

EARTH SCIENCES

Cheryl Simon reports from Philadelphia at the spring meeting of the American Geophysical Union

Disintegrating diamonds

Not every diamond is destined to grace a gold band on someone's finger. After diamonds are created deep in the earth's mantle, some are pushed upward by geologic processes and exposed to different temperatures and pressures. If the rocks cool quickly, carbon in the diamonds is frozen into its pyramid shape. When the diamonds cool slowly, they decompose into graphite, which in turn can react with oxygen, forming carbon dioxide, or with water, forming methane.

Thomas J. Shankland of Los Alamos National Laboratory and Alfred G. Duba of Lawrence Livermore National Laboratory suggest that carbon at the boundaries of grains of different minerals may explain the high electrical conductivity observed in the mantle 50 to 130 kilometers below the earth's surface. Graphite conducts electricity better than most rocks. In studies of the conductivity of oil shale, Duba finds that when heated, shale becomes more highly conductive as carbon-rich residue covers the rocks. The earth is said to contain about 100 billion billion (10^{20}) tons of carbon. The high conductivity in the mantle could be explained if even .001 percent of the carbon coats mineral grains in the mantle rocks, the scientists report. They also speculate that the methane that occurs abiogenically — without the organic material typically required for making hydrocarbons — may be formed when graphite meets water high in the rock column. While this methane usually is present in low concentrations, possibly the natural gas could be trapped by an impermeable rock layer, and is ready for discovery by vigilant geophysicists. The scientists also hypothesize that the CO_2 emitted copiously from active volcanoes is not necessarily derived from primitive sources trapped in the mantle. Instead, they say, the gas may result from oxidation of elemental carbon.

Contaminated magmas

Volcanoes in the South American Andes offer geochemists a tantalizing glimpse into the origins of magmas and the relation of the melted material to plate movements occurring as oceanic crust is subducted beneath South America. George Tilton and Barbara Barreiro of the University of California at Santa Barbara are studying the primary sources of Andean magmas, as well as possible contamination of the magmas by crustal material acquired as the melt rises to the surface. When Barreiro measured lead isotopes in magmas from different parts of the Andes, she found that while magmas in the Southern Andes (south-central Chile) and the Northern Andes (Ecuador) have different isotopic values, they show little crustal contamination. Samples from the Central Andes (northwest Argentina and southern Peru), indicate crustal contamination, probably by an ancient outcropping of metamorphic rocks. The work was done at the Carnegie Institution of Washington, D.C.

Tracking water sources with ^{16}O : ^{18}O

By measuring ratios of oxygen isotopes in seawater, two researchers at Lamont Doherty Geological Observatory find that they can identify the source of water samples taken from the North American continental shelf. Robert W. Houghton and Richard G. Fairbanks report that each of the rivers feeding into the North Atlantic possesses a unique ratio of ^{16}O to ^{18}O . The method is useful, Houghton says, because it allows improved overall estimates of the time that water from coastal rainfall and rivers remains on the continental shelf. The technique also may be used to trace contaminants and current movements. It is not applicable on the West Coast because the high mountain ranges there affect stream flows such that isotopic ratios are less specific to individual sources.

BEHAVIOR

Prepping for the Apgar

An infant who is asphyxiated during birth typically shows immediate physical and behavioral deficits, and it is standard hospital practice to assess the newborn's responsivity, respiration, muscle tone, color and general activity level. Generally referred to as the Apgar test — after anesthesiologist Virginia Apgar who originated it — it is the child's earliest and most fundamental behavioral assessment and the score is considered a good predictor of later development. Recently, evidence has accumulated to indicate that an infant's natural opiates may be responsible for the physical problems caused by asphyxiation, and now there is further evidence that an opiate "antagonist" — a drug that counters the effects of the opiates — can successfully resuscitate a newborn who has suffered asphyxiation. Pediatricians Victor Chernick and Randy J. Craig of the University of Manitoba report in the June 11 *SCIENCE* that the rabbit pups of mothers who had been given "naloxone" (an opiate antagonist) before delivery survived asphyxiation in much better shape than did controls — as measured on a laboratory version of the Apgar. On all measures, the pups who received the drug did better than asphyxiated pups who received a placebo. The American Academy of Pediatrics currently discourages the routine clinical use of naloxone because of its potential for interference with the body's own defense against asphyxiation.

Mistreatment for pain?

High anxiety has been thought to sharpen sensitivity to pain, and patients who suffer from chronic pain are often treated with anti-anxiety medication. Preliminary evidence from the National Institute of Mental Health indicates that quite the opposite might be true — that anxiety may reduce the ability to sense pain and that so-called "anxiolytic" drugs may actually intensify the experience of pain. In an experiment conducted by NIMH psychiatrist Thomas W. Uhde, subjects were administered a series of 93 shocks varying in intensity, and the subjects experiencing high anxiety were found to be significantly less sensitive to subtle differences in pain than were less anxious controls. The subjects fell into two quite distinct groups, according to Uhde, and the correlation between anxiety and analgesia was given further support by the finding that the most anxious subjects had significantly higher blood levels of a metabolite of noradrenaline, a neurochemical transmitter implicated in modulating pain.

Distress among blacks: Look again

There have been several attempts over the past decades to assess the mental health of black Americans, but most of these studies have confined themselves to comparisons of blacks and whites. As a result, according to psychologists James S. Jackson and Harold W. Neighbors of the University of Michigan's Institute for Social Research, very little has been known about the actual sources of psychological distress among blacks. Jackson and Neighbors have just completed a massive survey, designed to sample all black American adults, and the preliminary analyses suggest that some basic assumptions about the mental health of blacks may be badly distorted. The results indicate, for example, that education and income bear no relationship to psychological distress, contrary to the common assumption that low socioeconomic status causes psychological problems. The researchers also found that distress is less common among very young and very old adults — another contradiction of previous belief — and that neither southern blacks nor urban blacks run exceptionally high psychological risk. In general, Jackson concludes, the survey has revealed a great deal of variability within the black population that has previously been obscured.