Development of USGS reference Materials

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USGS Reference Materials

- Reference materials for geochemical analysis
  - Established 1951
  - 34 reference materials in distribution
- Silicate matrix
- Soils, sediments, coal, Mn nodules
- Microanalytical reference materials
- Assist organizations with RM needs

RM development guidelines

- Large sample size, 10+ year supply
- Particle size reduction <75 micron
  Spike additions
- Blending single batch
- Splitting spinning riffler
- Bottle 50-100g
- Element homogeneity
  major 1-5% RSD
  minors 5-10% RSD

Reliability assessment

- Total element analysis
- Multiple techniques, multiple labs
- Sample selection
  - nth, random
- Intra-laboratory study
  - n=3, replicate analysis, QC
- Statistical analysis
- Recommended, information values

USGS Methods of Analysis

- WDXRF major elements
- EDXRF Minor and trace elements
- ICP-AES, ICP-MS Minor and trace elements
- INAA Minor and trace elements
- MC-ICPMS Trace elements, isotopes
- LECO, CV-AAS, HG-AAS

TiO_2 QC material

Rutile, Ilmenite — Sand

Leucoxene, Zircon — (250 – 75 u)

Heavy mineral conc. 5%, 2.5%, 0.5%

600, 100g units

2-5% RSD

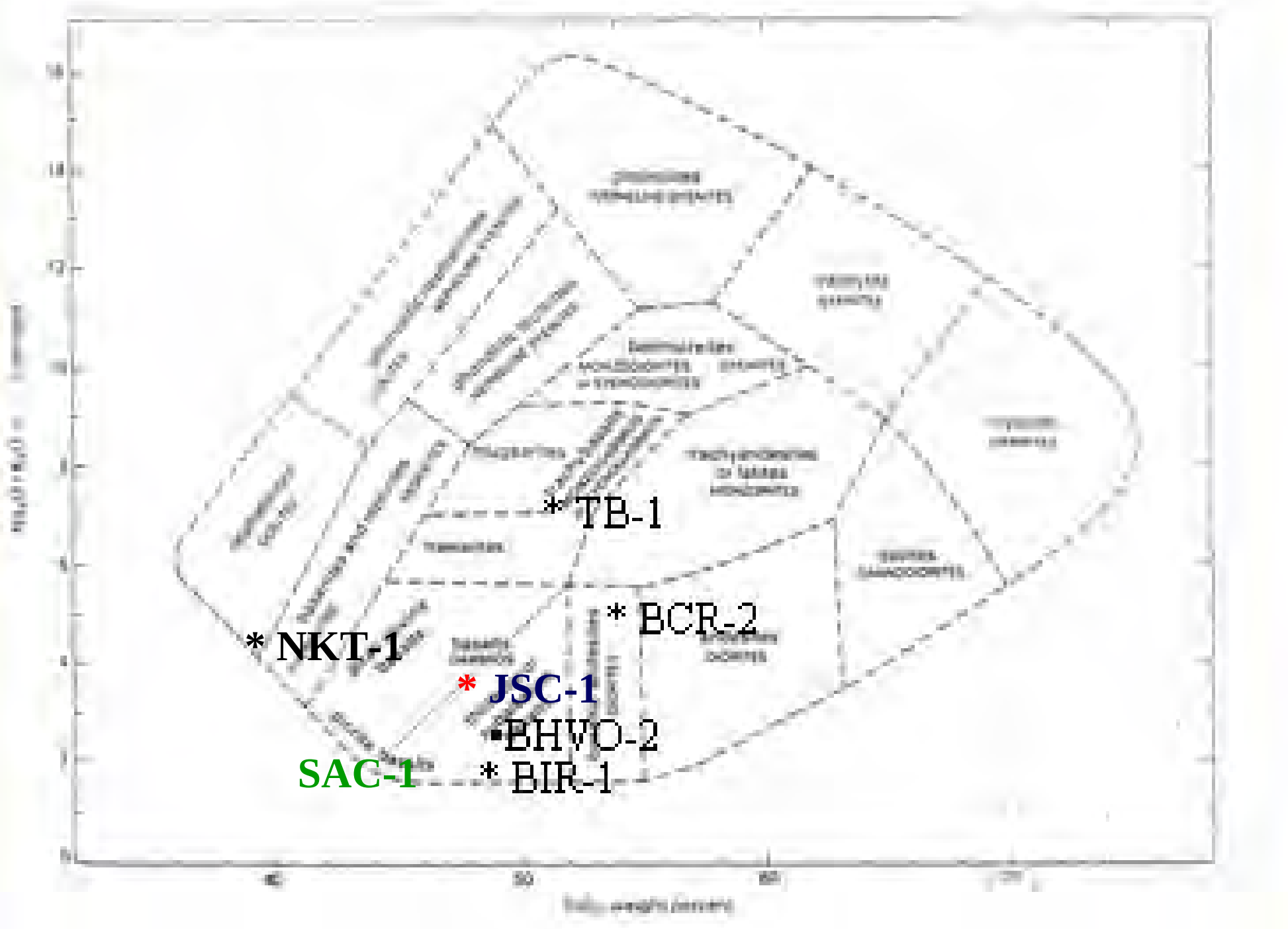
USGS reference material SSAR-1

- Stream Sediment mineralized area
- Baseline sediment, REE enriched
- Minimize elements with less than concentrations
- Blend ratio 70:30

Element concentration SSAR-1

Oxide	[ ]	% rsd	Element	ppm	% rsd
Al_2O_3%	9.99	1.00	Ba	728	2.2
Fe_2O_3	13.1	0.66	Ce	135	5.7
MgO	14.2	1.12	Cu	71	2.6
Na_2O	3.27	0.93	Ni	315	1.8
SiO_2	37.7	0.34	Th	8.4	6.6
TiO_2	3.81	0.58	Zn	153	1.8

USGS


* TB-1
* BCR-2
* NKT-1
* JSC-1
*BHVO-2
SAC-1
* BIR-1

SAC chemical composition

Oxide	Conc. %	Element	Conc. mg/kg
SiO_2	42.9	Cr	1640
Al_2O_3	18.7	Cu	988
MgO	11.8	Mn	758
CaO	10.8	Ni	2140
Fe_2O_3	8.2	Zn	34
TiO_2	0.09	Pt	15

USGS

Lunar soil simulant preparation

Original sample 50,000 lbs

Crush material

Grind material

Blend as continual batch

Split spinning riffler

Chemical Bulk

USGS