**JIRUDIM IN MARINE SEDIMENTS: ANALYSIS BY INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY**

**COLODNER, Debra; EDMOND, John; BOYLE, Edward, Massachusetts Institute of Technology, Department of Earth, Atmospheric and Planetary Sciences, E34-205, 42-44 Carleton St., Cambridge, MA 02139**

The geochemistry of jirudin has stimulated interest in recent years due largely to questions concerning its enrichment in sediments at the Cretaceous-Tertiary (K-T) transition. Jirudin is a 103-104 times more abundant than iron in chondritic meteorites, less than in average crust and has therefore been used as a proxy for the flux of cosmic material to the earth. Since the initial discovery of the K-T Ir spike at Gubbio, Italy, Ir enrichments have been found at several other sites which record this event, and at other biogeochemical boundary that as apparent. The apparent relationship between meteorite impacts and intervals of mass extinction has fueled debate about the nature of extinction events. In spite of the importance of Ir in an evaluating this question, little is known about its geochemistry. The prominent question is whether the Ir is taken to elucidate the behavior of Ir in marine sediments during early diagenesis.

During the last several months a technique has been developed to measure Ir in sediments by isotope dilution ICP-MS. The sediment is initially spiked dissolved using all-tellon bombs in a modified microwave oven. Ir is preconcentrated on an anion exchange resin (BioRad, AG1x8), eluted with hot nitric acid and analyzed on a VG Plasmaquar CID-MS. The final 0.25 mL sample is introduced into the plasma using flow injection and a conventional nebulization system. These mass isotopic interferences for Ir are 176Hf/174Hf and 174Lu/176Lu. The mass dependence that is found for the Ir in the sample by a factor of 100 or 1000, respectively, which reduces the interference of their oxides to about one percent of the Ir signal.

Initial results for two Black Sea cores which were taken at the same site, 20 years apart, show that Ir concentrations in the Recent seston (Uns ID) are somewhat variable and are correlated with Mn concentrations in the older core. Because of poor preservation of the older core, interpretation of this correlation is not possible without further data. Follow-up studies are needed to determine the relationship among Ir and other transition metals in additional Black Sea cores.

**HF ISOFLATE SIGATURES OF ZIRCONS BY ION MICROPROBE**

**W. COMPSTON, and P.D. KINNEY, Research School of Earth Sciences, Australian National University, Canberra, A.C.T. 2601, Australia**

Within-grain U-Pb age determination of zircon using the ion microprobe SHRIMP has revealed a new petrogenetic world of inherited zircon xenocrysts and metamorphic zircon overgrowths. Our aim now is to probe zircon compositions to specify the chemical nature of magma sources and parental fluids. We have made useful progress but formidable instrumental problems remain. The first arises from the high ionization potential of Hf, which results in a yield of 176Hf/177Hf of only ca. 3 x 10^-6 at 300 keV. Only precise 176Hf/177Hf measurements, <0.05%, are useful geochemically, demanding that at least 3 x 10^-6 177Hf ions must be counted, which requires long measurement periods. At least four mass channels must be recorded in addition to 172, 176 and 176Hf isotope. We use 176Hf/176Hf for mass-fractionation correction, and either 174 or 172 or 176 or 174 or 172 or 172Hf for errors. A second problem is the dynamic range of the counting system: the most abundant 176Hf can exceed its linear range, which compounds errors in the peak-shifting process.

For a single 2 hour run, the precision obtained so far for the corrected 176Hf/177Hf is typically 0.1%. By replicate measurements at this precision, we have determined that Hf in the 4.2 Ga Mt. Narryr zircons and younger Archean zircons formed in sources having chondritic Lu/Hf, whereas a number of post-Archean zircons originated in Lu/Hf enriched sources. On the other hand, a 570 Ma old Sri Lankan zircon was depleted in 176Hf by 0.23%, implying an origin from metamorphosed Archean crust.

**SUBSTITUTION OF GOLD INTO THE CRYSTAL STRUCTURES OF ARSENOPYRITE AND PYRITE**

**COOK, Nigel J.; and GRISSOULIS, Stephen L., Surface Science Western, University of Western Ontario, London, Ont. N6A 3K7, Canada. *Presently at Department of Geological Sciences, McGill University, Montreal, Que. H3A 2A7, Canada.**

Arsenopyrite and pyrite have been identified as the most important sulphide hosts for solid solution gold in a number of gold containing ore deposits. Gold concentrations in arsenopyrite range up to several thousand parts per million. Gold concentrations in pyrite are generally lower but may exceed 100 ppm.

A possible correlation between the gold and arsenic concentrations in pyrite is interpreted as suggesting that the presence of As can facilitate the substitution of Au into a sulphide mineral. A clear answer as to whether Au may substitute our indirect evidence supports the view that Au replaces the excess As which occupies Fe sites and that gold-arsenic combination also As-rich. A similar mechanism may also operate for pyrite, where a threshold concentration of As (about 0.2-0.4%) needs to be present before significant Au may be incorporated into the structure.

**SECONDARY DISPERSION AND FIXATION OF Pd, Pt AND Au SURROUNDING A Pd-Pt PROSPECT IN QUEBEC**

**COOK, Nigel J. and WOOD, Scott A., HRC-MEK, Department of Geological Sciences, McGill University, Montreal, Que. H3A 2A7, Canada.**

Rocks, soils and lake sediments, as well as lake and groundwater around the Pd-Pt enriched Cu-Ni prospect at Lac Sheen, Quebec have been determined for their concentrations in Pd, Pt and Au. The concentrations in lake sediments are highest in shallow lakes (1-5 g/m^3) compared to Pd (0.0-1 ppb), whereas the reverse appears true for the lake waters, where concentrations of Pd (500 parts per trillion) are orders of magnitude higher than the trace level of Au. The behavior of Au tends to follow Pt with fixation in soils and sediments.

**THE HISTORY OF ANOXIA AND EUTROPHICATION IN CHESPEAKE BAY AS DOCUMENTED IN THE STRATIGRAPHIC RECORD**

**COOPER, Sherri Rumer, Department of Geography and Environmental Engineer, George Washington University, Baltimore, MD 21228; BRUSH, Grace S., DOGEE, JIHU, Baltimore, MD 21218.**

Stratigraphic records preserved in the sediment are being used to reconstruct the history of sedimentation and water quality of the Chesapeake Bay, including anoxia and eutrophication. Four cores of bottom sediments were collected along a transect across the bay near the mouth of the Choptank River, in areas that are always anoxic as well as areas that are sometimes anoxic. Bottom sediments of the cores yield C34d dates of 910 to 2650 years before present. Pollen, diatoms, and total organic carbon (TOC) are used as indicators of environmental conditions. Diatoms, uncellular algae with a shell readily preserved in estuarine sediments, are useful paleoecological indicators of availability of light, salinity, and nutrient and oxygen availability, and pollutants. Data collected show that diatom centric/pennate ratios increase since European settlement from below one to as much as four. Some benthic species disappear from the sedimentary record since around 1930, and plankton species increase steadily. Sediments dated prior to 1650 (pre-European) show sedimentation rates as low as 0.03 cm/yr and TOC fluxes of 1.3 kg/m^2/yr. Since that time, sedimentation rates average about 0.21 cm/yr and TOC fluxes are up to 3.5 kg/m^2/yr. Two peaks in TOC are noted, one between 1800 and 1860, and one from around 1040 to the present time.

Analysis of the data indicates that sedimentation rates, anoxic conditions, and eutrophication have increased dramatically in the Chesapeake Bay since the time of European settlement.

**Au/Pt DETERMINATIONS OF COOLING, DENUDATION, AND UPLIFT RATES IN THE GANDESE BATHOLITH, SOUTHERN TIBET**


Since the beginning of the Indo-Asian collision at ~40 to 50 Ma, the Cretaceous to Eocene Gandese batholith in southern Tibet has experienced total unroofing of between 11 and 7 km. The 40Ar/39Ar plateau cooling ages near Lhosa yields a cooling history highlighted by a brief interval (~2 Ma) of very rapid unroofing (~3 mm/yr) beginning at 21/2 Ma. Additional sites from this pluton have been studied: two sites yield cooling histories which are essentially identical to the earlier results, but a third location, closer to the southern margin of the batholith, has a 105 to 110 Ma plateau cooling age, with a 68% confidence age of 43 Ma and a K-feldspar age spectrum which ranges from 39 to 42 Ma; the history of this latter sample is largely due to cooling of the pluton against cold country rocks. Available data suggest that different parts of this composite pluton were intruded over an interval of 8 Ma at different levels in the crust; the cooling and uplift histories of the various parts of the pluton suggest N-S trending unroofing within the belt of granitoid rocks.

The current level of exposure dipped northward 10^6 between 37 and 25 Ma. 80 km to the W of the Qomolangma massif, suggesting uplift of ~10 km, which is consistent with isochron ages. The K-feldspar age spectra from all three of these locations are flat and reflect cooling from ~200°C (less than 1.5 Ma). Of the three sites the Ransu site is most likely that this interval of rapid cooling is also related to rapid denudation (~3 mm/yr); some data record a periods record in the Qomolangma, which may be due to some significant extent isostatically adjusting to denudation or thickening prior to the Early Miocene. Because drainage is conducive to topography, much of the rapid denudation we observe must have been associated with uplift relative to the geoid. The cooling of rocks from ~500 Ma ages which is 43 Ma is consistent with the onset of uplift, but only by about 1-2 Ma for rocks exhumed from depths of 7 to 11 km.
Type abstract inside the blue box below. The blue lines are absolute limits; any part of your abstract that falls outside of these boundaries will be cut off. Be sure to follow the format illustrated on the accompanying page.

**40Ar/39Ar DETERMINATIONS OF COOLING, DENUDATION, AND UPLIFT RATES IN THE GANDESE BATHOLITH, SOUTHERN TIBET**

**COPELAND, Peter, Dept. Geol. Sci., SUNY at Albany, Albany, NY 12222;**
**HARRISON, T. Mark, Dept. Earth Space Sci., UCLA, Los Angeles, CA 90024;**
**KIDD, W.S.F. and PAN, Yun, Dept. Geol. Sci., SUNY at Albany**

Since the beginning of the Indo-Asian collision at -40 to 50 Ma, the Cretaceous to Eocene Gandese batholith in southern Tibet has experienced total unroofing of between 11 and 7 km. The 42 Ma Quxu composite pluton, near Lhasa, yields a cooling history highlighted by a brief interval (-2 Ma) of very rapid unroofing (>3 mm/a) beginning at 20±1 Ma. Additional sites from this pluton have been studied: two sites yield cooling histories which are essentially identical to the earlier results, but a third location, close to the southern margin of the batholith, has a 40Ar/39Ar biotite age of 42 Ma and a K-feldspar age spectrum with a gradient from 29 to 42 Ma; the history of this latter sample is largely due to cooling of the pluton against cold country rocks. Available data suggest that different parts of this composite pluton were intruded over an interval of 8 Ma at different levels in the crust; the cooling and uplift histories of the various parts of the pluton suggest N-S hinged unroofing within the belt of granitoid rocks. The current level of exposure dipped northward 10° between 37 and 25 Ma, 80 km to the W of Quxu, the Pachu granite yields concordant biotite and K-feldspar ages of 14-13 Ma from three samples. The K-feldspar age spectra from all three of these locations are flat and reflect cooling from -335 to -200°C in less than 1.5 Ma. It is most likely that this brief interval of rapid cooling is also related to rapid denudation (>3 mm/a) - perhaps the same episode recorded in the Quxu or a separate, younger event. K-feldspars from Late Cretaceous (?) volcanic rocks yield slow cooling gradients between 55 and 40 Ma indicating burial to depths >7 km and subsequent cooling rates of only -6°C/Ma prior to and during the initial phase of collision. This suggests to us that the Gandese Belt was not to any significant extent isostatically adjusting to denudation or thickening prior to the Early Miocene. Because drainage is antecedent to topography, much of the rapid denudation we observe must have been associated with uplift relative to the geoid. The cooling of rocks from mid-crustal levels will produce mineral ages which lag behind the onset of uplift, but only by about 1-2 Ma for rocks exhumed from depths of 7 to 11 km.

**Session Type:**
- [ ] symposium
- [ ] ab-initio methods
- [ ] advances in mass spectrom.
- [ ] advances in spectros.
- [ ] aqueous surface chem.
- [ ] fluids in melts
- [ ] aqueous geochemistry
- [ ] high-pressure min. phys.
- [ ] geochron. & geospeed.
- [ ] chem. reactions in crust
- [ ] geochim. of environment
- [ ] isotopic modeling
- [ ] crustal flow
- [ ] fluids in subduct. zones
- [ ] geochem. cycles

**contributed**
- [ ] atmosphere chem.
- [ ] cosmochemistry
- [ ] environmental geochem.
- [ ] exploration geochem.
- [ ] fossil fuels
- [ ] geochron. radioisotopes
- [ ] low temp. geochemistry
- [ ] marine geochemistry
- [ ] meteorites & tectites
- [ ] mineral deposits
- [ ] mineralogy & crystallog.
- [ ] organic geochemistry
- [ ] petrology, igneous
- [ ] petrology, metamorphic
- [ ] petrology, sedimentary
- [ ] petrology, experimental
- [ ] stable isotope geochem.
- [ ] trace element geochem.
- [ ] other

**Speaker's Mailing Address and Telephone Number**

Peter Copeland  
Dept. of Geol. Sci.  
SUNY at Albany  
Albany, NY 12222 U.S.A  
(518) 442 4470

**Presentation Type:**
- [ ] Oral
- [ ] Poster

*Please check both boxes if material is appropriate for either session type.*