,14 | 0,07 | 581 | 31 | 16 |
| <b>Bo1357</b> | 2,544292 | 42,719906 | 0,22 | 0,09 | 549 | 30 | 9  |
| <b>Bo1358</b> | 2,554856 | 42,716194 | 0,21 | 0,08 | 550 | 36 | 11 |
| <b>Bo1359</b> | 2,562709 | 42,719692 | 0,20 | 0,03 | 552 | 12 | 10 |
| <b>Bo1360</b> | 2,578570 | 42,719735 | 0,22 | 0,05 | 544 | 21 | 15 |
| <b>Bo1363</b> | 2,579484 | 42,716765 | 0,16 | 0,08 | 569 | 35 | 11 |
| <b>Bo1383</b> | 2,477976 | 42,742178 | 0,21 | 0,05 | 545 | 21 | 10 |
| <b>Bo1384</b> | 2,469910 | 42,746818 | 0,18 | 0,07 | 563 | 31 | 10 |
| <b>Bo1458</b> | 2,530007 | 42,720097 | 0,22 | 0,04 | 564 | 34 | 20 |
| <b>Bo1460</b> | 2,527152 | 42,722952 | 0,19 | 0,07 | 555 | 29 | 20 |
| <b>Bo1465</b> | 2,529150 | 42,727045 | 0,19 | 0,06 | 542 | 22 | 14 |
| <b>Bo1469</b> | 2,533753 | 42,734148 | 0,24 | 0,12 | 557 | 29 | 16 |

### Supplementary material 3

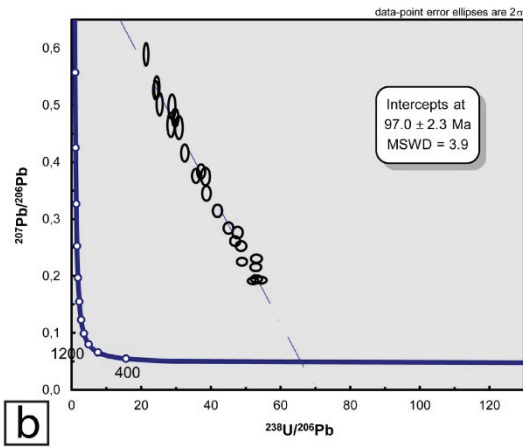
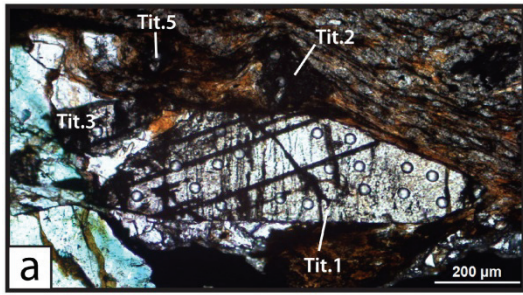


### Supplementary material 4

|              | % SiO <sub>2</sub> | % TiO <sub>2</sub> | % Al <sub>2</sub> O <sub>3</sub> | % FeO | % MnO | % MgO | % CaO | % Na <sub>2</sub> O | % K <sub>2</sub> O | % Cr <sub>2</sub> O <sub>3</sub> |
|--------------|--------------------|--------------------|----------------------------------|-------|-------|-------|-------|---------------------|--------------------|----------------------------------|
| Microcline   |                    |                    |                                  |       |       |       |       |                     |                    |                                  |
| (orthoclase) | 64.73              | 0                  | 17.75                            | 0.03  | 0     | 0     | 0     | 0.682               | 16.89              | 0                                |
| Anorthite    | 48.74              | 0                  | 32.43                            | 0.225 | 0     | 0     | 16.2  | 2.66                | 0.061              | 0                                |
| Titanite     | 31.41              | 35.13              | 3.46                             | 0.19  | 0.065 | 0.018 | 29.21 | 0.011               | 0.017              | 0.017                            |
| Biotite      | 38.41              | 1.616              | 18.02                            | 16.19 | 0.194 | 11.39 | 0.519 | 0.08                | 9.49               | 0.079                            |

Supplementary material 5





Supplementary material 6

## Radiogenic ratios

| Titanite | $U^{238}/Pb^{206}$ | $\pm$    | $Pb^{207}/Pb^{206}$ | $\pm$   |
|----------|--------------------|----------|---------------------|---------|
| Tit.1.1  | 35.71429           | 0.459184 | 0.37578             | 0.00507 |
| Tit.1.2  | 52.11047           | 0.624565 | 0.19117             | 0.00227 |
| Tit.1.3  | 54.34783           | 0.679348 | 0.1926              | 0.00243 |
| Tit.1.4  | 41.89359           | 0.544073 | 0.31435             | 0.00447 |
| Tit.1.5  | 21.39495           | 0.279224 | 0.58918             | 0.00800 |
| Tit.1.6  | 52.88207           | 0.643198 | 0.21536             | 0.00280 |
| Tit.1.7  | 38.44675           | 0.532135 | 0.37459             | 0.00628 |
| Tit.1.8  | 28.52253           | 0.423038 | 0.46525             | 0.00867 |
| Tit.1.9  | 47.66444           | 0.613413 | 0.27628             | 0.00411 |
| Tit.1.10 | 53.07856           | 0.647987 | 0.23032             | 0.00289 |
| Tit.1.11 | 46.97041           | 0.595679 | 0.26113             | 0.00349 |
| Tit.1.12 | 45.06534           | 0.568648 | 0.28406             | 0.00412 |
| Tit.1.13 | 48.6618            | 0.615672 | 0.25248             | 0.00353 |
| Tit.1.14 | 37.17472           | 0.469866 | 0.38335             | 0.00515 |
| Tit.1.15 | 48.92368           | 0.598382 | 0.22501             | 0.00278 |
| Tit.1.16 | 32.49919           | 0.433041 | 0.41579             | 0.00612 |
| Tit.2.1  | 53.07856           | 0.647987 | 0.19466             | 0.00263 |
| Tit.2.2  | 24.14293           | 0.303098 | 0.52607             | 0.00654 |
| Tit3.1   | 24.44988           | 0.328788 | 0.53126             | 0.00783 |
| Tit4.1   | 29.7619            | 0.380882 | 0.47789             | 0.00641 |
| Tit4.2   | 28.82675           | 0.415491 | 0.49704             | 0.00880 |
| Tit5     | 30.83565           | 0.446893 | 0.46060             | 0.00822 |
| Tit.1.17 | 25.29084           | 0.351795 | 0.50170             | 0.00810 |
| Tit.1.18 | 38.72967           | 0.509996 | 0.34505             | 0.00532 |

Supplementary material 7