LITHIC MATERIALS IDENTIFICATION
Anth 502 (2cr)
University of Idaho, S'75
Instructor: Knudson

The focus of this course is to provide a physical identification of a specific lithic resource, Republican River Jasper. The identification will involve structural, mechanical, and chemical properties of the Jasper, or more specifically:

structural properties
- a. geological identification of the source; amount of chemical and physical weathering; size and shape of nodules or cobbles /instructor will complete/
- b. petrographic identification of the materials

mechanical properties
- a. tensile strength
- b. density
- c. Poisson's ratio
- d. Young's modulus of elasticity
- e. compressive strength

chemical properties
- a. trace element analysis, by one or all means:
  - (1) electron microprobe
  - (2) neutron activation
  - (3) x-ray fluorescence

During the course, the student will be responsible for completing background reading, preparing and submitting samples for various analyses, and preparation of a final report on the entire identification project. The latter report should be appropriate for professional publication, in content, form, and style, and is due Monday, May 12. There will be weekly meetings with the instructor to discuss the readings as well as the progress or problems of the analyses.

Scheduling is generally the problem of the student, but should follow this general sequence:

I. Begin background reading, at least enough to know the difference between quartzite, chert, and obsidian, and to have some idea of the techniques and output of the various kinds of analyses.

II. Contact the various labs who might do needed analysis, and find out their schedules, availability, number of samples needed, necessary sample preparation, and analysis cost. Charles Knowles, Bureau of Mines, deals with the electron microprobe; check with him about the x-ray fluorescence possibilities. George Williams, Department of Geology, will help with the petrography and perhaps the x-ray work. The Materials Testing Laboratory (first floor, Buchanan Engineering Lab) should help with the mechanical tests. Neutron activation analyses are being arranged off campus.

III. Have the tests run, interpret the results, and write up the report.

LITHIC MATERIALS IDENTIFICATION: preliminary bibliography
/Limited to non-obsidian siliceous rocks./

R. Knudson
Univ. Idaho
1/28/75

General background reading on archeological significance, examples of studies

Bryan, Kirk
1939 Stone cultures near Cerro Pedernal (New Mexico) and their geologic antiquity. Texas Archeological and Paleontological Society 11:9-46.

Clayton, Lee, W. B. Bickley, Jr., and W. J. Stone
1970 Knife River flint. Plains Anthropologist 15:282-290.

Cornwall, I. W.
1964 The world of ancient man. Mentor Book, New American Library, New York. /"Rocks and minerals," pp. 123-157./

Crabtree, Don E.
1967 The flintknapper's raw material. Tebiwa 10(1).

Goodman, Mary E.
1944 The physical properties of stone tool materials. American Antiquity 9:415-433.

General reading in mineralogy

Folk, Robert L.
1968 Petrology of sedimentary rocks. Hemphill's, Austin, Texas.

Folk, Robert L., and C. E. Weaver
1950 Surface features of chert as studied by the electron microscope /abstract/. Geological Society of America Bulletin 61:1461-1462.

1952 A study of the texture and composition of chert. American Journal of Science 250:498-510.

Frondel, Clifford
1962 The system of mineralogy of James Dwight Dana and Edward Salisbury Dana, 7th ed. Vol. III: Silica minerals. John Wiley and Sons, Inc., New York.

Iler, R. K.
1955 The colloid chemistry of silica and silicates. Cornell University Press, Ithaca.

Pelto, C. R.
1956 A study of chalcedony. American Journal of Science 254:32-50.

Siever, Raymond
1962 Silica solubility, 0°-200° C, and the diagenesis of siliceous sediments. Journal of Geology 70:127-150.

General reading in mineralogy, cont.

Shepherd, Walter
1972 Flint: its origin, properties and uses. Faber and Faber.

Electron microprobe analysis

Beaman, D. R., and J. A. Isasi
1972 Electron beam microanalysis: the fundamentals and applications. ASTM Special Technical Publication 506. American Society for Testing and Materials, Philadelphia.

Birks, L. S.
1963 Electron probe microanalysis. Interscience Publishers, a division of John Wiley & Sons, New York.

Sweatmen, T. R., and J. V. P. Long
1969 Quantitative electron-probe microanalysis of rock-forming minerals. Journal of Petrology 10:332ff.

X-ray fluorescence (on obsidian)

Stevenson, D. P., F. H. Stross, and R. F. Heizer
1971 An evaluation of x-ray fluorescence analysis as a method for correlating obsidian artifacts with source location. Archaeometry 13:17-25.

Neutron activation analysis

Aspinall, A., and S. W. Feather
1972 Neutron activation analysis of prehistoric flint mine products. Archaeometry 14:41-53.

DeBruin, M., P. J. M. Korthoven, C. C. Bakels, and F. C. A. Groen
1972 The use of non-destructive activation analysis and pattern recognition in the study of flint artefacts. Archaeometry 14:55-63.

Ives, David J.
1974 Activation analysis at the U. M. C. Laboratory for Nuclear Archaeology: II. lithics. Paper presented at the 39th annual meeting of the Society for American Archaeology, Washington DC (Program and Abstracts p. 40); photocopy.

Luckenbach, Alvin H., C. G. Holland, and Ralph O. Allen
1975 Soapstone artifacts: tracing prehistoric trade patterns in Virginia. Science 187:57-58.

Taylor, S. R.
1966 The application of trace element data to problems in petrology. Physics and Chemistry of the Earth 6:122-213.

General references

Oakley, K. P.
1939 The nature and origin of flint. Scientific Progress 34:277-286.

Stanton, R. E., A. J. MacDonald, and I. Carmichael
1967 The determination of some trace elements in silicate rocks. The Analyst 87(1031):134-139.

Weide, David L.
1969 A petrographic examination of basalt artifacts from the Panamint Valley, California. In The Western Lithic co-tradition, by E. L. Davis, C. W. Brott, and D. Weide. San Diego Museum Papers 6.

---check out the first and second editions of Science in Archaeology, ed. by Don Brothwell and Eric Higgs, Basic Books, New York

Other references on patination and thermal alteration are available

Mechanical properties

Faulkner, Alaric
1972 Mechanical principles of flintworking. Ph.D. dissertation, Washington State University, Pullman. University Microfilms, Ann Arbor.

1973 Mechanics of eraillure formation. Newsletter of Lithic Technology 2(3):4-12.

1974 Flintworking mechanics: fracture forms and processes. Paper presented at the Symposium on Primitive Technology and Art, University of Calgary.

Purdy, Barbara Ann
1974 Investigations concerning the thermal alteration of silica minerals: an archaeological approach. Tebiwa 17:37-66.

Speth, John D.
1972 Mechanical basis of percussion flaking. American Antiquity 37: 34-60.

1974 Experimental investigation of hard-hammer percussion flaking. Tebiwa 17(1):7-36.

Tsirk, Are
1974a Continuum mechamics and flaking - some comments and questions. Paper presented at the Sumposium on Primitive Technology and Art, University of Calgary.

1974b Mechanical basis of percussion flaking: some comments. American Antiquity 39:128-130.