24-3 BTH 20 Heck, Jason N.

THE PETROLOGY AND MINERAL CHEMISTRY OF SELECT LAMPROPHYRE DIKE INTRUSIONS IN WESTERN KENTUCKY

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The Illinois-Kentucky Fluorspar District (IKFD) of western Kentucky and southeast Illinois is one of the most productive fluorspar districts in the world. The IKFD includes a series of northwest trending ultramafic dikes that are classified as lamprophyres. The dikes have been hydrothermally altered to varying degrees by interaction with surrounding carbonate strata. This study was carried out to determine the primary mineralogy and mineral chemistry of the dikes and compare them to known mantle–derived lamprophyres. Samples were drill cores from the Hutson, Minner and Lady Farmer mines in western Kentucky. The Hutson dike is ±450 feet thick, although it is thought to be two parallel dikes. Primary mineralogy is biotite and clinopyroxene with accessory perovskite, Ti-magnetite and apatite. No primary olivine was observed, but serpentine pseudomorphs after olivine were present in the least altered samples. Petrographic analysis of least altered samples from the center of the dikes reveal a primary assemblage of subhedral coarse poikilitic biotite with inclusions of clinopyroxene and subhedral coarse to fine grain clinopyroxene. Secondary minerals are serpentine and leucoxene. Increasing alteration produced greater modal abundance of serpentine followed by dolomite. Most altered samples contain biotite, serpentine and dolomite. Samples from the dike margins contain medium to fine grain subheadral biotite. Clinopyroxene is coarse to medium grained with replacement by serpentine then dolomite. Dike samples show increased CPX replacement toward the margin rim of the dike. Wavelength dispersive electron microprobe analysis indicates CPX is diopside with Mg/(Mg+Fe) = 0.843 to 0.998. Biotite is Ti-phlogopite with Ti atoms/22 O = 0.048 to 0.571, and Mg/(Mg+Fe) = 0.799 to 0.926. Opaque phase is magnetite-spinel solid solution with minor Ti and Cr. These features will be compared to other alkalic ultramafic dikes and diatremes from the southwestern U.S.

24-4 BTH 21 Taylor, Jessica L.

CALC-SILICATE PODS IN NORTH COLUMBUS METAMORPHIC COMPLEX AND IN JUNCTION CITY MYLONITE GNEISS OF WEST-CENTRAL GEORGIA: DIOPSIDE+GARNET METAMORPHISM FOLLOWED BY ZEOLITE CRYSTALLIZATION

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Calc-silicate pods are minor but common parts of the North Columbus Metamorphic complex, a migmatitic unit that forms the central portion of the Lake Oliver Synform, the main structure of the Uchee Terrane of Georgia and Alabama. They are rare in the Junction City mylonitic orthogneiss, a possible western extension of the Carolina terrane. Amphibolite, pelitic gneiss, and metamorphosed mafic rocks are additional pod lithologies.

Though most calc-silicate pods are dominated by diopside with minor garnet, some pods contain the skarn-like assemblage of a diopside marble core surrounded by diopside, garnet, actinolite, epidote and plagioclase. Blue apatite is a common accessory. Where the marble has been dissolved, calc-silicate minerals are left behind in relief. Secondary calcite and zeolites partially fill these cavities. Stilbite, analcime, chabazite, laumantite, and mesolite have been identified by habit. In addition, blue barite is found in one cavity from Junction City.

We interpret these pods to be part of lithologically diverse terranes that were involved in migmatization during regional metamorphism (Uchee belt pods), or intruded by plutons (Junction City pods). Later, the calcite was dissolved from some pods and zeolites crystallized in the cavities probably under hydrothermal conditions.

24-5 BTH 22 Smith, Erin S.

MAPPING PARTS OF THE TOQUIMA AND TOIYABE RANGES IN NEVADA USING DEM ALONG WITH ASTER AND ALI REMOTE SENSING DATA

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The purpose of this study was to apply satellite remote sensing imagery combined with digital elevation data to map geologic units and structures exposed in the Toquima and Toiyabe ranges near Kingston, Nevada. This area is well suited for this type of research because of the abundance of phyllosilicate-bearing rock, carbonates, and volcanic units. Two types of remote sensing data sets were used: imagery from the ASTER (Advanced Spaceborne Thermal Emission and Reflectance Radiometer) operating on the Earth Observation System Terra satellite; and data from the EO-1 (Earth Observer 1) ALI (Advanced Land Imager) satellite. Both satellite sensors measure surface radiance in the VNIR (visible near-infrared) and SWIR (short wave infrared) spectral ranges.

Prior to image analysis, layer stacking of the VNIR and SWIR bands and masking of snow and vegetation were necessary to eliminate interference and facilitate use of spectral profiling. Next, band math ratios and analysis of spectral profiles were utilized to differentiate geologic units. Structures were mapped by applying shaded relief topography to a DEM (digital elevation model). Finally, we created a three-dimensional model exhibiting the geologic units and structures within the Toquima and Toiyabe ranges by draping the ASTER and ALI remote sensing results over a three-dimensional DEM of the region. Preliminary results of the comparison between use of ASTER and ALI data to map geologic units will be presented at the conference along with the results of ASTER and DEM mapping.

24-6 BTH 23 Betka, Paul M.

STRUCTURAL EVOLUTION OF THE SAURATOWN MOUNTAIN QUARTZITES: EVIDENCE FOR POLYPHASE DEFORMATION AND SHEARING

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Quartzites exposed in the Sauratown Mountains, NC provide a unique record of several phases of deformation along the continental margin during the Paleozoic. Sauratown quartzites represent a continental margin sedimentary package that was deposited on top of Mesoproterozoic (1.2Ga) schist and gneisses. The Sauratown Mountains window exposes the core of a broad anticlinorium containing intensely deformed interlayered quartzite (1-3m) and pelite (1cm – 10cm). Previous work suggests that following their deposition along the continental margin these rocks were transported westward from their original locations as part of the Blue Ridge – Piedmont thrust sheet to their current location in the western piedmont.

Relationships between overprinting, crenulation cleavage, and stretching lineations record three phases of deformation (D1-D3). Isoclinal recumbent folds (F1) trend east-west and are the earliest generation of folding. The axial surfaces (S1) create a pervasive sub-horizontal foliation throughout the outcrop. Isoclinal F1 folds are overprinted during D2 by southeast vergent, shallowly to moderately plunging (0º-32º) open F2 folds (N40ºE-N65ºE). Open folds are most commonly preserved in the pelitic layers and define a dominant crenulation in pelitic rocks associated with a steeply dipping southeast vergent foliation (S2). Stretching lineations are prevalent throughout the outcrop and are sub-parallel to the orogen. Previous work suggests that these stretching lineations were generated during D1 and D2 (L1 and L2) and then rotated to their current orogen parallel orientations by later warping (F3, F4) of the anticlinorium. However, it is possible that L1 and L2 stretching lineations were rotated to their current orientations by oblique convergence or shearing. Stretching lineations common in highly strained quartz veins are sub-parallel to the prominent stretching lineation throughout the outcrop indicating that crystal plastic processes accommodated some deformation during D3. These lineations (L3) record NE-SW extension when L1 and L2 were rotated into parallelism with L3. Together this evidence suggests that two phases of deformation in the Sauratown quartzites culminated in final phase of orogen-parallel extension.

24-7 BTH 24 Slack, Trever Z.

FRACTURE ORIENTATIONS IN MIOCENE SEDIMENTARY ROCKS, SOUTHEAST GEORGIA COASTAL PLAIN

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Neogene sedimentary rocks in the vicinity of Statesboro, GA consist of clastic rocks of the Miocene Coosawhatchie Formation. The rocks of the study area are weakly consolidated fine to coarse, locally conglomeratic, clayey sandstones with interbedded mudstone and siltstone. The presence of ghost shrimp burrows (*Ophiomorpha nodosa*) indicates that at least some of the Coosawhatchie Formation was deposited in an intertidal or shallow marine environment. Outcrops throughout the study area contain ubiquitous systematic joint sets. This study was undertaken to record fracture morphology, lithology, and the relative ages of the fracture sets found in the rocks of the Coosawhatchie Formation. A data set of 785 joint measurements was analyzed using stereonets and rose diagrams. Two joint set orientations were found to be dominant; I) 000°-180° +/- 20° and II) 070°-250° +/-20°. Three minor joint set orientations are III) 035°-215° +/- 15°, IV) 105°-285° +/- 15°, and V) 140° -320° +/- 15°. Dips of joints range from 75° to 90°. Relative age relationships, determined from joint terminations, indicate that set II is older than set I. Age relationships among the minor sets showed that set V is younger than the other two minor sets (III and IV). Age relationships between minor sets III and IV have not been determined. A strong relationship between lithology and fracture propagation exists. Fractures are better developed in sandstone layers than in clay-rich units. With increasing percentage of clay in sandstones, fractures are poorly developed and are typically non-linear. In outcrops with interbedded sandstone and mudstone, fractures in sandstone layers die out or terminate abruptly at contacts with mudstone layers. The joint orientations in this study are consistent with orientations and deformation sequences noted by previous workers in the Coastal Plain of GA (Bartholomew et al. 2000; Davis and Rich, 2005). The presence of systematic joint sets throughout sedimentary rocks of the GA Coastal Plain suggests fracturing in response to regional tectonic stresses, rather than localized deformation associated with discrete structures.

24-8 BTH 25 Hall, David

CRITERIA FOR DETERMINING LIVE VS. DEAD FAUNAL ELEMENTS AND FAUNAL INTERACTIONS ON AN OBRUTION SURFACE FROM THE UPPER ORDOVICIAN MIAMITOWN SHALE, SHARONVILLE, OHIO

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A bivalve shell pavement collected from the Upper Ordovician (Maysvillian) Miamitown Shale at Trammel Industrial Park in Sharonville, Ohio, preserved various marine organisms that were smothered by a thick layer of siliclastic mud. Taxa found included two species of bivalves *Ambonychia* and *Modiolopsus*, two species of gastropods *Loxoplocus* and *Cyrtolites*, one species of orthonconic cephalopod, three species of brachiopods *Zygospira*, *Dalmanella*, and *Ralinesquina*, one species of tube worm *Cornulites*, two species of edrioasteroids *Isorophus* and *Carnyella*, one trilobite species *Flexicalymene* and three species of bryozoans including encrusting globular trepostomes, thin ramose trepostomes, and dendritic cyclostomes. Evidence suggests that some of the taxa were part of the smothered community while others were skeletal debris on the sea floor prior to the obrution event. Criteria for the identification of living versus dead faunal elements include: faunal interactions, articulation of skeletal remains, preserved life position, preserved biological interaction, and nature of encrustation. Bivalves on the surface showed bryozoan encrustation on both internal and external surfaces clearly indicating they were debris. These shells form the substrate upon which the smothered community attached. The brachiopod *Zygospira* was found in life position in clusters around the bivalves suggesting live attachment at the time of burial. These brachiopods further showed biological interactions with *Cornulites* that were epibiotically attached to their valves with their apertures along the commissure where they fed parasitically from the brachiopod's feeding currents. The edrioasteroids were in life position and fully articulated indicating they were part of the live smothered community. *Rafinesquina, Flexicalymene*, thin ramose bryozoans, and cephalopods were preserved as broken and disarticulated skeletal debris suggesting that they were not part of the smothered community at least locally. Whether the encrusting trepostome and cyclostome bryozoans, and gastropods were alive or dead at the time of burial is equivocal.

24-9 BTH 26 Brellenthin, Stephen

SPACE UTILIZATION BY FAUNAL ELEMENTS ON A BIVALVE SHELL PAVEMENT, UPPER ORDOVICIAN MIAMITOWN SHALE, SHARONVILLE, OHIO

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An approximately 7,700 cm^2 slab of a bivalve shell pavement from the Upper Ordovician Miamitown Shale was collected in Sharonville, Ohio to examine spatial distribution of taxa. This deposit was preserved by obrution and includes species of bivalves, gastropods, cephalopods, brachiopods, *Cornulites*, edrioasteroids, and bryozoans. The surface is smooth, having only a few centimeters of relief. Local topographic highs occur where dead bivalve shells are found. To examine how the taxa were distributed on the substrate, spatial analyses were run on each of the species. A pavement of dead bivalve shells forms hard substrate of the slab, and the valves were determined to have a uniform distribution on the surface. Some weak clustering of edrioasteroids was observed where they were attached to the bivalves on the surface. Small edrioasteroids preferentially attached to the edges of bivalves whereas large edrioasteroids were centrally positioned. Edrioasteroids also showed weak orientation, with almost all individuals oriented between 150 and 360 degrees. The brachiopod *Zygospira* was found apparently attached to bivalve shells,