

AFFIDAVIT OF RICHARD E. LINGENFELTER

STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN DIEGO)

Richard E. Lingenfelter, being first duly sworn, deposes and says, under penalty of perjury:

Introduction

1. I, Richard Lingenfelter, am over eighteen years of age, and I give this affidavit based upon my research concerning historical navigation and mining in Arizona.

2. I have been retained by Freeport-McMoRan Corporation (“Freeport”) to provide an affidavit concerning the history of navigation in Arizona and regarding whether the Gila River was navigable or susceptible to navigation in its ordinary and natural condition at and prior to statehood.

3. In addition to my background in historical navigation and historical mining in Arizona, I am familiar with case law concerning navigability in the context of the Equal Footing Doctrine, including cases such as *United States v. Utah* (1931). As part of this retention, I have reviewed *PPL Montana* (2012) and *State v. ANSAC* (2010), and my opinions concerning the non-navigability of the Gila River are made in the context of, and are consistent with, these authorities.

Professional and Academic Background

4. I am currently an Emeritus Research Physicist in the Center for Astrophysics and Space Sciences at the University of California, San Diego (“UCSD”).

5. From 1969 until I came to UCSD in 1979 I was a Professor in Residence at the University of California, Los Angeles, jointly in the Astronomy, and the Planetary & Space Sciences Departments, and also in the History Department, while I taught their course on the History of the American West. In 1968-69 I was a Fulbright Scholar at the Tata Institute of Fundamental Research in Bombay, India, and I was elected a Fellow of the American Physical Society and the chair of their Division of Astrophysics.

6. In addition to my work in the fields of physics, astrophysics and geophysics, I have long studied various aspects of the history of the Western United States, and have written, or edited, over 20 books in this area since 1957, more than half of them published by university presses.

7. A copy of my *Curriculum Vitae* is attached as Exhibit A to this affidavit.

Research Concerning Historical Navigation in Arizona

8. My historical research has included the study of historical navigation in Arizona, as the major part of a broader study of navigation on the Colorado River and its tributaries.

9. I devoted roughly four years to this research, drawing particularly on the historical newspaper and manuscript resources of some thirty libraries across the country, most notably those of the Arizona Historical Society, the Yuma County and Mohave Pioneers' historical societies, the Sharlot Hall Museum, the University of Arizona, and the Arizona State Library and Archives, plus the Bancroft Library, the Huntington Library, the Southwest Museum, the California Historical Society, those of San Diego and Needles, and the California State Library, as well as the Nevada, Utah, and Colorado historical societies, universities and state libraries, the LDS Church Historian's Office, the Manuscript Division of the New York

Public Library, the Library of Congress, and the National Archives, plus many individual collections.

10. The richest sources proved to be the historical newspapers which included not only news reports, but many letters by participants and editorial comment. These were supplemented by manuscript letters, journals, reminiscences and photographs, as well as government records and reports, plus legal cases and testimony. In order to find what additional information has since become available through the extensive historical newspaper archives now searchable online on the internet, I have also searched these archives for information related to navigation of the Gila River.

11. In 1978 I published the results of this research in a book covering the history of steamboat operations on the Colorado River and its tributaries, *Steamboats on the Colorado River, 1852-1916*. Tucson: University of Arizona Press, 1978. xv + 195 pp. illus. maps. In its 1998 Final Report, *Criteria for Assessing Characteristics of Navigability for Small Watercourse in Arizona*, the State of Arizona cited my book as one of two “major general works on boating in Arizona.” (pg. B-1). Jonathan Fuller, who I understand has been retained as an expert witness for the Arizona State Land Department, was a coauthor of this report by the State.

12. In the course of my research into historic navigation on the Colorado River and its tributaries, I found that there was no historical record whatever of any commercial navigation on the Gila River, except for occasional excursions only five miles up the Gila from its junction with the Colorado. My historical research revealed that the Colorado River was Arizona’s only navigable stream. This conclusion is consistent with Fuller’s 2003 report prepared on behalf of the Arizona State Land Department and entitled *Arizona Stream Navigability Study for the Gila River: Colorado River Confluence to the Town of Safford*. In that report, Fuller cites Swanson

and Altschul (1991, pp. 17 and 64) which state that “the Gila, much smaller than the Colorado, has always been marginal for navigation” and “The Gila was less attractive as a navigation artery, but it too was explored with the discovery of placer gold around Gila City in the early 1860s.”

13. Most recently I have completed a six-year study of the economic history of metal mining in the American West, which includes two of Arizona’s major copper mines at Ajo and Clifton-Morenci. These mines are close to the Gila and their development and operations have important bearing on the question of the demand for commercial navigation on that river, as discussed below. This two-volume history, *Bonanzas & Borrascas, 1848-1918*, University of Oklahoma Press, 2012, 461 + 586 pp. illus. maps, won the Mining History Association’s Clark Spence Award for the Best Book in Mining History of 2011-2012.

Historical Navigation on the Colorado River

14. Commercial navigation of the Colorado River and its tributaries began in 1852, spurred by government contracts to supply the newly established Fort Yuma on the Colorado 180 miles above its delta, and opposite the mouth of the Gila. The first boat, launched in November of that year, was a side-wheel steamer, the *Uncle Sam*, 65 feet long with a shallow draft of less than 3 feet. In the next sixty years, at least 18 steamboats and numerous gasoline boats would ply the Colorado in Arizona for over 600 miles from the gulf, where they connected with sea-going steamers, up to Callville under present Lake Mead just below the Grand Canyon. On above the canyon in Utah, starting in 1891, a half dozen more steamers and many gasoline boats would run all the way to Wyoming on the Green River, the Colorado’s only navigable tributary. (*Steamboats on the Colorado River, 1852-1916*. pp. 9, 161-166).

15. Although Colorado River steamboats were initially on military supply contracts, they rapidly increased their business, as they helped open new mines all along the river around Castle Dome, La Paz, the McCrackin and Moss mines, Mineral Park and Eldorado Canyon. Bringing in passengers, supplies and machinery, and carrying out high-grade ore, crude lead and silver bullion and gold, the Colorado Steam Navigation Company prospered. Heralded as “the cheapest public carriers on the Pacific Coast,” they dominated trade in Arizona until they sold out to the Southern Pacific Railroad with the coming of the tracks in 1877. But the railroad continued to feed the river steamers until the completion of the Laguna Dam just above Yuma effectively closed the river to navigation in 1909. With the introduction of gasoline powered boats in 1891, however, smaller competitors got into local runs and excursions. (Prescott *Arizona Miner*, Dec. 24, 1874; *Steamboats on the Colorado River, 1852-1916*. pp. 31, 73-74, 164-166).

16. The largest boats on the Colorado River, the *Cochan*, *Cocopah*, *Colorado*, *Gila* and *Mohave*, were all sternwheelers of close to 150 foot length with about 30 foot beam and 3 foot draft, while the smallest commercial steamers were still close to 100 feet by 20 feet with similar draft. The gasoline boats, however, were more typically closer to 50 feet by 20 feet and the *Aztec* had a draft of just 20 inches with a 50-ton cargo. But even she was only able to get five miles up the Gila River, and only during periods of high water. (Yuma *Arizona Sentinel*, Jun. 2, 1894; *Steamboats on the Colorado River, 1852-1916*. pp. 86, 161-163). Moreover, the Arizona Navigable Stream Adjudication Commission determined in its 2009 report concerning the Gila River that at least 2.5 miles of this portion consists of the ordinary high water mark of the Colorado River. (*Report, Findings and Determination Regarding the Navigability of the Gila River from the New Mexico Border to the Confluence with the Colorado River*. pp. 80-82).

17. The commercial steamers on the upriver tributary, the Green River, ran all the way down to its junction with the Colorado and up it as far as Moab. But they did a much lighter business, mostly running excursions and supplying ranchers and prospectors in the canyons, and they were also smaller craft, similar to the smallest steamers on the Colorado. (*Steamboats on the Colorado River, 1852-1916*. pp. 105-108, 161-163).

Absence of Historical Navigation on the Gila River

18. On the pioneer steamer *Uncle Sam's* first trip to Fort Yuma in November 1852, she had taken the Army officers on an exploratory excursion up the Colorado and also a short distance up the Gila. But that was as far as any steamboat would ever go on the Gila. For, in all the time that commercial boats were operating on the Colorado, none were ever reported to have gone more than half a dozen miles up the Gila River. The only other boat trips on the Gila were just excursions to seasonal picnic grounds during periods of high water, made mostly by the new gasoline-powered paddle-wheelers, the *Electric* and the *Aztec* in the 1890s. (*Yuma Arizona Sentinel*, Jun. 2, 1894; *Steamboats on the Colorado River, 1852-1916*. pp.11, 86).

19. Their failure to go farther up the Gila River, however, was not for lack of demand or imagination. For Arizona's first gold rush in 1858 to the placers at Gila City just twenty miles up the river prompted the formation of the Gila Mining and Transportation Company in San Francisco. Hoping to navigate the Gila, they sent down mining machinery and a small, disassembled "mail steamer" from San Francisco on the schooner *Arno*. She arrived at the mouth of the Colorado in March 1859, but promptly struck a sand bar, bilged and sank, "a total loss in less than half an hour." No one else attempted to put a steamer on the Gila, and the rush petered out. (*Los Angeles Vineyard*, Apr. 8, 1859; *Steamboats on the Colorado River, 1852-1916*. pp. 31-33).

20. Several years later, however, Samuel “Steamboat” Adams, after helping to organize a rival steamboat company on the Colorado in 1864, turned to the possibility of putting steamboats on the Gila, as well as the Salt. But he finally dropped the idea after concluding, it was said, that the only way to do it was in “steam boats with big broad wheels something on the order of our present traction engine wheels, and when there was water they were to act as water wheels and in places where the river sank they were to carry the boat over dry [land]”! Moreover, the boats would need “double turret guns one in front and one behind, in case of Indians it could be turned on the enemy, and in tight pulls either on land or water the firing of the gun at the rear acted as a pusher by the recoil of the charge, or a shot from the front or bow would make the vessel back out in case they got stranded.” (Prescott, *Arizona Journal-Miner*, Nov. 7, 1900; *Steamboats on the Colorado River, 1852-1916*. pp. 43).

21. Even if they couldn’t get up the Gila, adventurers still occasionally tried rafting down during flood stage. As early as 1847, the Mormon Battalion, headed for California during the Mexican War, tried to float their supplies down the Gila from the Pima villages on two wagon beds tied together. But they repeatedly ran aground and they were finally forced to jettison part of their cargo. From that attempt alone, Edwin Corle concluded in his classic, *The Gila: River of the Southwest* (1951, pg. 154), they “demonstrated that the Gila River was not practical for navigation.” However, in the gold rush to California in 1849, one enterprising Argonaut, Edward Howard, seeing the Gila River on a map, built a flatboat, 16 by 5.5 feet, which he first tested in Lake Michigan, and then used as a wagon bed until he reached the Pima villages on the Gila. There in September, catching the river in flood, he launched his boat and with his pregnant wife, a child, a doctor, and a preacher, he claimed they reached Yuma, a meandering distance of 250 miles, in three and a half days “without serious impediment.” Other

adventurers would also occasionally try riding the floodwaters down the Gila in all sorts of flatboats with very mixed results. Often swamped and nearly drowned in the “hazardous waters,” losing their provisions, and forced to belay their boats through rapids by rope and make portages by train, they took as much as two months from the upper Gila, their harrowing tales of terrifying adventures were spread as warnings in the press. Even for those who claimed success, it was a very seasonal and risky business, which they vowed never to repeat even “for wealth untold.” (Howard’s letter in *San Francisco Bulletin*, Jul. 8, 1885; *Yuma Arizona Sentinel*, Mar. 9, 1895; *Imperial, Cal., Press*, Apr. 1, 1905).

22. When the seasonal floods suddenly made the roads across the usually dry Gila River bed impassable for wagons, ferries were also hauled out and used, not to navigate the river, but to cross the river. But obviously such ventures, trying to reopen the roads across the river bed, could not be considered a commercial use of the river as a “highway for commerce.”

There Were Significant Needs to Use the Gila for Commercial Navigation

23. Although no attempts were later made to put commercial boats on the Gila, it was not for lack of demand. For in my recent research into the economic history of western metal mining, I found that transportation costs, particularly shipping out copper matte and highgrade ores, were very often the largest expenses of the mining operation, and frequently determined whether profitable operations were possible. This was the case for two of Arizona’s major copper mine complexes at Ajo and Clifton-Morenci. These mines are close to the Gila and their early development and operations were primarily dictated by the cost of shipping out the copper. Thus, the early operators of these mines were constantly looking for cheaper transportation, either by river or by rail.

24. As soon as the country south of the Gila passed into American hands after the ratification of the Gadsden Treaty in 1854, an enterprising San Francisco merchant, Edward Ely Dunbar, staked claim to the Ajo mine. He and his partners formed the Arizona Mining & Trading Company for \$500,000 in \$100 shares, and commenced mining in June 1855. Despite numerous problems, within a year they had shipped to San Francisco over 100 tons of the very richest ore that returned as much as \$300 a ton. Since the costs of mining the rich surface ores and shipping them by steamer from Yuma were only a small fraction of that return, the mine could be quite profitable. But the cost of hauling the ore by wagon, a roughly 300-mile round trip between Ajo and Yuma, was nearly half of the value of the ore, and made the working of ores running less than about \$150 a ton unprofitable.

25. Thus there was a clear need for cheaper transportation, and since Ajo is only about 50 miles from the Gila, if they could have just rafted the ore on down the river, they could cut shipping costs by two-thirds, and profitably worked a much larger amount of lower grade ore. But they found that even rafting down the Gila, let alone running a steamer up it, was simply not possible most of the year. So after another couple years, extracting the last profitable ore, Dunbar finally had to shut down, because he couldn't cut the cost by shipping it on the Gila. (*Bonanzas & Borrascas, 1848-1918. pp. 79-80*)

26. Lack of cheap river transportation also slowed the development of the even richer copper mines at Clifton and Morenci just off the Gila close to the New Mexico line. These mines were opened in 1872 by the Detroit Copper Company, owned and managed by some wealthy Michigan steamboat captains. But even they failed to find any way to successfully navigate the Gila, instead of paying as much as \$240 a ton hauling crude copper matte by road to

the nearest railhead at Trinidad Colorado, before the Southern Pacific railroad finally reached eastern Arizona in 1881. (*Bonanzas & Borrascas, 1848-1918*. pp. 182-182)

27. Clearly these mining entrepreneurs would have eagerly undertaken navigation of the Gila if it had been at all possible. The failure of anyone to do so was not for lack demand, but for lack of sufficient water. The Gila River was simply not susceptible to commercial navigation.

Crafts Customarily Used for Trade and Travel at the Time of Statehood

28. Through my research, I am very familiar with the types of crafts that were “in customary use for trade and travel at the time of statehood.” (*PPL Montana* at 1233). These did not include craft that are similar to modern day recreational craft such as modern lightweight canoes and kayaks.

29. The craft customarily used for trade and travel at the time of statehood included large steamboats and gasoline powered paddle wheelers, as described above.

The Gila River Was not Susceptible to Commercial Navigation

30. In over fifty years of researching and writing on Western American history, I have found no historical evidence of any commercial navigation on the Gila River more than a short distance above its junction with the Colorado, despite a continued demand from developing mines for cheaper transportation. Thus, the failure of commercial operations on the river can only be explained, not by a lack of demand but by a lack of water.

31. In particular, I have researched the history of commercial navigation on both the Colorado River and its tributaries all the way from the Gulf of California to the Rockies, culminating in my book, *Steamboats of the Colorado, 1852—1916*, (University of Arizona Press, 1978). I found that there was extensive commercial navigation on the Colorado River during that period, serving both military posts and mines throughout much of Arizona, and also some on its

only navigable tributary, the Green River in Utah. But in all that time, I found evidence of only one aborted attempt to put a commercial steamboat on the Gila River, and occasional picnic excursions just five miles up the river from the Colorado during periods of high water, but nothing above that.

32. Moreover, I have found that the continuing failure to put commercial vessels on the Gila was clearly not the result of a want of demand for such services. For, as I have found in my recent research into the economic history of the Western American mining industry, *Bonanzas & Borrascas, 1848-1918* (University of Oklahoma Press, 2012), there was great need for cheaper transportation for developing copper mines along the Gila, from the Ajo mine in 1854 to the Clifton-Morenci mines in the 1860s-70s prior to arrival of the railroad in 1881. These mines could have supported commercial navigation on the Gila River, had that been possible.

FURTHER AFFIANT SAYETH NOT.

DATED this 16 day of May, 2014.


RICHARD LINGENFELTER

The foregoing instrument was acknowledged before me this _____ day of May, 2014, by
Richard Lingenfelter.

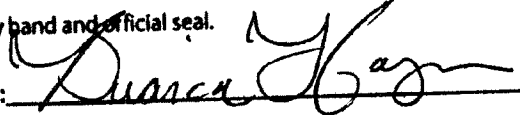
Notary Public

My Commission Expires:

State of California
County of San Diego
On 05-16-2014 before me, Bianca Rose Haynes, Notary Public
personally appeared

RICHARD LINGENFELTER
who proved to me on the basis of satisfactory evidence to be the
person(s) whose name(s) is/are subscribed to the within instrument
and acknowledged to me that he/she/they executed the same in his/
her/their authorized capacity(ies), and that by his/her/their
signature(s) on the instrument the person(s), or the entity upon
behalf of which the person(s) acted, executed the instrument.
I certify under PENALTY OF PERJURY under the laws of the State of
California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature: 

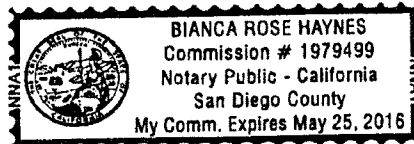


EXHIBIT A
CURRICULUM VITA
RICHARD EMERY LINGENFELTER

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BIRTH DATE & PLACE: April 5, 1934 -- Farmington, New Mexico

EDUCATION: B.A. 1956, Physics, University of California, Los Angeles

HONORS: Fulbright Research Scholar in India (1968-1969)

Fellow of American Physical Society

PROFESSIONAL SOCIETIES: American Astronomical Society

American Geophysical Union

American Physical Society (Past Chair of Division of Astrophysics)

Economic History Association

Mining History Association (Founding Member)

Western History Association

POSITIONS:

1979-Date -- Research Physicist, Center for Astrophysics & Space Sciences,
University of California San Diego, La Jolla, California

1969-1979 -- Professor in Residence, Depts. of Astronomy, Earth & Space Sciences,
and History, University of California, Los Angeles, California

1968-1969 -- Visiting Fellow, Tata Institute of Fundamental Research, Bombay, India

1962-1968 -- Research Geophysicist, Institute of Geophysics, University of California,
Los Angeles, California

1957-1962 -- Physicist, Reactor Program, Lawrence Radiation Laboratory, Livermore,
California

TEACHING: Undergraduate & graduate courses in Astronomy, Earth & Space Sciences & History

Dissertation advisor for half a dozen doctoral students

Post-Doctoral courses at the Astrophysics Institute, Nanjing University, China, the Tata
Institute for Fundamental Research, Bombay, India, and the International Summer
School in Balatonfured, Hungary

RESEARCH FIELDS:

High Energy Astrophysics, Solar Physics, Geophysics & Western American History

ADVISORY ACTIVITIES:

Serves on advisory committees for Federal government agencies, the

Universities Space Research Association and the California Space Institute

Reviews proposals for National Science Foundation, National Aeronautics & Space

Administration, National Endowment for the Humanities, National Research Council
of Canada, Australian Research Grants Committee and International Science Found.

Reviews manuscripts for a couple dozen scientific & historical journals, university
presses and other book publishers.

RICHARD E. LINGENFELTER --- SELECTED PUBLICATIONS

SCIENTIFIC

Over 270 articles on astrophysics and geophysics in scientific journals and books, 1956 to present.

HISTORICAL

Over 20 books on Western American and Pacific Island history. Half of these were published by university presses, and two-thirds deal with western mining history. They include:

First Through the Grand Canyon, by Richard E. Lingenfelter. (Los Angeles: Dawson, 1958), 119 pp. illus. port. facsimis.

The Songs of the Gold Rush, edited by Richard Dwyer, Richard Lingenfelter and David Cohen. (Berkeley and Los Angeles: University of California Press, 1964), xi + 200 pp. illus.

Songs of the American West, edited by Richard E. Lingenfelter, Richard A. Dwyer and David Cohen. (Berkeley and Los Angeles: University of California Press, 1968), xii + 595 pp. illus.

The Hardrock Miners: A History of the Mining Labor Movement in the American West, 1863-1893, by Richard E. Lingenfelter, (Berkeley and Los Angeles: University of California Press, 1974), viii + 278 pp. illus. map.

Steamboats on the Colorado River, 1852-1916, by Richard E. Lingenfelter. (Tucson: University of Arizona Press, 1978), xv + 195 pp. illus. maps.

The Newspapers of Nevada, A History and Bibliography, 1854-1979, by Richard E. Lingenfelter and Karen Rix Gash. (Reno: University of Nevada Press, 1984), xxvii + 312 pp. illus.

Death Valley and the Amargosa. A Land of Illusion, by Richard E. Lingenfelter. (Berkeley and Los Angeles: University of California Press, 1986), viii + 664 pp. illus. maps.

Death Valley Lore: Classic Tales of Fantasy, Adventure and Mystery, edited by Richard E. Lingenfelter and Richard A. Dwyer. (Reno: University of Nevada Press, 1988), xii + 344 pp. illus.

Dan De Quille, The Washoe Giant: A Biography and Anthology, by Richard A. Dwyer and Richard E. Lingenfelter. (Reno: University of Nevada Press, 1990), xii + 452 pp. port.

The Mining West: A Bibliography & Guide to the Literature & History of Mining in the American & Canadian West, compiled & edited by Richard E. Lingenfelter. (Lanham, Md.: Scarecrow Press, 2002), 2 volumes, x + 705 and vii + 847 pp.

Bonanzas & Borrascas: Gold Lust and Silver Sharks, 1848-1884. v. 1; Copper Kings and Stock Frenzy, 1885-1918. v. 2. by Richard E. Lingenfelter. (Norman: Arthur H. Clark Co. / University of Oklahoma Press, 2012), 2 volumes, 461 + 586 pp. illus. maps.