V11B-09 1050 H

$^{40}Ar/^{39}Ar$ Isotopic Results for the Basement Rocks of a Young Mountain Belt in Taiwan

C. H. Lo and T. C. Onstott (Dept. Geol. & Geophys. Sci., Princeton Univ., Princeton NJ 08544)

To shed light on the thermal evolution of the active mountain belt of Taiwan, $^{40}Ar/^{39}Ar$ step-heating age analyses have been performed on hornblende, biotite, muscovite and K-feldspar from a poly-metamorphosed amphibolite, granitic rocks and a pegmatite in the basement of northern Taiwan. Hornblende from the amphibolite, which was intruded by the granites, yields 110-130 Ma dates for the high temperature steps. The plateau dates on hornblende (82 Ma) and muscovite (79 Ma) from the granites are younger than the 86-90 Ma U-Pb zircon dates published for the same granites, and probably record the post-intrusion cooling history.

The $^{40}Ar/^{39}Ar$ spectra for muscovite exhibit a release pattern similar to that expected for minor argon loss. The $^{40}Ar/^{39}Ar$ spectrum of K-feldspar from a pegmatite displays a saddle-shaped release pattern with a mid-temperature plateau at 1.9 Ma, which is considered to date the cooling and uplift related to the modern tectonism. The integrated dates on biotites range from 20 to 32 Ma and the spectra exhibit an undulatory shape similar to that observed by York and Lopez-Martinez (1986) reflecting partial argon loss.

York, D. and Lopez-Martinez, M. (1986) The two-faced mica, Geophysical Research Letters, 13, 973-975.

V11B-10 1105 H

Rapid Early Miocene Uplift of Southern Tibet

PETER COPELAND, T. MARK HARRISON, W.S.F. KIDD (Dept. of Geological Sciences, SUNY at Albany, Albany, NY 12222)
XU RONGHUA, ZHANG YUQUAN (Academia Sinica, Beijing, PRC)

Five samples from the 42 Ma old Quxu granodiorite of the Gangdese Batholith, southern Tibet, ~25 km SW of Lhasa, have been collected at 250 m vertical intervals along a 2 km traverse from 3.6 to 4.6 km ASL. Biotite from these rocks yield monotonically decreasing $^{40}Ar/^{39}Ar$ total gas ages with decreasing elevation of 26.8 ± 0.2, 23.3 ± 0.5, 19.7 ± 0.3, 18.4 ± 0.4 and 17.8 ± 0.1 Ma, respectively. Coexisting K-spars have minimum ages in the early portion of $^{40}Ar/^{39}Ar$ release which are essentially identical at 17.0 ± 0.5 Ma. The calculated closure temperature (T_c) for this interval is ~250°C. From the differences in age, elevation, and/or T_c of these samples, advection corrected uplift rates can be calculated for the period 25-17 Ma. These results indicate a constant and relatively slow uplift rate of $0.07^{+0.03}_{-0.01}$ mm/a from 25 to 20 Ma. Between 20 and 17 Ma this region experienced a continuously accelerating uplift to a rate in excess of 1.3 mm/a. The subsequent uplift rate of these rocks is constrained to an average of 0.6 mm/a over the past 19 Ma from the requirement that rocks presently exposed at the surface were at the biotite Ar closure isotherm (~11 km) at ca. 19 Ma. We can further constrain the post-15 Ma average uplift rate to about 0.4 mm/a because the rapid uplift episode at 19 to 15 Ma must be offset by a correspondingly slow rate since. Muscovite, biotite and K-spar $^{40}Ar/^{39}Ar$ age of 15.1 ± 0.4, 13.3 ± 0.1 and 9.7 ± 0.4 Ma, respectively, from a granite exposed in the southern Nyainqentanghla range, ~80 km to the NW, indicate uplift rates consistent with a rapid deceleration at 15 Ma. These results suggest that during the wanning phase of spreading of the South China Sea (20-17 Ma), continental convergence was translated into crustal uplift in southern Tibet before another mechanism began to accommodate the stress. These observations are consistent with the view of recent workers who have called upon topographic loading in the Middle Miocene to explain extensional features in the Higher Himalayas.

V11B-11 1120 H

Denudation rates of Grenville basement near Parry Sound, Ontario: Constraints from $^{40}Ar/^{39}Ar$ thermochronology

M.A. COSCA and E.J. ESSENE (Both at: Dept. Geological Sciences, University of Michigan. Ann Arbor, MI 48109)
J.F. SUTTER (USGS, Reston, VA 22092)

$^{40}Ar/^{39}Ar$ age spectra of hornblende, biotite and microcline help constrain rates of cooling and uplift of upper amphibolite to granulite facies metamorphic rocks in the Grenville Province near Parry Sound, Ontario. Peak metamorphic conditions for this area are 750 ±50°C and 10.5 ± 1.0 kb. $^{40}Ar/^{39}Ar$ plateau ages range between 970-1000 Ma for hornblende, 860-920 Ma for biotite and 845-875 Ma for microcline. Calculations based on Ar closure temperatures of 480 to 500°C for hornblende, 260 to 280°C for biotite and about 150°C for microcline yield linear cooling rates of 2-4°C/Ma between about 500 and 150°C. Some differential cooling between structural domains is evidenced by variable mineral ages between domains and by hornblende ages less than 970 Ma in or near ductile shear zones that bound the domains.

A portion of the high-temperature and -pressure end of the retrograde P-T path for this region has been estimated from zoning profiles in garnet. Projection of this path to the Ar closure temperature for hornblende followed by linear extrapolation to surface conditions yields an average geothermal gradient of 28°C/km in the depth range where temperatures are 500°C or below. Calculations incorporating this geothermal gradient with ^{40}Ar-^{39}Ar age data yield denudation rates that range from 0.07 to 0.14 km/Ma for temperatures between about 500 and 150°C. This apparently slow time-averaged denudation rate may be characteristic of terranes where large-scale crustal shortening has occurred, such as is presently inferred below the Tibetan plateau.

V11B-12 1135 H

Dating Ontario's Gold

N. DAWN McMASTER, A. MASLIWEC, DEREK YORK (Dept. of Physics, University of Toronto, Toronto, Ontario, M5S 1A7, Canada), S. MARMONT and A. J. ANDREWS (Ontario Geol. Surv., Toronto, Ontario, M7A 1W4, Canada)
(Sponsor: P. W. Layer)

40Ar/39Ar age spectra have been obtained for mineral samples drawn from the Dome and Hollinger mines near Timmins, the Hemlo deposit, and the Red Lake area.

In the Timmins area, U-Pb ages on zircons from gold-hosting porphyries, and argon spectral ages on green micas coeval with the gold indicate that the Dome and Hollinger deposits are approximately 2630-2688 and 2615-2688 m.y. old, respectively. Age spectra from the micas record the effects of disturbances which mathematical modelling indicates occurred roughly 2450 m.y. ago. In contrast, the age spectrum of the Hemlo mica is only slightly disturbed and suggests that the Hemlo gold is at least 2670 m.y. old.

Gold in the Red Lake area is known to be younger than the 2718±1 m.y. Dome Stock (U-Pb age by Corfu and Wallace, 1986). 40Ar/39Ar spectral dating of hornblendes and micas from plutons and surrounding rocks shows that rapid cooling followed the end of pluton emplacement. Age spectra of micas from gold mines suggest a minimum age of 2630 m.y. for the mineralization. The age spectra of micas from the Cochenour and Campbell mines are strikingly reminiscent of those found at Timmins and suggest that both regions may have been disturbed by movements on faults several hundred million years after regional cooling.

Phase Transformations and Mineral Properties at Very High Pressures (V11C)

Room 104 Mon AM
Presiders, R. Jeanloz
Univ of California B
R. M. Hazen
Carnegie Inst. of Washington

V11C-01 0830 H

Crystal structure of andradite to 190 kbar: An optimal x-ray diffraction experiment

R. M. HAZEN and L. W. FINGER (Both at: Geophysical Laboratory, 2801 Upton St., N.W., Washington, DC 20008)

The crystal structure of the garnet andradite, $Ca_3Fe_2Si_3O_{12}$, has been determined at several pressures to 190 kbar, the highest pressure attained in a single-crystal structure study. The bulk modulus of this near end-member sample from Val Malenæ, Italy, is 1.59 Mbar ($K' = 4$), in agreement with recent measurements of Bass (*J. Geophys. Res.* 91, 7505-7516, 1986). The Ca 8-coordinated polyhedron, Fe^{3+} octahedron, and Si tetrahedron all show significant compression. The average Ca-O bond is approximately twice as compressible as Fe-O and Si-O bonds. In previous high-pressure structure studies, which were limited to lower pressures, significant Si-O compression was seldom observed. Bond compression is accompanied by a significant decrease in Si-O-Fe angle. The high-pressure behavior of andradite is thus similar to that of framework silicates, in which a corner-linked network of smaller, more rigid polyhedra "collapses" about larger, more compressible polyhedra.

Two modifications of standard procedures optimize single-crystal structure determinations above 100 kbar. First, a crystallized gas (in this instance neon) is used as the pressure-transmitting medium. Gas media, including H, He, Ne and Ar, remain quasi-hydrostatic to more than 500 kbar, well above the limit for conventional pressure liquids. Single-crystal research at lower mantle pressures thus appears feasible.

The second modification of standard single-crystal procedures is to make relatively long intensity measurements of a selected subset of accessible reflections, rather than making shorter measurments of all reflections. In garnet, with a cubic unit cell edge of 12.05 Å, there are more than 1,000 accessible reflections in a diamond-cell experiment, but only 3 variable positional parameters (the x, y, and z of oxygen). The ten structure factors that most significantly affect the determination of these positional parameters are determined by the procedure of Prince and Nicholson (in A.J.C.Wilson (ed.), *Structure and Statistics in Crystallography*, pp.183-196) and all accessible equivalent reflections are collected. In a typical experiment the data collection time is reduced by approximately half, compared to conventional methods, but the precision of the resulting coordinates is improved by 30%.

V11C-02 0845 H

Reversals of the High-Pressure Phase Transition in $MnTiO_3$

JAIDONG KO, C. T. PREWITT and T. GASPARIK (Department of Earth and Space Sciences, State University of New York, Stony Brook, New York 11794)

The phase transition in $MnTiO_3$ between the low-pressure ilmenite phase and high-pressure $LiNbO_3$ phase (Jaidong Ko and C. T. Prewitt, 1986, EOS 67, 1240) was reversed at 1200 and 1400°C, using the DIA-6 type cubic anvil apparatus (SAM-85). The temperature was measured with W3%Re vs. W25%Re thermocouples and controlled automatically. The starting material was a 1:1 mix of the low-pressure phase synthesized at 1 atm and 940°C and the high-pressure phase synthesized at 80 kbar and 1100°C using a split sphere cubic anvil apparatus (USSA-2000). The boundary was located at 1200°C and 56.7 (± 0.6) kbar, and at 1400°C and 46.3 (± 0.6) kbar. The pressures are based on the calibration with a similar cell-assembly at 1000°C, using the fayalite-spinel (53 ± 2 kbar) and the $CaGeO_3$ garnet-perovskite (61 ± 1 kbar) transitions. The two brackets gave the following equation for the phase boundary:

$$P(\text{kbar}) = -0.052\ T\ (^{\circ}C) + 119.1\ .$$

Our data are in complete agreement with the reversed data of Syono et al. (1969, J. Phys. Chem. Solids 30, 1665-1672). However, the present tight reversals suggest a slightly larger negative slope of the boundary than the preferred solution of Syono et al. Work is in progress to obtain more reversals in the temperature range of 1000-1500°C and to refine the pressure calibration.

V11C-03 0900 H

Phase Transformations in Basalt, Harzburgite and Pyrolite Compositions to 25 GPa

T. IRIFUNE and A.E. RINGWOOD (Both at: Research School of Earth Sciences, Australian National University, Canberra ACT 2601, Australia)

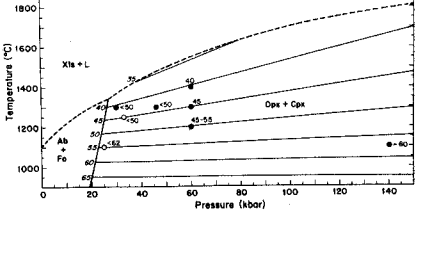
The mineralogies adopted by primitive MORB (DSDP), harzburgite and pyrolite compositions have been studied to 25 GPa at 1200-1400°C. The pyroxene-garnet components in these compositions transform to garnetite at 14 - 18 GPa, dependent on composition. $CaSiO_3$-rich perovskite is exsolved from garnet at about 20 GPa in both DSDP and pyrolite compositions, and garnet completely transforms to $CaSiO_3$-rich and/or $MgSiO_3$ perovskites by 25 GPa. Mineral proportions and densities in these compositions have been calculated as a function of depth. The density profile calculated for the pyrolite composition agrees well with that obtained from seismic observations throughout the upper mantle and the transition region. A calculation of density differences between subducting slab and surrounding pyrolite mantle demonstrates strong negative buoyancy of the slab at depths of 300 - 500 km whilst the slab becomes substantially buoyant between 670 and 750 km. These results have important implications for the mechanism of deep focus earthquakes and the dynamical behaviour of the slab when it encounters the 670 km discontinuity.

V11C-04 0915 H

The Enstatite-Jadeite Solvus at 140 kbar

TIBOR GASPARIK (Department of Earth and Space Sciences, State University of New York, Stony Brook, N.Y. 11794)

The compositions of coexisting orthopyroxene (Opx) and clinopyroxene (Cpx) on the enstatite ($En=Mg_2Si_2O_6$) - jadeite ($Jd=NaAlSi_2O_6$) join were experimentally determined at 1200-1400°C and 30-60 kbar in a DIA-6 type cubic anvil apparatus (SAM-85). The resulting orthopyroxene has compositions in the range of 10-15 mol % Jd and clinopyroxene contains 40-50 % Jd (Gasparik, 1986, EOS, 67, 368). This study is now being extended to pressures above 100 kbar using a split-sphere cubic anvil apparatus (USSA-2000). At 140 kbar and 1100°C, the Jd-rich C2/c clinopyroxene containing around 60 mol % Jd coexists with an En-rich $P2_1/c$ clinopyroxene with 25-30 % Jd. Thus, the solubility of Jd in the En-rich pyroxene increases with pressure. Such pyroxene could be stable to much higher pressures than the enstatite endmember and thus could play a major role in the transition zone. The Figure shows the Jd-content of the coexisting clinopyroxene, which is mostly pressure independent.



velocity and the recurrence interval between the inception of successive magma spheres.

The model constrains geologically realistic combinations of magma body size, ascent velocity and recurrence interval. For magma spheres of 2-4 km radii, ascent velocities of 1.E-7 to 6.E-9 m/s and recurrence intervals of 3000 to 80,000 yrs, the model predicts that the volume of magma erupted from any system may represent only a small fraction of the total magmatic input. Most magma bodies cool and solidify at depth, losing heat and thermally preparing a conduit capable of erupting magma at the surface. The geothermal gradient adjacent to such a conduit becomes significantly steeper with increasing magmatic input. Establishing a conduit which permits eruption of magmas can take place relatively rapidly; 8000 years are required for ascent velocities of 6.E-7 m/s, whereas up to 1.8 million years are required for larger bodies ascending 6.E-9 m/s.

Marsh (1978) Phil Trans Roy Soc London, 288:611-625

V11A-09 1042 H

Rhythmically Layered Gabbros from the Bay of Islands Ophiolite

DON ELTHON [2,3], STEVE KOMOR[1], and JOHN F. CASEY [3]
(1. Dept. Geol. & Geophys. Univ. of Wisc., Madison, WI 53706 2. LPI, 3303 NASA Rd. 1, Houston, Tx. 77058 3. Dept. of Geosciences, Univ. of Houston, Houston, Tx. 77004)

A rhythmically layered interval 4-10 m wide outcrops at the base of the layered gabbro unit of the BOI ophiolite. One traverse across the rhythmic interval encounters 37 adcumulate anorthosite layers (98-100% PLAG, balance CPX; Zr<6 ppm) with average thickness 1.3 cm, and 36 adcumulate to mesocumulate gabbroic layers (49% PLAG/40% CPX/10% OL/1% OPX; 6<Zr<20 ppm) averaging 6.9 cm thick. The rhythmic interval's integrated average modal composition is 57% PLAG/34% CPX/8% OL/1% OPX. Sharp contacts (1-5 mm across) are present between anorthosite layers and overlying gabbroic layers, whereas contacts between anorthosites and underlying gabbro are diffuse (5-20 mm). Olivine compositions in the gabbroic layers are Fo83.7-86.5, with corresponding calculated liquidus temperatures of 1205-1229 °C. The rhythmic interval is sandwiched between thick (>50 m) layers of monotonous gabbro with nearly constant modal proportions (54% PLAG/39% CPX/3% OL/4% OPX). Olivine compositions in these gabbros are Fo73.7-77.8, corresponding to crystallization at 1161-1181 °C. The transition from the rhythmic interval to the massive gabbros occurs over a stratigraphic interval of <1 m. Modeling of OL Mg#'s and NiO contents suggests that the rhythmically layered and massive gabbros crystallized from two separate magma batches, unrelated by fractional crystallization. A possible scenario for production of the rhythmic layering begins with crystallization and cooling of the massive gabbros. The incoming olivine-saturated magma destined to produce the rhythmically layered gabbros is chilled against the massive gabbros. Chilling causes the magma to depart from its equilibrium liquid line of descent (ELLOD) and enter the PLAG primary phase volume, releasing a flood of PLAG crystals (anorthosite). The magma composition now is driven toward the ELLOD, but severe depletion in normative PLAG causes it to bypass the ELLOD and crystallize gabbros deficient in PLAG relative to cotectic proportions. The layered interval builds up by continued oscillation of the magma composition about the ELLOD. The final form of layer contacts in the rhythmic interval (i.e. sharp or diffuse) is a consequence of postcumulus solute-rejection.

V11A-10 1056 H

Correlation of Residual Liquid Composition with Roof Rock Composition in the Dore Lake Complex, Quebec

LAPALLO, CHRISTOPHER M., ALFARO, M., RODEN, M.F., ALLARD, G. O., (All at the Department of Geology, University of Georgia, Athens, Georgia 30602)

The Dore Lake Complex is an Archean layered intrusion which exhibits remarkable compositional heterogeneity in its upper units. In the south a quartz-feldspar porphyry (QFP) forms the roof. Anorthosite occurs at the base of the section and is overlain by (1) layered ferropyroxenite, ferrogabbro, magnetitite; (2) massive ferrodiorite; (3) Na2O-rich granophyre and (4) and an "upper border zone" (ferrogabbro, diabase, gabbroic-anorthosite). In the north a carbonate-rich banded iron formation intercalated with chlorite schists and metabasalts forms the roof. Here, anorthosite is overlain by (1) poorly layered ferrowebsterites and ferrodunites; (2) an "upper" anorthosite and (3) an Fe-rich, ultramafic upper border zone. Major and trace element analyses indicate that the sodagranophyres and the QFP's are remarkably similar (high Na2O, Zr, SiO2, low FeO*, MgO, CaO) and are distinct from the ferrodiorites (high FeO*, moderate SiO2, CaO, low MgO). Granophyres are not associated with the Fe-rich ultramafics in the north and the rocks at the top of the section are rich in FeO*, MgO and poor in SiO2 and alkalies.

The sodagranophyres appear to represent melts of the QFP, whereas, the underlying ferrodiorites may represent a residual liquid from the crystallization of the layered complex. The difference in inferred densities of the two liquids (0.3 g/cm^3) prevented comingling and preserved the compositional differences. To the north, bulk melting of the refractory roof rocks is unlikely but compositional and mineralogical contrasts between the Fe-rich ultramafics here and the ferrodiorites in the south, and the occurrence of carbonate xenoliths in the Fe-rich ultramafics suggest that assimilation of Fe-carbonates desilicified the residual liquid causing crystallization of abundant Fe-rich olivine.

V11A-11 1110 H

The Lake Owens Mafic Complex, SE Wyoming: I. geologic field relations

JAMES D. MYERS, ALLAN D. PATCHEN and ROBERT S. HOUSTON, Department of Geology and Geophysics, University of Wyoming, Laramie, Wyoming 82071

The Lake Owens Mafic Complex (LOMC) is a layered, Precambrian body in SE Wyoming that has been tilted to reveal a 5.8 km thick section of mafic rocks. The body, which consists of gabbronorite, olivine gabbro, troctolite and minor anorthosite lenses, has been divided into three zones (Lower Zone-LZ; Middle Zone-MZ; Upper Zone-UZ). The LZ is ≈2.3 km thick and marked at the base by orthocumulates (≤ 600m). Mesocumulates dominate the rest of the LOMC. Above this section, the LZ is dominated by oxide gabbronorite. Gabbronorite and a fine-grained olivine gabbro are also found in the LZ. Well-developed planar, mineral-graded layering (pyx at the base and plag at the top) and mymerkitic quartz-plagiocalse intergrowths are common in the gabbronorite. The base of the MZ is marked by a 500m thick troctolite which forms an excellent marker horizon throughout the complex. Abundant, rounded to elongate cpx-rich clots (≤ 25cm) are common at the base but give way to thin, wavy, discontinuous, cm-thick layering throughout most of the troctolite. A distinctive Cr-magnetite-bearing layer marks the top of this unit. Above the troctolite, the MZ consists of a 1 km thick olivine gabbro with wispy layering. Two cycles of gabbronorite separated by an olivine gabbro (1.3 km) complete the MZ. The base of the UZ is marked by an olivine oxide gabbro containing a well-layered section. Above this unit, the UZ contains gabbronorite. The exposed UZ is 700m thick and of limited lateral extent. A cyclic distribution of oxide phases, early primary cumulus opx, a general lack of olivine, an overall leucocratic nature and the absence of extreme differentiation distinguish the LOMC from most layered mafic bodies. These features are attributed to a primary magma with high aSiO2 and replenishment of the magma chamber with more mafic liquids.

V11A-12 1124 H

The Lake Owens Mafic Complex, SE Wyoming: II. mineralogy and compositional characteristics

ALLAN D. PATCHEN and JAMES D. MYERS, Dept. of Geology and Geophysics, Univ. of Wyoming, Laramie, Wyoming 82071

Cumulus assemblages in the Lake Owens Mafic Complex include: pl-cpx-opx-oxides; pl-ol; pl-cpx-ol;pl-cpx-opx; and pl-cpx-ol-oxides. Except for a small area along the base with pl-cpx-ol, the Lower Zone consists of a thick sequence of pl-cpx-opx±oxides. The Middle Zone begins with pl-ol cumulate phases and the appearance of Cr-spinel. Spinel reaches a maximum (2%) immediately before the appearance of cumulus cpx. Olivine decreases in abundance upward and is replaced by opx. Upsection the amount of opx increases and oxides join the cumulus assemblage. Near the top of the exposed section, a pl-cpx-ol-oxide cumulate appears. Major intercumulus phases are cpx, opx and hbl. Minor phases include ap, qtz and bt. Hornblende is most abundant in the lowest orthocumulate and is a minor phase in the rest of the body. Although cpx and opx are significant intercumulus phases in the troctolites, only opx is important in the olivine gabbro. Hbl is the dominate intercumulus phase in gabbro norites. Intercumulus minerals seldom account for more than 10 vol % of any rock type.

Compositions of cumulus phases are nearly constant in the Lower Zone (An60; opx - En65; cpx - En41Wo43). At the base of the Middle Zone, all phases exhibit a significant shift toward higher temperature compositions, i.e. An80 opx - En75; cpx - En43Wo46. The cumulus olivine defining the base of the MZ is intermediate in composition (Fo76-80). Proceeding upsection, the phases define weak fractionation trends. Representative compositions at the top of the body are: An56; opx - En58; cpx - En38Wo44; Fo64.

These compositional features are attributed to influxes of more mafic magma into the body. The troctolite with its marked change in cumulus mineralogy and compositions probably represents a major influx. Smaller degrees of replenishment are probably represented by thin, unusually mafic units throughout the complex.

V11A-13 1138 H

A LATE ARCHEAN/EARLY PROTEROZOIC ANORTHOSITIC INTRUSION IN THE GRENVILLE PROVINCE

L.D. ASHWAL (Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058)
J.L. WOODEN (U.S. Geological Survey, Isotope Geology Branch, 345 Middlefield Rd., Menlo Park CA 94025

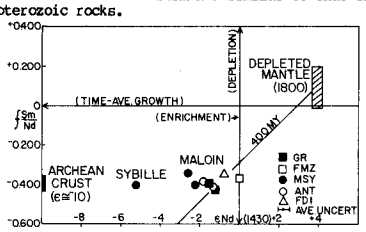
The River Valley Pluton (RVP) is a 100 km^2 body of anorthositic and gabbroic rocks about 50 km NE of Sudbury. RVP is entirely within the Grenville Province, but its western margin is a series of imbricate thrust faults associated with the Grenville Front Tectonic Zone. RVP is dominated by coarse leuconorite and leucogabbro, with lesser anorthosite, gabbro, and rare ultramafics. Igneous textured rocks are abundant, are being quarried for building stone, and consist of plagioclase (An_{60-70}) with abundant Fe-Ti oxide inclusions (giving the rock a deep black color), low-Ca pyroxene (opx and/or inv. pig.), and augite. A variety of deformed and metamorphosed equivalents of these rocks are present, and are composed largely of calcic plagioclase and hornblende, with minor garnet, epidote, biotite, sphene and quartz. Sr, Nd, and Pb isotope studies show the following. 10 samples (igneous & deformed) give a Pb-Pb whole rock isochron of 2556 ± 155 Ma; the subset of 6 igneous textured samples gives 2554 ± 75 Ma, which probably represents the time of primary crystallization. RVP is thus the oldest anorthositic intrusive yet recognized in the Grenville Province, although it is different (more calcic, augitic & lacks Fe-Ti oxide ores) from typical massif anorthosites. An Sm-Nd isochron (2 igneous leucogabbros + 1 cpx separate) gives 2377 ± 68 Ma, suggesting slight resetting. The Rb-Sr system gives 2185 ± 105 Ma, indicating either a discrete event at this time or a partial resetting from a variety of younger possible events including the Grenvillian event about 1 Ga ago. Initial isotopic ratios correspond to μ_1 = 8.05, ϵ_{Nd} = 0 to -3, and I_{Sr} = 0.7015 - 0.7021, which collectively imply an Archean upper crustal component as a contaminant of a mantle derived primary magma.

V11A-14 1152 H

Implications of Nd Isotopes in the Maloin Ranch Pluton, Laramie Anorthosite Complex (LAC), Wyoming

A. Kolker, D. H. Lindsley, and G. N. Hanson (Dept. of Earth and Space Sciences, SUNY, Stony Brook, NY 11794)

The Maloin Ranch Pluton, a Proterozoic composite intrusion at the SE margin of the Laramie Anorthosite, lies about 30 km south of a projected shear zone separating Archean (north) and Proterozoic (south) country rocks. ϵNd(1430) for the Maloin Pluton ranges from -0.02 to -2.61 for samples including fine-grained monzonite (FMZ), ferrodiorite (FDI), monzosyenite (MSY), anorthosite (ANT), and granite (GR). Our mapping indicates that all members of the Complex intruded in rapid succession, possibly within the error of U-Pb-zircon dating of LAC monzosyenites (1430± 15; Subbarayudu et al., 1975 GSA Abs.). Of several possible interpretations, the Nd data are most consistent with generation of the ANT-MSY-GR suite from lower-crustal material which was derived from a depleted mantle at about 1800 m.y. (figure). Such a crustal precursor appears to match the oldest crust south of the Archean/Proterozoic discontinuity (Depaolo, 1981, Nature). A single sample (ϵ(1430) = -5.2) from the Sybille MSY, located along the trace of the discontinuity, may have a substantial component of Archean crust with an f(Sm/Nd) similar to that of the Proterozoic rocks.



Ar-Ar and U-Pb Geochronology: Methods and Applications (V11B)

Room 303 Mon AM
Presiders, T. M. Harrison
SUNY Albany
J. J. Irwin
Univ of California B

V11B-01 0830 H

Detection of excess 40Ar in biotite - a reevaluation of the utility of the 40Ar-39Ar incremental heating technique.

Ajoy K. Baksi (Dept. of Geology, Louisiana State Univ., Baton Rouge, LA. 70803-4101).

A number of recent reports in the literature suggest that 40Ar-39Ar incremental heating studies on biotites containing excess argon ($40Ar_e$), may yield plateaus, where the ages do not carry chronological significance. These cases were reevaluated (where necessary) for proper recognition of plateaus, calculating errors in step ages in the proper manner [1].

Of 13 specimens known to contain > 10^{-4} ccNTP/g of $40Ar_e$, only four gave proper plateaus; the oft-cited biotites from granitoids in the Kola Peninsula [2] do not yield plateaus. Of 16 specimens containing 1-10 x 10^{-5} ccNTP/g of $40Ar_e$, 7 showed good plateaus, though some others closely approximated plateaus. Most biotites containing $40Ar_e$ released >50% of the total 40Ar at low (<760°C) laboratory heating temperatures. In contrast, bio-

EOS

Transactions, American Geophysical Union
Vol. 68 No. 16 April 21, 1987