

AAAS ARCTIC DIVISION

In Fight over Alaskan Mine, Public Interest Turns to Science

DILLINGHAM, ALASKA—Every summer, salmon by the millions swim from Bristol Bay up into the Nushagak and Kvichak Rivers, bound for tundra waters where they repeat the primeval cycle of spawning before death. But the discovery of other natural riches beneath the tundra—a vast lode of copper, gold, and other minerals—is raising deep questions about the future of the salmon and the region itself.

While Bristol Bay may be the most productive wild salmon fishery remaining in the world, a plan under development by an international consortium would put one of the world's biggest mines in the watershed that feeds the bay. It is called the Pebble Mine, and when the AAAS Arctic Division convened here recently, elected officials, Alaska native leaders, and Pebble's CEO joined with scientists, fishermen, educators, and students to explore a critical question of science and engineering:

Can a mine be developed in a sensitive environment and an active earthquake zone without endangering the fishery and the communities that depend on it?

"It's unusual to see a scientific meeting become a forum for public engagement on

a regional scale," said Lawrence K. Duffy, executive director of the AAAS Arctic Division. "But it certainly was inspiring."

The annual Arctic Division meeting—held for the first time in the Alaskan Bush—convened 21 to 24 September at the University of Alaska-Fairbanks, Bristol Bay Campus. More than 75 scientists, policy-makers, and others attended from Alaska, the Lower 48, Canada, and Russia's Kamchatka Peninsula, and at a half-day Pebble Mine forum, they were joined by more than 150 local residents in the Dillingham Middle School gymnasium. The meeting was organized by Duffy; division president Todd Radenbaugh, director of the campus Environmental Science Lab; and Al Teich, senior science policy adviser at AAAS and liaison to the division.

The controversy over the proposed mine has already inspired lawsuits, special elections, and an intensive public relations campaign—and the fight is likely to escalate. What the Arctic Division meeting made clear, however, was that science will be critically important both to public opinion and policy decisions on the project.

Researchers at the meeting said the mine would pose an array of risks, from dust and

A future mine? A proposal by the Pebble Limited Partnership, a global mining consortium, could put a massive pit and underground mine on the Alaskan tundra upriver from Bristol Bay salmon fisheries.

fuel spills to habitat destruction and dissolved copper contaminating the Bristol Bay watershed. For John Shively, chief executive officer of Pebble Limited Partnership, the key is whether engineering and technology can neutralize those risks. He said the mining consortium has thus far invested \$120 million and hired some 500 researchers to conduct "the largest science project ever undertaken for any mining project anywhere in the world."

The Pebble site is about 200 miles southwest of Anchorage, on undeveloped state-owned land just north of Lake Iliamna, one of the biggest lakes in North America. Exploratory studies over the past decade have revealed an awesome lode: 10.75 billion tons of ore, containing an estimated 80.6 billion pounds of copper, 5.6 billion pounds of molybdenum, and 107.4 million ounces of gold, plus smaller amounts of silver, rhenium, and palladium. The estimated value: \$300 billion to \$500 billion.



Community-wide discussion. Researchers, policy-makers, fishermen, students, and others joined in the Pebble Mine forum at the AAAS Arctic Division meeting.

The mine would require a huge investment and a supreme feat of modern engineering. While Pebble has not yet detailed its plans or applied for a permit, some accounts say an open pit at the mine could measure over two square miles and 1700 feet deep. Dams would be built to create underwater storage for mine wastes; one earthen dam would rise to 740 feet—higher than the Hoover Dam. Roads, pipelines, and massive electricity and water treatment plants would be built to support the effort.

If the mine is fully developed, there might be 10 billion tons of waste ore stored underwater and behind dams at the site. In technical sessions, researchers offered a troubling scenario: Water leaching through sulfide-sulfur wastes could create an acid solution strong enough to dissolve remaining traces of copper and other metals. The copper could migrate down through the porous silt, sand, and gravel beneath the tailings, first contaminating groundwater and then welling up into streams and lakes.

Even low levels of dissolved copper could be “highly toxic” to fish, said biologist Sarah O’Neal, associate director of Fisheries Research & Consulting. “Two to 10 parts per billion ... can impair a salmon’s ability to smell—its ability to recognize mates, to recognize prey or predators.” Such contamination also could disrupt its sense of direction, reducing its ability to navigate upstream to spawn.

Mine wastes also could be released by earthquakes or by floods and droughts associated with climate change, researchers said. Pebble might be mined-out after 100 years,

but the risk would endure in perpetuity.

Shively acknowledged at the forum that Pebble’s studies show transfer from groundwater to waterways beyond the mine site. But Pebble will plan to prevent that, and if environmental safety cannot be ensured, he said, “it’s going to be very, very difficult” to proceed.

In a region slowly losing population,

SUSTAINABILITY

Cities Find Economic Reasons to Go Green

For Dwight Jones, a sustainable city is more than a place where carbon emissions are low and businesses are green. When the Richmond, Virginia, mayor considers sustainability, he thinks of his visit to the home of a city school teacher “where the heating bill was only \$80 a month in the dead of winter.”

Practical challenges from water delivery to traffic congestion are pushing the concept of sustainability beyond a focus on pollution and natural resource protection, urban leaders and scholars said at a symposium held at AAAS. Cities are turning green, they suggested, as a way to meet the urgent economic and quality-of-life concerns of their residents.

Battered by a faltering economy, cities are also looking beyond costly technology for solutions. Instead, mayors like Jones are encouraging cultural shifts that support sustainability while seeking new ways to invest the money generated by becoming more energy-efficient and developing a green job base.

Pebble says, the mine would create about 2000 jobs during construction and about 1000 high-skill, high-wage operating jobs for 25 years or more. In addition, Pebble says spending on the project would create an economic surge in the region and generate a windfall in tax revenue.

Many fishermen and others in the Bristol Bay region see a different equation: If the mine threatens a salmon industry that creates thousands of full- and part-time jobs and generates \$400 million to \$500 million a year, sustainably, why risk it? “It scares the hell out of me,” said commercial fisherman Pete Andrew, a board member of the Bristol Bay Native Corporation.

Opponents are preparing for a battle that could last decades, much as conservationists have fought since the 1970s to block oil and gas drilling in the Arctic National Wildlife Refuge.

Meanwhile, research will continue. By year’s end, Shively said, Pebble will release a massive “environmental baseline document” of 53 chapters and 20,000 pages. And the U.S. Environmental Protection Agency this year announced a comprehensive scientific assessment of the Bristol Bay region that could be completed in the fall of 2012.

To learn more about Pebble discussions at the 2011 AAAS Arctic Division meeting, visit www.aaas.org/go/arcticmine.

The 6 October event on building sustainable cities was sponsored by Hitachi America, the Brookings Institution, and AAAS. Policy-makers, researchers, and city managers from cities including Boston, Phoenix, and Charlotte, along with Jones and Mayor Roy Buol from Dubuque, Iowa, kept the discussions focused on practical initiatives already in place across the United States and globally.

Sustainability makes sense when cities face tight budgets and need to lower operational costs, said Tom Shircliff, the chairman of Envision: Charlotte Steering Committee, a public-private collaboration to develop sustainability programs in the city. With less money to spend, he said, cities need to emphasize “soft changes” such as encouraging business districts to conserve energy and altering leases to encourage green retrofitting of older buildings.

In Dubuque, Buol said, the city has partnered with IBM to root out inefficiencies in its water, energy, and transportation systems. Its

Report Offers Roadmap for Haitian Science

Haiti and the international community should work together to advance Haiti's science sector, building on the nation's existing science capacity to support earthquake recovery and long-term, sustainable development, says a new report from AAAS.

Science for Haiti was delivered to Haitian leaders in business, science, and education—and to a top adviser to President Michel Martelly—during meetings 19 to 20 September in Port-au-Prince. The report includes a set of strategic goals and more than three dozen specific recommendations to strengthen science and science education, and it urges the international science community, donor and aid organizations, and others to provide collaborative partnerships and other support.

"The report resolutely opts for long-lasting development," said Fritz Deshommes, president of the newly formed Haitian Association for the Advancement of Science and Technology (HAAS). "It offers the possibility of a vision for Haiti that is more rational, authentic, and reassuring,

pilot water program led to a 6.6% reduction in water usage and an eightfold improvement in leak detection and repair. The program used "smart" water meters, online games, and real-time water consumption reports to show residents how to scale back their use. "We have to come up with ways of giving people information so that they'll make a conscious decision to reduce their usage," Buol said.

Richmond supports a variety of sustainability initiatives, from telework programs and energy-efficient stop lights to cycling paths, said Jones. Retooling cities to greener standards, he suggested, could provide job training and new jobs.

"We see it as an economic development opportunity," agreed James Hunt, chief of environment and energy for Boston, who talked about city sustainability efforts that include LED lighting in public places and a pilot program for electric car charging stations. Many green changes, he and others noted, can be made with off-the-shelf technologies.

The panelists urged more cooperation between local, state, and federal governments to fund projects that cross traditional bound-

aries, such as a project that promotes walking to reduce traffic and improve health. Cities that "connect infrastructure intelligently" may also be more resilient during natural disasters, said Michinaga Kohno, senior chief engineer for Hitachi's Smart City Business Management division.

one that is not limited to humanitarian aid nor condemned to perpetual dependence." *Science for Haiti* "is an important, ambitious document," said Alan I. Leshner, chief executive officer of AAAS and executive publisher of *Science*. "Through this collaboration, the authors have developed a roadmap for building Haiti's prosperity and improving the lives of its people."

The report is the result of workshops and discussions, organized by AAAS and its Caribbean Division, involving over 100 scientists, engineers, educators, and government leaders from Haiti, Puerto Rico, Canada, Rwanda, and the United States. It was based on a key principle: Haitians must chart their own goals for science and their own future, with the international science community supporting their efforts.

Among key recommendations, the report calls for Haitian policies to build science capacity as an "integral element of social and economic development"; hiring and training of more teachers and improved science education materials and textbooks; and expanded engagement

between Haitian and international scientists through research programs in key disciplines.

Haiti, already one of the world's poorest nations, was shattered by a magnitude 7.0 earthquake on 12 January 2010. The quake killed 222,500 people and injured more than 300,000. Hundreds of government buildings, research facilities, and educational institutions were destroyed or badly damaged.

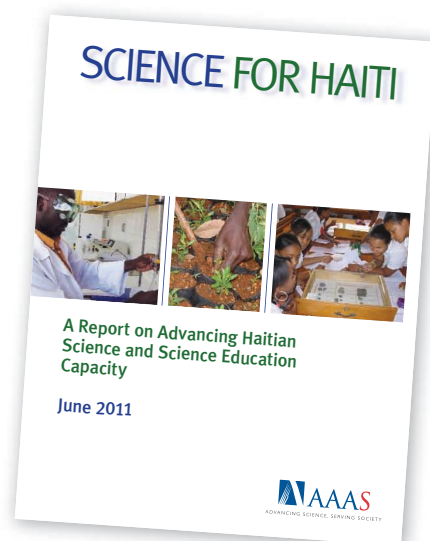
The project received support from the AAAS International Office, the University of Idaho, the University of Puerto Rico-Río Piedras (UPR), and the Association of American Geographers (AAG). The authors of *Science for Haiti* include AAAS Fellow Gary Machlis, professor of conservation at the University of Idaho; AAAS Caribbean Division President Jorge Colón, professor of chemistry at UPR; and Jean McKendry, AAG senior researcher.

Machlis and McKendry arrived in Port-au-Prince on 18 September and attended one of the first meetings of HAAS. The next day, they presented the recommendations to scientists from universities and the private sector, including Jean-Vernet Henry, rector of L'Université d'État d'Haïti, as well as secondary school principals and science teachers.

McKendry and Machlis later discussed the report with a counselor to President Martelly, the Haitian Chamber of Commerce, Haitian journalists, and staff at the U.S. Embassy.

The report was presented at a AAAS event on 20 October.

Read *Science for Haiti* at www.aaas.org/go/haiti2011/.



AAAS Council Reminder

The next meeting of the AAAS Council will take place during the AAAS Annual Meeting and will begin at 9:00 a.m. on 19 February 2012 in Vancouver, Canada, in the Grand Ballroom of the Fairmont Waterfront Hotel.

Individuals or organizations wishing to present proposals or resolutions for possible consideration by the council should submit them in written form to AAAS Chief Executive Officer Alan I. Leshner by 28 November 2011. This will

allow time for them to be considered by the Committee on Council Affairs at its winter meeting.

Items should be consistent with AAAS's objectives and be appropriate for consideration by the council. Resolutions should be in the traditional format, beginning with "Whereas" statements and ending with "Therefore be it resolved."

Late proposals or resolutions delivered to the AAAS Chief Executive Officer in advance of the February 2012 open hearing

of the Committee on Council Affairs will be considered, provided that they deal with urgent matters and are accompanied by a written explanation of why they were not submitted by the November deadline. The Committee on Council Affairs will hold its open hearing at 2:30 p.m. on 18 February 2012 in Room 210 of the Vancouver Convention Center. Summaries of the council meeting agenda will be available during the annual meeting in the AAAS headquarters office in the convention center.

ELECTIONS

AAAS Annual Election: Preliminary Announcement

The 2011 AAAS election of general and section officers will be held in November and December. All members will receive a ballot for election of the president-elect, members of the Board of Directors, and members of the Committee on Nominations. Members registered in more than one section will receive election ballots for each section they are enrolled in.

Candidates for all offices are listed below. Additional names may be placed in nomination for any office by petition submitted to the Chief Executive Officer no later than 15 November. Petitions nominating candidates for president-elect, members of the Board, or members of the Committee on Nominations must bear the signatures of at least 100 members of the Association. Petitions nominating candidates for any section office must bear the signatures of at least 50 members of the section. A petition to place an additional name in nomination for any office must be accompanied by the nominee's curriculum vitae and statement of acceptance of nomination. Biographical information for the following candidates will be enclosed with the ballots mailed to members in November.

Slate of Candidates

GENERAL ELECTION

President: Phillip A. Sharp, Massachusetts Institute of Technology; Jeremy A. Sabloff, Santa Fe Institute

Board of Directors: Bonnie L. Bassler, Princeton Univ.; May Berenbaum, Univ. of Illinois at Urbana-Champaign; David Fischhoff, Monsanto; Michael S. Turner, Univ. of Chicago

Committee on Nominations: To be announced

SECTION ELECTIONS

Agriculture, Food, and Renewable Resources

Chair Elect: Harry J. Klee, Univ. of Florida; Susan McCouch, Cornell Univ.

Member-at-Large of the Section Committee: Jo Handelsman, Yale Univ.; David J. Mackill, Univ. of California, Davis

Electorate Nominating Committee: Ed Buckler, Cornell Univ.; Candace Haigler, North Carolina State Univ.; Leon Kochian, Cornell Univ.; Gregory B. Martin, Cornell Univ./Boyce Thompson Institute for Plant Research

Council Delegate: Thomas W. Bruulsema, International Plant Nutrition Institute; Maud A. W. Hinchey, ArborGen, Inc.

Anthropology

Chair Elect: Dennis H. O'Rourke, Univ. of Utah; John H. Relethford, SUNY-Oneonta

Member-at-Large of the Section Committee: Kathleen R. Gibson, Univ. of Texas-Houston Health Science Center Medical School; Karen R. Rosenberg, Univ. of Delaware

Electorate Nominating Committee: David G. Anderson, Univ. of Tennessee, Knoxville; Robert G. Franciscus, Univ. of Iowa; Leslea J. Hlusko, Univ. of California, Berkeley; James J. McKenna, Notre Dame Univ.

Astronomy

Chair Elect: Michael F. A'Hearn, Univ. of Maryland, College Park; Sandra M. Faber, Univ. of California, Santa Cruz

Member-at-Large of the Section Committee: S. George Djorgovski, California Institute of Technology; Megan Donahue, Michigan State Univ.

Electorate Nominating Committee: Carol A. Christian, Space Telescope Science

Institute; Eli Dwek, NASA Goddard Space Flight Center; Martha P. Haynes, Cornell Univ.; Bruce Margon, Univ. of California, Santa Cruz

Atmospheric and Hydrospheric Sciences

Chair Elect: Andrew Dessler, Texas A&M Univ.; Michael D. King, Univ. of Colorado-Boulder

Member-at-Large of the Section Committee: Russell R. Dickerson, Univ. of Maryland, College Park; Alan Mix, Oregon State Univ.

Electorate Nominating Committee: Dennis Hansell, Univ. of Miami; Margaret Leinen, Florida Atlantic Univ.; Joyce Penner, Univ. of Michigan; Don Wuebbles, Univ. of Illinois at Urbana-Champaign

Biological Sciences

Chair Elect: Joy Bergelson, Univ. of Chicago; John Doebley, Univ. of Wisconsin-Madison

Member-at-Large of the Section Committee: Scott V. Edwards, Harvard Univ.; Ellen D. Ketterson, Indiana Univ.

Electorate Nominating Committee: Robert R. H. Anholt, North Carolina State Univ.; Sarah Hake, Univ. of California, Berkeley; Jeannie T. Lee, Massachusetts General Hospital/Harvard Medical School; Patricia J. Pukkila, Univ. of North Carolina at Chapel Hill

Chemistry

Chair Elect: Ehud Keinan, Technion Univ., Israel/Scripps Research Institute; Alfred P. Sattelberger, Argonne National Laboratory

Member-at-Large of the Section Committee: Mark Ediger, Univ. of Wisconsin-Madison; Melanie Sanford, Univ. of Michigan

Electorate Nominating Committee: Anna K. Mapp, Univ. of Michigan; Coleen Pugh, Univ. of Akron; Shannon S. Stahl, Univ. of Wisconsin-Madison; William B. Tolman, Univ. of Minnesota

Dentistry and Oral Health Sciences

Chair Elect: Paul H. Krebsbach, Univ. of Michigan; Ichiro Nishimura, Univ. of California, Los Angeles

Member-at-Large of the Section Committee: Casey Chen, Univ. of Southern California School of Dentistry; Christopher H. Fox, American Association for Dental Research/International Association for Dental Research

Electorate Nominating Committee: Anne George, Univ. of Illinois at Chicago; Steven D. Goodman, Univ. of Southern California; J. Timothy Wright, Univ. of North Carolina School of Dentistry; Lynne Opperman, Texas A&M Health Science Center

General Interest in Science and Engineering

Chair Elect: Eric J. Jolly, Science Museum of Minnesota; Marilee Long, Colorado State Univ.

Member-at-Large of the Section Committee: Joseph M. DeSimone, Univ. of North Carolina at Chapel Hill; Erica Goldman, COMPASS (Communication Partnership for Science and the Sea)

Electorate Nominating Committee: Lynne Timpani Friedmann, ScienceWriters; Barbara Gastel, Texas A&M Univ.; James P. O'Brien, Tidewater Community College; J. Michael Redding, Tennessee Technological Univ.

Geology and Geography

Chair Elect: Tim Dixon, Univ. of South Florida; Emi Ito, Univ. of Minnesota

Member-at-Large of the Section Committee: Sherilyn C. Fritz, Univ. of Nebraska-Lincoln; Naomi Oreskes, Univ. of California, San Diego

Electorate Nominating Committee: Brenda Ekwurzel, Union of Concerned Scientists; Karl W. Flessa, Univ. of Arizona; Philip A. Meyers, Univ. of Michigan (emeritus); Walter D. Mooney, U.S. Geological Survey

History and Philosophy of Science

Chair Elect: Davis Baird, Clark Univ.; Geoffrey C. Bowker, Univ. of Pittsburgh

Member-at-Large of the Section Committee: Cathryn Carson, Univ. of California, Berkeley; Naomi Oreskes, Univ. of California, San Diego

Electorate Nominating Committee: Marcel Chotkowski LaFollette, Smithsonian Institution Archives; Thomas Nickles, Univ. of Nevada, Reno; Robert T. Pennock, Michigan State Univ.; Zuoyue Wang, California State Polytechnic Univ.

Council Delegate: Carl F. Cranor, Univ. of California, Riverside; Vassiliki Betty Smocovitis, Univ. of Florida

Information, Computing, and Communication

Chair Elect: Eric Horvitz, Microsoft Research; Henry Kautz, Univ. of Rochester

Member-at-Large of the Section Committee: Peter Freeman, Georgia Tech; José-Marie Griffiths, Bryant Univ.

Electorate Nominating Committee: Toni Carbo, Drexel Univ.; Tom Dietterich, Oregon State Univ.; David D. Lewis, Consultant; Paul F. Uhler, National Academy of Sciences

Linguistics and Language Science

Chair Elect: Karen Emmorey, San Diego State Univ.; Keren Rice, Univ. of Toronto, Canada

Member-at-Large of the Section Committee: Laura L. Koenig, Long Island Univ./Haskins Laboratories; Colin Phillips, Univ. of Maryland, College Park

Electorate Nominating Committee: Mark Aronoff, Stony Brook Univ.; Hagit Borer, Univ. of Southern California; Eric Potsdam, Univ. of Florida; Don Ringe, Univ. of Pennsylvania

Mathematics

Chair Elect: David C. Manderscheid, Univ. of Nebraska-Lincoln; Juan C. Meza, Univ. of California, Merced

Member-at-Large of the Section Committee: James H. Curry, Univ. of Colorado-Boulder; Sheldon Katz, Univ. of Illinois at Urbana-Champaign

Electorate Nominating Committee: Carlos Castillo-Chavez, Arizona State Univ.; David Kinderlehrer, Carnegie Mellon Univ.; Phil Kutzko, Univ. of Iowa; Annie Selden, Tennessee Technological Univ.

Medical Sciences

Chair Elect: Barry Collier, Rockefeller Univ.; Beverly L. Davidson, Univ. of Iowa

Member-at-Large of the Section Committee: Harry B. Greenberg, Stanford Univ. School of Medicine; Claire Pomeroy, UC Davis Health System

Electorate Nominating Committee: Karen Hsiao Ashe, Univ. of Minnesota Medical School; Daniel DiMaio, Yale School of Medicine; Stephen Feinstone, U.S. Food and Drug Administration; Katherine Amberson Hajjar, Weill Cornell Medical College

Council Delegate: Jay A. Berzofsky, National Institutes of Health; Stephen B. Calderwood, Massachusetts General Hospital/Harvard Medical School; Mary C. Dinauer, Washington Univ. School of Medicine in St. Louis; Katherine A. High, Children's Hospital of Philadelphia; James Hoxie, Univ. of Pennsylvania Medical School; Nancy H. Ruddle, Yale Univ. School of Medicine

Pharmaceutical Sciences

Chair Elect: Kenneth D. Tew, Medical Univ. of South Carolina; Rick G. Schnellmann, Medical Univ. of South Carolina

Member-at-Large of the Section Committee: John Carpenter, Univ. of Colorado; Jashvant (Jash) D. Unadkat, Univ. of Washington

Electorate Nominating Committee: Alice M. Clark, Univ. of Mississippi; James M. Gallo, Mt. Sinai School of Medicine; Ashim Mitra, Univ. of Missouri-Kansas City; Murali Ramanathan, Univ. at Buffalo

Social, Economic, and Political Sciences

Chair Elect: David Collier, Univ. of California, Berkeley; Arthur Lupia, Univ. of Michigan

Member-at-Large of the Section Committee: Eileen Crimmins, Univ. of Southern California; Gary King, Harvard Univ.

Electorate Nominating Committee: Lynda T. Carlson, National Science Foundation; C. Gregory Knight, Pennsylvania State Univ.; Jonathan Mayer, Univ. of Washington; Aman Ullah, Univ. of California, Riverside

Council Delegate: Ronald R. Rindfuss, Univ. of North Carolina at Chapel Hill; Amy O. Tsui, Johns Hopkins School of Public Health

Statistics

Chair Elect: Sally C. Morton, Univ. of Pittsburgh; Jane-Ling Wang, Univ. of California, Davis

Member-at-Large of the Section Committee: R. W. Doerge, Purdue Univ.; Jessica Utts, Univ. of California, Irvine

Electorate Nominating Committee: Xuming He, Univ. of Michigan; Hans-Georg Müller, Univ. of California, Davis; Javier Rojo, Rice Univ.; Naisyin Wang, Univ. of Michigan

Science

AAAS News and Notes

Science **334** (6055), 469-473.
DOI: 10.1126/science.334.6055.469

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