Quest of the Blue Shells

By Ronald L. Ives

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THE QUEST OF THE BLUE SHELLS†

By RONALD L. IVES*

TRACER TECHNIQUES, according to almost any "authority," are a recent development, roughly contemporaneous with Relativity, Atomic Fission, and the Singing Commercitl. Certainly, public awareness of this valuable scientific method dates from about 1940.

A more careful investigation discloses that tracer techniques were used effectively more than a century ago to indicate sources of pollution of water supplies, to locate primary ore bodies from valley train deposits, and even to determine the direction of travel of the Pleistocene continental glaciers.

The first recorded use of tracer techniques in North America, so far as available records go, occurred slightly more than two and a half centuries ago, and was the work of Eusebio Francisco Kino, S.J., a most competent scientist who is better known to History as "The Apostle to the Pimas."

Using the blue shells of the common abalone, *Haliotis linnaeus,* as a trace element, Father Kino demonstrated, by rigorous reasoning and diligent field investigation, that there was extensive trade and travel between the Pacific coast, where the abalone occurred and the desert land of Papagueria, where the abalone shell was present as a "trade item," serving not only as a kitchen utensil, but also as the raw material for many decorative artifacts.

The entire concept of the interrelation of the abalone source, the mode of dissemination of the shells, the occurrence of the shells in Papagueria, and the geographical significance of the whole, apparently occurred to Father Kino in a matter of moments in March of 1699, while returning to Mission Dolores from the country of the Yumas. This he clearly states in his diaries[1] ". . . those blue shells must be from the opposite coast of California and the South Sea, and that by the route by which they had come thence, from there to here, we could pass from here thither, and to California."

Modern psychologists will class this, correctly, as a "flash of insight," the precursor of most important scientific discoveries. Typical, also, is the implied question, "Why didn't I think of this before?" (". . . and still it did not occur to us, etc. . . ."). Like most "sudden" discoveries, this one was a long time in gestation. From Father Kino's own diaries we learn that he first observed the blue abalone shells on the Pacific shore of Baja California about Dec. 30, 1684, where he had journeyed as cosmographer of the Atondo Expedition. Here (near the present Boca de San Gregorio, Lat. 26°03′ N.; Long. 112°17′ W. approx.), at low tide, members of the party noted "shells of rare and beautiful luster, of all colors of the rainbow, every one of them larger than the largest mother-of-pearl shells." Local Indians used the blue abalone shells as drinking cups.

During the ensuing fourteen years and some months, Father Kino saw and recorded abalone shells in many inland locations, and received gifts of abalone from the Yumas only a few days before their geographical significance became apparent to him.

The long time lapse between first clear evidence and final concept is not at all unusual, and is no reflection on Father Kino's mental processes. Educators, and those concerned with expediting scientific progress, are still wrestling with the problem of rapid acquisition of "background" and reduction of "soak-in time." It is interesting to note, in passing, that none of Father Kino's associates drew any geographical conclusions from the distribution of the abalone shells, although all of them, specifically including Capt. Juan Mateo Manje, Kino's military companion on many difficult marches, were men of considerable education, and demonstrated intellectual acumen.

A scientific hypothesis, no matter how plausible it may appear, must be rigorously checked, by all available methods, before it merits wide acceptance. Although Father Kino probably never heard the term "scientific method," he was fully aware of the *modi operandi* of scientific investigation, and promptly set out to prove[2] his hypothesis. Appreciable part of his diaries for 1699 and 1700 closely resemble an experimental scientist's notebooks, recording in detail the

†The writer is indebted to Dr. Myra Keen, Department of Geology, Stanford University, for many helpful discussions of the abalone, its habitat, and its present and former range.

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investigations made and the results obtained. His official correspondence for the same period contains many mentions of the blue shells, their possible significance, and the progress of his inquiries and searches.

The intensity and thoroughness of this investigation is clearly shown by diary notations. On April 26, 1700, at the rancheria of San Xavier del Baac, Kino writes, "I tried to take and did take measures to find out whether the blue shells came from any other region than the opposite coast of California. To that end I dispatched various messengers in all directions—to learn with all possible exactness in regard to the blue shells and the land passage of California."[3]

While the messengers were en route, Kino and party, with many Indian aides, "began the foundations of a very large and capacious church house and house of San Xavier del Baac" (April 28, 1700).

Soon the various queries began to get results. At a night assemblage and conference on April 30, 1700, Kino "made further and further inquiries as to whence came the blue shells, and all asserted that there were none in this nearest Sea of California (the Gulf of California), but that they came from other lands more remote."[4] The next day, May 1, 1700, saw the arrival of many "justices, captains and governors" from the west, and conferences were continued again far into the night. Among the subjects covered were "various inquiries regarding the blue shells which were brought from the northwest and from the Yumas and Cutganes, which admittedly came from the opposite coast of California and from the sea which is ten or twelve days' journey father than this other Sea of California, on which there are shells of pearl and white, and many others, but none of the blue ones which they gave us among the Yumas . . ."[5]

From the accumulated evidence, of which the foregoing quotations are only a small part, Father Kino drew the following conclusions:

1. That the blue abalone shells occur only on the shores of the South Sea (Pacific Ocean), and that they do not occur in the nearer Sea of California (Gulf of California).

2. That all of the blue abalone shells found in Papagueria were brought in from the west, by Indians, who travelled overland.

3. That the western shore of California was ten to twelve days' journey (afoot) west of the country of the Yumas.

As a direct result of these conclusions Kino immediately dropped his plans to complete a boat at Caborca, planned for the sea exploration of the upper part of the Sea of California; and drew up plans for an overland search for the much-to-be-desired land passage to California. The first change of plans undoubtedly pleased Kino's superior, Father Mora greatly[6]; about the second he was dutifully silent.

The findings in regard to the blue shells, samples of the shells themselves, and the rigorously tested hypothesis that there was a passage by land to California, were all communicated rapidly to Kino's ecclesiastical superiors and co-workers; eliciting, in most instances, enthusiastic replies, accompanied by the hope that a land exploration would soon be made.

These expeditions were made, and the records of them form an important and impressive chapter in the history of American exploration. Most widely-known result of these investigations was Kino's famous and beautiful map "Passo por Tierra a la California," dated 1701. The most important expedition, geographically, was that made between Feb. 5, 1702, and the middle of April of the same year, by Father Kino, in company with Father Rector Manuel Gonzales. Travelling by way of Sonoyta and the Camino del Diablo, the two Fathers reached the western shore of the Gulf of California, just below the mouth of the Colorado, and watched the sun rise over the Gulf on the morning of March 11, 1702!

Misfortune dogged the return journey from the head of the Gulf. The first eastward attempt, made directly across the *Medanos* toward Pinacate, failed for lack of water and high winds, necessitating difficult backtracking to the longer route via Yuma.[7] At Sonoyta, Father Gonzales, who had embarked on the journey suffering from a "painful flux"[8] of long standing, became too ill to ride farther, and was carried in a litter, borne by Papago volunteers, from Sonoyta to Tubutama. There, despite the best medical efforts of all concerned, he died sometime after April 8, 1702, and before April 17, of the same year. With his death, Father Kino lost not only an old and valued friend, and sympathetic superior, but also a much-needed "official witness" to his discoveries.

The "official" demonstration of the peninsularity of California took place in the fall of 1706, when Father Kino took a party of

observers to the Sierra of Santa Clara (Pinacate), and showed them the lands visible at the head of the Gulf, including "the great sandy beach where the sea ends." The night of Nov. 5-6 was spent atop the Pinacates, and observations were continued the next morning. The joint report of the expedition,[9] was signed by Father Kino, Fray Manuel de la Oyuela y Vedarte, Alferez Juan Matheo Ramires and squadron commander Juan Antonio Duran, indicates that all were conviced of the peninsularity of California. Also interesting is the separate certification of the same facts by Fray Manuel de la Oyuela,[10] who apparently was much impressed by Sonoran progress.

So far as Father Kino and the official witnesses were concerned, the peninsularity of California, first indicated by the origin and distribution of the blue abalone shells, was now conclusively proven. Some geographers accepted these findings almost immediately, others stubbornly cherished the legendary "Island of California" and "Strait of Anian" for almost a century more.

Here we have, in greatly abbreviated form, the history of a very successful scientific investigation, completed a quarter of a milennium ago. Unlike many "old" studies, this one, being entirely correct, has stood the test of time, and today's maps, although containing more detail, look much like Kino's.

Critical review of the entire investigation, using all available modern knowledge, which contains perhaps 10,000 times as many pertinent facts as were available to Father Kino, shows plainly that the ancient study was not only successful, but also sound and competently conducted.

Father Kino's choice of the abalone shell as a tracer was most fortunate, for it is a unique shell, easily identifiable, and not likely to be mistaken for anything else. Structure of a typical abalone shell is shown in Fig. 1, in which the laminated interior configuration, and the variegated mother-of-pearl lining are apparent. The irridescent blues, reds, and occasional yellows of the shell lining cannot, of course, be shown in black and white, and they constitute a severe test of even the best of our modern color reproduction processes.

The abalone today occurs in the Pacific coastal waters from central Oregon to central Baja California, and in no other North American waters. Paleontological studies show that the range of the abalone has been quite stable in pleistocene and recent times, despite known changes in sea levels, ocean currents, and ocean temperatures, particularly during the Ice Ages. The first Californians of whom we have records found the abalone in about the same places where we find them today. This we know to be true, for abalone shells and shell fragments are found in the oldest shell middens of the California coasts.

As Father Kino correctly noted more than two and a half centuries ago, the abalone does not occur in the waters of the Gulf of California. Studies of ancient beaches and fossil shell deposits along the shore of the Sea of Cortez disclose no evidence or suggestion that the abalone ever did live there. In consequence, we can state with great confidence, as did Father Kino just before 1700, that any abalone shells found in Papagueria "must be from the opposite coast of California and the South Sea."

Normal range of the abalone is shown in Fig. 2, a summary map based on the best data available today.

Abalone shells were a popular "trade item" among the American Indians, as is clearly shown by the Kino documents, and many related early accounts. Extensive archaeological investigations in recent years have shown that abalone shells were traded eastward from the California coast to numerous sites east of the Mississippi. The same studies indicate that this trade continued for considerably more than 1,000 years before Kino's time. Limits of the area

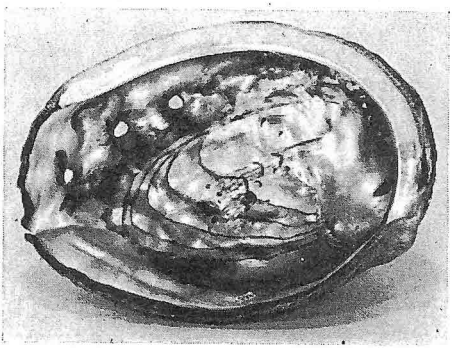

Fig. 1. Interior of the common abalone shell *(Haliotis linnaeus)*, showing physical structure and variegated lining. This specimen, from Monterey Bay, California, was loaned by the Department of Geology, Stanford University.

in which abalone shells have been found in archaeological sites are shown in Fig. 2.[11]

Interestingly, abalone shells are still a trade item, many visitors to California coastal areas purchasing one or more, which ultimately find their way to points as far distant as the Atlantic coast. Archaeologists of the far future may be sorely puzzled at the interdeposition of abalone shells with the vacuum tubes and Coca Cola bottles in the middens of the primitives of the Fourth Interglacial!

Because many of our modern trade and travel routes approximate those used by the Indians, going from water hole to water hole in desert areas; and over the smoothest terrain in those well-watered, the trajectory of the traded abalone shell has changed lit-

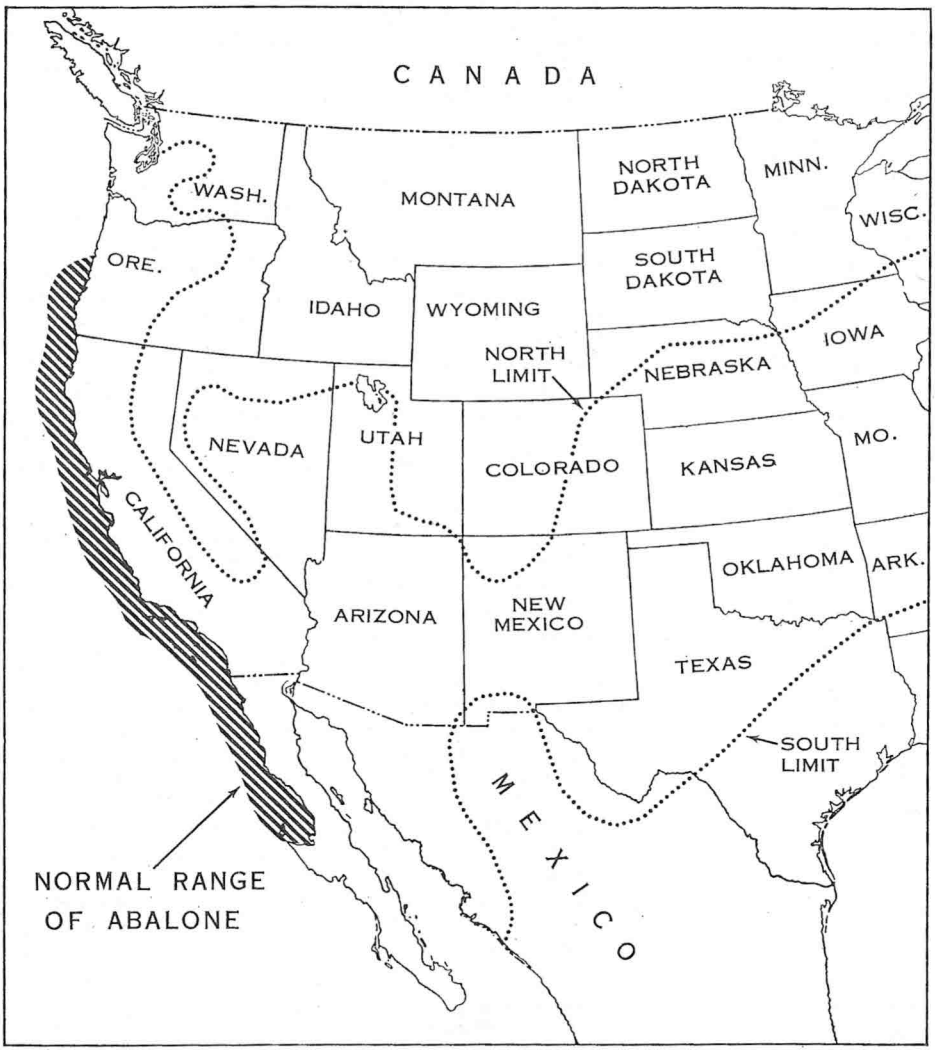

Fig. 2. Summary map of the western United States and adjacent parts of Canada and Mexico, showing normal range of the abalone, and limits of the area within which abalone shells were an aboriginal "trade item."

tle in the last 1,000 years, although the speed of dissemination has increased greatly.

Thus it appears that Father Kino's pioneer use of ecological tracers—the "blue shells"—was not only a successful and competently-conducted study in his time; but must still be regarded as a brilliant scientific investigation, worthy not only of mention, but of careful study, after a lapse of a quarter of a milennium!

NOTES

1. Bolton, Herbert E.; *Kino's Historical Memoir of Pimeria Alta,* Cleveland (Clark), 1919; Berkeley (Univ. Calif. Press), 1948, v. I, p. 230.
2. *Prove* is here used in the sense *to test by experiment* or *to try out,* and not necessarily in the sense *to establish as true.*
3. Bolton, Herbert E. *op. cit.* p. 235.
4. Bolton, Herbert E. *op. cit.* p. 237.
5. Bolton, Herbert E. *op. cit.* p. 238.
6. Bolton, Herbert E. *Rim of Christendom,* New York, (Macmillan), 1936, p. 386-389.
7. These *Medanos* were successfully crossed somewhere in this area by Francisco Garces, in 1771; and a pack train was taken across them by Carl Lumholtz and Alberto Celaya in 1910.
8. This may well have been advanced amoebic dysentery, still endemic in the Sonoran Desert area.
9. Bolton, Herbert E. *op. cit.* (Memoir), p. 919-209 (Vol. II).
10. Bolton, Herbert E. *op. cit.* (Memoir), p. 209-214 (Vol. II).
11. These limits are set on the basis of information contained in 200-odd references, which may or may not be a fair sampling of the field. In areas without the indicated limits, the situation may be any one of the following: (a) No abalone (b) Insufficient study to find abalone present (c) Abalone finds not reported (d) Report not seen by this writer.