**DM3: Details of depth determinations**

Yang (2017) provided an empirical method for estimating the crystallization pressure of water-saturated and quartz-oversaturated granitic systems. The method is based on haplogranite ternary phase equilibria derived from laboratory melting experiments. Yang (2017) showed that pressure exhibits a positive curvilinear relationship with normative quartz (Qtz) and a negative curvilinear relationship with normative albite (Ab) plus orthoclase (Or), providing two independent geobarometers for granitic intrusions. The geobarometers are effective over ranges of 15-40 wt% *Qtz* and 60-85 wt% *Or+An*. Over these compositional ranges the difference in pressure estimates derived from the two equations is ~16 MPa.

This method has been applied to the acid members of the Souter Head suite of rocks using nominal Fe3+/FeT=0.20. Samples SH4, SH11 and SH9 have *Qtz* contents ~40 wt% and are thus at the extreme limits of the calibration of the method and the pressure estimates of <100 MPa they provide must therefore be treated with caution. However, quartz-feldspar porphyry SH5 contains 27.5 wt% *Qtz* and falls well within the range of the calibration of the method. Sample SH5 yields pressures of crystallization of 395 and 363 MPa for the *Qtz* and *Ab+Or* barometers respectively. Increasing Fe3+/FeT to 0.45 decreases pressure by ~20 MPa which is close to the uncertainty between the two geobarometers. Consequently, variation in iron oxidation state is not critical in providing pressure estimates for this sample.

Depth estimate: Average crustal density is between granite (2.72 t/m3) and diorite 2.90 t/m3) in composition. Depth estimates for the former are 14.7 km (394 MPa) and 13.6 km (363 MPa) and for the latter 13.8 km (394 MPa) and 12.7 km (363 MPa). The estimated depth of emplacement for the Souter Head complex is in the range 13-15 km.

Calculations were made using the elemental data reported in Rice and Mark, this issue (also reported below). References reported in main text.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SH4 | SH11 | SH9 | SH5 |
| 100% dry basis | NXG | XG | Peg | QP |
| SiO2 | 72.50 | 72.82 | 74.02 | 73.70 |
| TiO2 | 0.38 | 0.38 | 0.13 | 0.06 |
| Al2O3 | 15.15 | 14.43 | 15.57 | 15.44 |
| FeO | 2.46 | 2.80 | 1.30 | 0.95 |
| MnO | 0.04 | 0.02 | 0.01 | 0.03 |
| MgO | 0.58 | 0.49 | 0.23 | 0.10 |
| CaO | 1.65 | 0.76 | 0.53 | 0.31 |
| Na2O | 3.28 | 2.53 | 2.37 | 4.61 |
| K2O | 3.77 | 5.60 | 5.70 | 4.74 |
| P2O5 | 0.19 | 0.16 | 0.14 | 0.05 |
| CIPW Norm Fe3+/FeT=0.20 | | | | |
| Qtz | 33.90 | 33.36 | 36.65 | 27.52 |
| Or | 22.79 | 33.09 | 33.68 | 28.01 |
| Ab | 27.75 | 21.41 | 20.05 | 39.01 |
| An | 6.90 | 2.73 | 1.71 | 1.21 |
| Cc | 3.12 | 3.21 | 4.87 | 2.28 |
| Hy | 4.11 | 4.31 | 2.08 | 1.45 |
| Mt | 0.75 | 0.86 | 0.39 | 0.29 |
| Il | 0.72 | 0.72 | 0.25 | 0.11 |
| Pressure estimates | | | | |
| Qtz eqn 1 MPa | 29 | 94 | 15 | 394 |
| Ab+Or eqn 2 MPa | 21 | 86 | 7 | 363 |

CIPW norm and derived pressure estimates for Souter Head acid intrusive rocks. Major elements are calculated to 100% on a dry basis and CIPW NORMS with a nominal Fe3+/FeT=0.20. ‘eqn 1’ and ‘eqn 2’ refer to equations 1 and 2 respectively of Yang (2017)