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## The Best and the Worst: Mining Historians Look Back at the Millennium

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*Edited by Sally Zanjani*

**T**he millennium offers an occasion for taking stock of what, when all is said and done, has mattered most during the last thousand years of mining history. A number of leading mining historians were surveyed for their reflections on several fundamental issues. Their written responses, ranging from contemplative essays to brief one-liners, proved surprisingly varied, and are directly quoted below in colloquy style. Some participants did not address every question.

Respondents were: Roger Burt, Department of History, University of Exeter, England; Stanley Dempsey, Royal Gold, Incorporated; Gene Gressley, Director Emeritus, American Heritage Center, University of Wyoming; Don Hardesty, Department of Anthropology, University of Nevada, Reno; Carlos Schwantes, Director, Institute for Pacific Northwest Study, University of Idaho; Duane Smith, Southwest Center, Fort Lewis College; and Robert Spude, National Park Service, Santa Fe.

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ZANJANI: What do you see as the most important mining discovery of the last thousand years?

GRESSLEY: The California Gold Rush, 1849-1852, would receive my vote for the most important gold discovery, not only for the amount of gold production of the first four years (circa \$220,000,000, with over one billion and a quarter by 1900), but for the enormous overall impact on world mining. The first major gold rush, in three centuries, by 1852, the miners scrambling about the gold fields of California numbered almost a quarter of a million souls.

As important for the history of gold mining as

the centripetal force of immigration to California was the centrifugal explosion of emigration from California. With rumors and coattails flying, the alumni of California mining camps could soon be found populating the hills and dales, to name a few, of Oregon, Colorado, Peru, Australia and South Africa.

It would be difficult to exaggerate the flow of investment that followed those scraggly bearded miners from [the] Eastern United States and Europe (long after the returns cauterized dreams of individual investor wealth). Other spin offs of the economic upheaval of the California Gold Rush can be ticked off with ease: the stimulation and importation of raw materials to the West coast, giving an impetus to nascent manufacturing and construction industries; the formation of a transportation network that went far beyond the first transcontinental railroad to include stage lines, narrow gauge railroads and ships setting sail from ports up and down the West Coast. And above all else, the incredible inflation the California gold rush provided for an entire international economy.

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ZANJANI: Three other respondents concurred on the significance of the California gold rush and offered some additional reasons.

DEMPSEY: The Spanish discoveries in Mexico, Peru and Bolivia certainly were important, but the repressive economic and social institutions of Spain prevented the full utilization of their benefits. The silver production of Guanajuato and Potosí were incredible, but the treasure was not very widely distrib-

uted when they got it home. To the contrary, the California rush was more egalitarian, and the gains monetized the United States for the first time.

The California rush also led to the Comstock discoveries, and the subsequent opening of mines all over the U.S. It was the fountainhead of Western U.S. mining.

SMITH: One immediate political consequence was the crisis of 1849-50 that both temporarily calmed the troubled sectional waters but also led to the Civil War in 1861. California's role in this was statehood with no balancing slave state ready to enter the union. It also gave us California, what has that meant since!!! It also stimulated tourism then, and ever since, not to mention literature, music, the arts, and helped create the legendary West.

HARDESTY: The California Gold Rush was the first truly global mining rush, bringing together in one place not only a great diversity of peoples and cultures but also global technologies ranging from Cornish stamps to the Chinese pump. It led to the explosive growth of California and stimulated a number of other mining strikes in other parts of the West, including the discovery of the Comstock Lode. The Comstock, in turn, developed and globally exported a pattern of industrialized deep mining that revolutionized the mining industry.

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ZANJANI: As Burt considered the question, he came to another conclusion.

BURT: Clearly massive new discoveries of a wide range of metals were made in all of the major continents that were visited and settled by Europeans. Which were quantitatively the most important, I am not sure—but I would guess that those made in what is now the United States hold prime position—followed by Australia? But whether they were fundamentally relevant to the long-term development of those nations, I rather doubt. California today I suspect would be much as it is without nineteenth-century gold, as would most of the western states

without gold/silver/copper and lead. The exploitation of their agricultural resources would have shaped them into a reasonable facsimile of their current condition, perhaps with a softer, less colorful “mid-western” edge. Probably the same is true of Australia, though I think that they, like Canada, have developed a society that sees an easy salvation to economic problems by digging up more raw materials and that they accordingly have a less rigorous approach to life and competition—but again, their vast agricultural resources are likely to have bred much the same attitudes, even without mineral discoveries.

I think that my vote for the discovery that had greatest consequences for the world in terms of the supply of material—the widest political and social consequences etc. was the discovery, first of diamonds, and then of gold, in South Africa. Those events effectively created that country as we now see it and made it the most powerful economy by far in the continent. They flooded the world with diamonds, greatly reducing their price and creating the base for new engineering technologies; they produced a flood of gold that created inflationary pressures across the world at the end of the nineteenth century and underpinned a new period of rapid international economic expansion; they attracted permanent residents from afar, virtually “creating” both the white and black population of the country, and their methods of working established the foundations of what became apartheid; they were the only real basis for establishing great new cities, such as Johannesburg and in every sense were the “makers of the country.” It could not be said of South Africa, as I have said of the U.S. that it would be much the same today without them.

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ZANJANI: Spude made a different choice.

SPUDE: I would have to go with the discovery of mines in Mexico (and Bolivia) shortly after the “discovery” of the New World by Columbus. The fifty year span from 1492 to opening the bonanzas of central Mexico would have worldwide impacts—in

economics, politics, law, labor, commerce. International policies would be impacted and other European countries would try to imitate the Spanish success in the New World. France would be eclipsed; the British eager to emulate. In a world mercantile system Spain dominated for centuries because of New World mines.

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ZANJANI: What is your second choice for most important mining discovery of the last thousand years?

SMITH: I have a tie for second place. The discovery of the Inca and Aztec empires and their mineral treasures started the discovery and colonial eras in world history and energized the search for precious metals throughout the world.

Pitchblende and carnotite had been mined for years in the twentieth century before World War II. With the development of the atomic bomb, world history was changed forever. The potential uses for nuclear energy have only been tapped, but perhaps the danger will limit them completely. Only the future will tell.

SPUDE: The California gold discovery, of course.

GRESSLEY: My second gold rush selection would be the Witwatersrand not only for the enormity of riches pouring forth from the Rand (roughly speaking, gold production of South Africa was twenty-two times that of the entire United States by 1960), but for the opportunity of encountering some of the most magnetic and electrifying characters ever to cross the world stage of mining, persons with such storied names as: Barney Barnato, Cecil Rhodes, Henry Struben, Joseph B. Robinson, Paul Kruger, Herman Eckstein—the colorful list marches on.

BURT: The Spanish discoveries of silver in South America in the sixteenth century would have to take the “silver medal.” It had an immeasurable impact on the local population and economy of Spanish America and very profound consequences

for early modern Europe, as monetary inflation resulting from the import of precious metal destabilized the entire continent. It thrust Spain into the forefront of tumultuous European politics but destroyed its once strong mining industry for 300 years, and perhaps in the longer run, undermined that country’s economic drive. But perhaps I could also introduce another concept—the mineral discovery that might have had very different consequences if it had taken place at a different time. How would things have turned out if a Mexican mill owner had discovered gold in Sutters Creek in 1838 or 1828. Would it have changed the course of history? Would the U.S. have been able to become a continental nation? the same major economic power? Would the history of the twentieth century have turned out differently? Perhaps I have now undermined my starting premise that the discoveries “in” the U.S. really were not that important for the progress of the nation!

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ZANJANI: What do you see as the most important invention in mining technology during the millennium.

DEMPSEY: I think electrification and better mechanical transmission of power are good candidates for the most important technological advances. Steam power helped, but the energy was hard (and dangerous) to transfer. Electric motors are more efficient, and our newer transmission drives allow us to get rid of line shafts and belts.

SCHWANTES: The solution extraction-electrowinning process to turn mine waste into valuable copper cathodes was certainly one of the best things to come down the pike in a long time.

SPUDE: Would it be the Arab Gerber’s discovery of Nitric Acid? Would it be the scientific revolution of the eighteenth century’s final impact on the chemical applications to mining in the late nineteenth—bringing about the cyanide process, the flotation system, the Hall process for aluminum, etc.?

GRESSLEY: If I were to name a technological revelation which had the most impact on mining in the last millennium, it would be cyanide heap leaching, which is altering the configuration of so much of your Nevada landscape.

SMITH: Electricity and dynamite. Not mining inventions per se, but they changed mining forever.

HARDESTY: The Newcomen steam engine. Steam engines made possible the application of a wide variety of machines, including pumps, hoists, air compressors, and locomotives, to mining and milling on a large scale. The steam engine made possible the industrialization of mining (e.g., the Comstock) with its mass production system, occupational specializations and diversity, and managerial hierarchies. And the high capital costs of steam engine-driven machines helped create the corporate structure of mining enterprises. Without the steam engine and its technological descendants, mining today still would be the same small-scale and human-powered enterprise that it was in the last few millennia.

BURT: There has only been one major productivity improving innovation in underground mining in the last hundred years, and that is the application of explosives. That innovation could itself be divided into two parts—gunpowder in the late seventeenth/early eighteenth century and dynamite in the late nineteenth century—the latter innovation being closely associated with the introduction of mechanical drilling. By comparison with those events, other innovations, such as the application of steam and electrical power are relatively insignificant. Steam was really only used to great advantage in the late eighteenth and nineteenth centuries to permit a few “older” mining districts to go deeper—most of great increase in output came from mines and districts that made relatively little use of it. If we go beyond underground mining to open pit, production is still predicated on the breaking of rock by the massive use of explosives.

The application of explosives had importance beyond productivity increases alone. They also pro-

vided the foundations for the early progression from small “owner-occupied” mines to larger, corporate enterprises. The link was through the potential that gunpowder gave for the driving of long, deep drainage adits. In the seventeenth/early eighteenth century this gave European mines the facility to overcome the production crisis produced by the exhaustion of shallow deposits and to begin mining at greater depths, but long adits required considerable advance funding and enabled external capitalists to enter the industry. That process of “corporate enlargement” within the industry followed on progressively thereafter in close association with other productivity increasing innovations—again largely concerned with the breaking and removal of ore. Arguably, it was this process that also led to the “proletarianization” of the labor force, changing the nature of the miners’ lives from independent miner/farmers/fisherman and turning them into full-time miners, damaging their health, oppressing their condition, removing their independence, etc. Similarly, the need for greater [capital] in a risky industry, gradually pushed the mineral owners (the kings, princes, and aristocrats) out of undertaking mining on their own account and pulled in the independent capitalist, breaking down old feudal relationships and preventing their resurgence in colonial mineral exploitation.

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ZANJANI: What is your second choice for most important invention in technology?

SPUDE: The power drill.

DEMPSEY: Flotation, cyanidization, and pyrite smelting are close runners up.

HARDESTY: The telegraph, which made possible the global stock markets that capitalized mining on a large scale after the mid-nineteenth century.

BURT: It has to be not an underground, but a surface technology—flotation. Whereas better explosives and drills enabled more ore to be pulled out

of the mines—the opportunity to go after lower grade ores—only the move from mechanical to chemical separation enabled those ores to be handled and concentrated.

GRESSLEY: A second option for technological techniques would be the advances that were made in ventilation, pumping, and the Deidesheimer square-set timbering later followed by block caving for mining in the depths.

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ZANJANI: In addition to “Eureka!” moments and great advances, the millennium has encompassed tragedies large and small and developments inimical to mining. What do you see as the worst of the millennium?

SMITH: The hands down winner, mine dumps and mill/smelter tailings. This has been going on ever since mining started—one might argue if it is the oldest, or second oldest, profession! We see the environmental impact throughout the world from precious and base metals to coal mining as well as oil. The mining camps and towns contributed their share as well.

SPUDE: Hmmm. The twentieth century scale of unbridled earth moving and waste heaping without the effort to reclaim, take care of the environment.

DEMPSEY: Failure to recognize the problems of acid drainage and mine fires are my pick. People are aware of the terrible coal mine fires, but most do not know that there were some pretty bad metal mine fires. The ones in Tasmania (turn of the century) and the Sunshine Mine fire more recently come to mind. Problems with free silica and radon dangers are a close third and fourth.

SCHWANTES: I suppose the worst was the lack of real safety consciousness in underground mining until the early twentieth century. To me the rise of

safety consciousness in the American mining industry since ca. 1913 has been one of the important advances in the history of hardrock mining.

GRESSLEY: Tragedies abound in the mining world as in life. But one can not avoid [thinking that] the greatest tragedy of all was simply the loss of life whether from disease, minimal nutrition, or from violent underground mine explosions.

BURT: Impossible to decide—too many terrible accidents, financial collapses etc. But what about a very contemporary one. The current collapse of confidence in gold—is gold mining doomed? If we have finally given up on needing it as a medium of exchange/base for paper currency—and if we have mountains of the stuff hidden in bank vaults that will now come on the market to facilitate the few “manufacturing” uses for it—will that whole sector of the mining industry be lost forever. I know that at the moment the world is still consuming gold faster than it is mining it—mainly for jewelry—but when the message filters through that its value is permanently diminished, will the demand for such a soft and really “undurable” metal also gradually wither. If it does, it will be the first mineral to see a permanent reduction in its demand. (But what about silver—the price of that metal also has slumped—but I'm not sure if that is because of a massive increase in output or a reduction in demand.)

If I need to find a “second place” here, I would suggest the various attempts to “corner” the market in metals/restrict production/drive up prices through cartelization. All attempts—in copper in the late nineteenth century and again lately—tin in the second half of the twentieth century, have all done serious longer-term harm to those sectors of the industry (the current condition of the tin producers is particularly convincing).

HARDESTY: The sixteenth century Spanish enslavement, through the institution of *encomienda*, of Andean Indians for mining precious metals, leading to large scale enslavement and decimation of indigenous populations.

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ZANJANI : Which mining rush would you most like to have joined?

DEMPSEY: I think I would have liked to have joined the rush to the Klondike. I am fascinated with New Guinea, but I am glad I did not get malaria on the way to Eddie Creek. I have enjoyed my work in outback in western Australia, but I am glad I never had to work on a dry blower.

SMITH: I would love to have participated in two Colorado mining rushes. Caribou in 1870 simply because this is my “first love” in mining history and I would like to see if I got it right! The second rush would be Leadville, that would be a fun one. Get to know Horace, Baby Doe, and a host of Colorado nineteenth century folk. The excitement, the boom, the silver bonanzas, the labor problems, the mining scandals, the millionaires, the red light district, just the urban Leadville world—all would make it fascinating.

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ZANJANI: Spude voted for the California gold rush or Australia in '54, Hardesty concurred on the California gold rush, and Gressley opted for the South African gold rush. My last questions—which mining rush are you most relieved to have missed?

SCHWANTES: I always find the Klondike Rush of 1898 fascinating, but I doubt that I would have joined it. No amount of gold could possibly have made it worthwhile for me to spend a winter in the frozen north.

SPUDE: I would miss the present gold rush to the Amazon.

HARDESTY: The Klondike. I would have happily missed the black flies and cold temperatures.

SMITH: Believe me. I would not have rushed north in '98 or any other time for that matter.

GRESSLEY: There are a host that I would have run from rather than to—primarily for climatological reasons. The frozen north of the Klondike and Siberia hold little appeal, as would have the heat and humidity of Peru and Brazil, and what manner of prospector would have enjoyed the desert sand storms of Australia? Of course there would [have been] thousands who endured all for the gamble of the golden fleece, which danced before their eyes well into advancing age.

BURT: I am relieved to have missed them all. I hate privations and a lack of comfort (they were all too hot/too cold/too wet/too dry). I hate sleeping in tents. I dislike dealing with Celts, who always seem to be intent on hitting Englishmen for some unreasonably perceived wrong done to their grandparents. I am profoundly pessimistic—I just know that I would never find anything. I am too easily seduced by drink and loose women, and would certainly have lost anything that I did find. Far better to let the adventurous have their fun and then come along in the second wave to collect the real profits from takeovers etc. Indeed, I seem to have found that it is possible to make a far better and more secure living by writing about mining than ever can be derived from actually being involved in it.