Geochemical analysis

The sampling was undertaken throughout several field campaigns in 2008, 2009 and 2010. Samples from the Amasia ophiolite and related metamorphics were analyzed for major and trace elements, including Rare Earth Elements (REE; Table 1). Samples were analyzed at the C.R.P.G. (Nancy, France). Analytical procedures and analyses of standards can be found on the following website (http://www.crpg.cnrs-nancy.fr/SARM). Additional data pertaining to the other Armenian ophiolites are published in Galoyan *et al*. (2009) and Rolland *et al*. (2009b; 2010).

In order to designate geochemical affinities and corresponding tectonic environments for sampled rocks (Pearce and Cann, 1973; Floyd and Winchester, 1975; 1978; Pearce and Norry, 1979; Pearce, 1982; 1983; 1996) the option to study relatively immobile elements, such as Ti, Zr, Y, Nb, Ta, Th, V and REEs, was chosen because of their relative immobility throughout low grade submarine alteration (e.g. Hart *et al*., 1974; Humphris and Thompson, 1978) (Figs. 8A, B & C). Normal Mid Oceanic Ridge Basalt (N-MORB) normalized spidergrams for the Armenian ophiolites are presented in Fig. 8D. In Amasia, considering the geochemical data obtained from ophiolite samples and related metamorphic rocks, two tendencies are observed: supra-subduction tholeiitic and alkaline.

Petrography and mineral chemistry

Mineral compositions were determined by electron probe microanalysis (EPMA). The analyses are presented in Tables 2-5. They were carried out using a Cameca Camebax SX100 electron microprobe at 15 kV and 1 nA beam current, at the Blaise Pascal University (Clermont-Ferrand, France). Natural samples were used as standards.

$^{40}Ar/^{39}Ar$ Dating

Geochronology was undertaken by single-grain laser $^{40}Ar/^{39}Ar$ dating on different mineral phases, amphiboles and white micas for amphibolites and green-schists parageneses, respectively. $^{40}Ar/^{39}Ar$ dating results are presented in Table 6 and Fig. 11 and detailed in the Appendix S2-S5. The amphiboles and white mica were analyzed by EPMA prior to dating in order to check mineral composition homogeneity (Tables 2 & 4). Grains between 800 µm and 500 µm were separated by careful selection by hand-picking under a binocular microscope to prevent the presence of altered grains. The samples were then irradiated in the nuclear reactor at McMaster University in Hamilton (Canada), in position 5c, along with Hb3gr hornblende neutron flux monitor, for which an age of 1072 Ma is adopted (Turner *et al*., 1971). The total neutron flux density during irradiation was 9.0×10^{18} neutron cm^{-2}. The estimated error bar on the corresponding $^{40}Ar^*/^{39}Ar_K$ ratio is ± 0.2% (1r) in the volume where the samples were set. All $^{40}Ar/^{39}Ar$ measurements were undergone in the University of Nice-Sophia Antipolis (UMR 7329 Géoazur). Analyses of amphibole grains were undertaken by step heating with a 50 W CO2 Synrad 48-5 continuous laser beam. Measurement of isotopic ratios was done with a VG3600 mass spectrometer equipped with a Daly detector system. Detailed procedures are described in Jourdan *et al*. (2004). The typical blank values for extraction and purification of the laser system are in the range 4.2–8.75, 1.2–3.9, and 2–6 cc STP for masses 40, 39 and 36, respectively. Mass discrimination was monitored by regularly analyzing air pipette volumes. Decay constants are those given by Steiger and Jäger (1977). Uncertainties on apparent ages are given at the 2σ level and do not include the error on the $^{40}Ar^*/^{39}Ar_K$ ratio of the monitor. Plateau and isochron age estimates are given with a 1σ error. Considering the homogeneous distribution of Ca/K values during the experiments and EPMA analysis, only one mineral phase has contributed to the $^{40}Ar/^{39}Ar$ signal in each sample.

U-Pb dating

LA-ICP-MS U–Th–Pb rutile analyses were performed in-situ on thin section. Analyses were carried out using a Lambda Physik CompEx 102 excimer laser generating 15 ns duration pulses of radiation at a wavelength of 193 nm. For analyses, the laser was coupled to an Element XR sector field ICP-MS (AETE-ISO regional facility of the OSU OREME, University of Montpellier). The instrument was tuned for maximum sensitivity and low oxide production (ThO/Th < 1%). Analytical conditions are identical to those reported in previous studies (e.g. Bosch et al., 2011; Bruguier et al., 2017) where ablation experiments were performed under helium, which enhances sensitivity and reduces inter-element fractionation (Gunther and Heinrich, 1999). The helium stream and particles ablated from the sample were mixed with Ar before entering the plasma. Laser spot size was 51 μm. The laser was operated at a repetition rate of 4Hz using a 12 J/cm^2 energy density. Total analysis time was 60s with the first 15s used for background measurement (laser disabled) which was substracted from the sample signal. Before each analysis, the surface of the targeted zone was cleaned with 10 pulses using a spot size twice larger than the size used for U-Pb analyses. All isotopes (202Hg, 204Pb + Hg, 206Pb, 207Pb, 208Pb, 238U and 232Th) were measured in pulse counting mode. The isotopes were measured using 15 points per peak and a 20% mass window resulting in 3 measured points for each mass station. Pb/U and Pb/Pb ratios were calibrated against the rutile reference material R10 (Luvizotto et al., 2009) which was measured four times each block of five unknowns. Reproducibility of the 207Pb/206Pb and 206Pb/238U ratios for the R10 standard was 0.4% and 1.1% respectively in the course of this study (n = 10). U-Pb isotopic data were reduced using GLITTER software (Reference) by carefully selecting the integration range for gas blank and sample. The decay constants and present-day 238U/235U value given by Steiger and Jäger (1977) were used and ages were calculated using the program Isoplot/Ex of Ludwig (2002).