Geochemistry Laboratory Use Policy

Utah State University, Department of Geology

The Geochemistry Laboratories at Utah State University (USU) are available for use by students and faculty of the geology department as well as to other researchers and organizations. Laboratories include the X-ray lab (GEO 117), the general geochemistry lab (GEO 115), the Stable Isotope Lab (GEO 115), and the ICP-MS lab (GEO 115B). The Department of Geology can provide the following analytical services:

Table 1. Analytical Services and Points of Contact

Instrument	Analyses	Primary POC	Secondary POC	Note
IRMS	stable isotopes (C,H,O,N): solids, water, gas	Andrew Lonero	Dennis Newell	ThermoScientific Delta V + Costech EA + GasbenchII
XRD	Mineralogical composition	Kelly Bradbury	John Shervais	Panalytical X'Pert Pro XRD
XRF	Elemental analysis: solids	John Shervais	Andrew Lonero	Panalytical PW2400 WD-XRF
ICP-MS	Elemental analysis: liquids and solids	Andrew Lonero	John Shervais	Thermo X-Series 2 Quadrupol; New Wave Research UP-213 laser ablation system
Malvern	Particle size distribution	Tammy Rittenour	Andrew Lonero	Malvern Mastersizer 2000 laser particle size analyzer
Picarro CO_2 analyzer	CO_2 gas and C stable isotopes	Andrew Lonero	Dennis Newell	Picarro G110-I CRDS
Portable XRF	Elemental analysis	Andrew Lonero	John Shervais	Bruker ED-XRF
Portable Gamma Detector	Natural gamma	Andrew Lonero	Tammy Rittenour	Canberra

Andrew Lonero	andrew.lonero@usu.edu	408-757-2941
Dennis Newell	dennis.newell@usu.edu	505-977-7225
Kelly Bradbury	kelly.bradbury@usu.edu	435-760-4506
John Shervais	john.shervais@usu.edu	435-760-3394
Tammy Rittenour	tammy.rittenour@usu.edu	435-213-5756

Laboratory Training

Users of Dept. of Geology laboratories are required to have the USU Laboratory Safety Initial training course that is offered by the USU Environmental Safety & Health (EH&S) office, and be current with the annual refresher to this class. Depending on the laboratory activity, additional safety training may be required (for example, radiation safety training). For further information on these training requirements, contact Dennis Newell, Andrew Lonero, or the EH&S office.

Additionally, prior to accessing the laboratories, users must coordinate with the Instrument Manager (Andrew Lonero) before starting work to receive task-specific training and instructions.

Analytical Costs

Tables 2 – 6 provide the current cost structure for obtaining analyses in these laboratories. Rates are scaled by USU student or course, USU faculty or department, and Non-USU (commercial, state, or another academic client). General information on the assumed sample form and container requirements (based on media) are provided in the tables. Additional per sample costs, such as sample crushing, are also provided. For sample media/forms or analyses not listed, please contact the Instrument Manager. Contact the Instrument Manager (Andrew Lonero) for information on discounted rates for bulk sample quantities.

Undergraduate and graduate students requiring geochemical analyses should identify a funding source for their work through their own grants or from their advisor's funds. Student rates assume that the student will participate significantly in the sample preparation and analysis. For students with limited funding resources, we will consider on a case-by-case basis facilitating the needed analyses at reduced or no cost. Prices also assume that Dept. of Geology courses that include laboratory activities/analyses have required student fees to cover costs as part of the course.

Additionally, situations where USU researchers (faculty, research staff) require analyses but have limited or no funding will be considered on a case-by-case basis. For example, a reasonable number (to be determined based on the instrument/media) of pilot samples for proposal development can be run at a discounted rate. This assumes that if successful, these funded projects will have samples analyzed in Dept. of Geology laboratories at the posted analytical rates.

Portable Instruments

Some of the instrumentation owned by the department may be taken for use to field sites or other labs, and these include the Bruker handheld XRF, the Canberra Gamma Detector, and the Picarro CRDS. Use of these instrumentation outside of the Dept. of Geology must be coordinated, scheduled, and approved well in advance of intended use dates. Outside use of instrumentation is subject to approval by the lab PIs and/or department. Depending on the instrument and activity, approval may require completion of instrument specific and safety training, and submittal of a field research plan.

Table 2. USU Stable Isotope Laboratory Prices			**In house (USU) rates ($/sample)**		**Non-USU ($/sample)**	**Notes**
Sample Type	**Instrument**	**Data Reported**	**Student/ Course**	**Faculty/ Dept.**		
Water O & H	IRMS Gasbench	$\delta^{18}O$, $\delta^{2}H$	10	15	20	glass or poly bottles (>5 ml)
Water O *or* H	IRMS Gasbench	$\delta^{18}0$ *or* $\delta^{2}H$	5	8	10	glass or poly bottles (>5 ml)
Water DIC	IRMS Gasbench	$\delta^{13}C$	8	12	15	approximate DIC known, amber glass gas-tight bottle, or in-field acidfication (contact)
Carbonates	IRMS Gasbench	$\delta^{13}C$, $\delta^{18}O$	10	12	15	crushed or powdered, known carbonate type (calcite, aragonite, dolomite) and approximate concentration
Organic matter (soil, shale, other compounds and solids)	EA-IRMS	TOC, TON, $\delta^{13}C$, $\delta^{15}N$	6	8	12	Processed, weighed, and loaded into Ag or Sn capsules;
Organic matter (soil, shale, other compounds and solids)	EA	TOC, TON	3	4	6	Processed, weighed, and loaded into Ag or Sn capsules
CO_2 discrete gas samples	IRMS Gasbench	$\delta^{13}C$	contact	contact	contact	contact
CO_2 gas	Picarro	$\delta^{13}C$, CO_2	contact	contact	contact	contact

Table 3. USU X-Ray Laboratory Prices			In house (USU) rates ($/sample)		Non-USU ($/sample)	Notes
Instrument	**Sample Type**	**Data Reported**	**Student/ Course**	**Faculty/ Dept.**		
XRD	XRD rock powder	minerals, qualitative	10	25	50	assumes sample in powder form
XRD	XRD clays - single scan	minerals, qualitative	10	20	40	assumes sample prepared onto glass slide
XRD	XRD full clay panel	minerals, qualitative	30	60	120	Clay panel includes glycol and heat treated runs: assumes sample prepared onto glass slide
XRD	XRD non-geologic	diffraction pattern	10	25	50	contact regarding sample preparation
WD-XRF	XRF pressed powder	trace elements quantitative; majors semi-quantitative	5	10	25	assumes sample in powder form
WD-XRF	XRF fused bead	major elements, quantitative	10	25	45	assumes initial powder form (cost includes fused bead preparation)
Portable (p) ED-XRF	XRF rock powder	K – U, qualitative	$20/hr	$35/hr	$50/hr	Powdered form
pED-XRF	XRF bulk samples	K – U, qualitative	$20/hr	$35/hr	$50/hr	contact
pED-XRF	XRF + He	Mg – Cl, qualitative	$22/hr	$35/hr	$50/hr	contact
pED-XRF	XRF Field Deployment	contact	contact	contact	contact	contact

Table 4. ICP-MS Lab Prices			In house (USU) rates ($/sample)		Non-USU ($/sample)	Notes	Elements Reported (bold quantitative, others semi-quant.)
Instrument	**Sample Type**	**Data Reported**	**Student/ Course**	**Faculty/ Dept.**			
ICP-MS	solutions: natural waters	Major and trace elements	15	20	30	provide estimate of TDS, note if filtered and acidified, HNO_3 only	**B, Na, Mg, Al, Si, P,** S, K, Ca**, Ti, V, Cr, Mn, Fe, Co, Cu, Zn,** As**, Br,** Se**, Rb, Sr, Mo, Cd, I, Cs, Ba, Pb, Th, U.**
ICP-MS	carbonate digestion	Major and trace elements	25	30	40	assumes powder form	**Be, B, Na, Mg, Al, Si,** P, S, K**, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge,** As, Se, **Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, Sn, Sb, Te, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, ±Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Tl, Pb, Th, U**
ICP-MS	silicate digestion	Major and trace elements	50	60	80	assumes powder form	**Be, B, P, ±Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, Ga, Ge,** As, Se**, Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, Sn,** Sb, Te, **Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, ±Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W,** Tl**, Pb, Th, U**
ICP-MS	Pre-prepared solutions	Major and trace elements	20	25	35	assumed nitric acid matrix	contact to ask about concentration range and elements of interest
Laser Ablation-ICP-MS	Thin-section or polished mounts	TBD	TBD	TBD	TBD	In development	

Table 5. Malvern Prices			In house (USU) rates ($/sample)		Non-USU ($/sample)
Instrument	**Sample Type**	**Data Reported**	**Student/ Course**	**Faculty/ Dept.**	
Malvern	Unconsolidated solids	0.1 – 1000 micron particle size distribution	5	10	25

Table 6. Additional services not included in base prices			
Service	**$/sample**	**Instrument**	**Notes**
alkalinity titration	2	IRMS	If C content not known for $\delta^{13}C$ DIC analysis
microdrilling	2	IRMS	
carbonate removal (<30 wt% carb)	2	EA-IRMS	calcite, aragonite: in-situ acidification or vapor acidification
carbonate removal (>30 wt% carb)	4	EA-IRMS	calcite, aragonite: acidification - rinse method
weighing, loading	2	EA-IRMS	Using microbalance, loaded into Sn or Ag capsules
low TOC (<0.5 wt %) or difficult samples	contact	EA-IRMS	refractory carbonates (dolomite, siderite); low TOC may require additional mass, specific method
Water filtration and acidification	2	ICP-MS	For ICP-MS
Rock Crushing	5	all	For analyses requiring powder form