

EARLY MAN AT SAN DIEGO: A GEOMORPHIC-ARCHAEOLOGICAL VIEW

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ABSTRACT

The relatively stable, slowly uplifted San Diego coastal belt has preserved ancient landforms to an exceptional degree. Much of the area can be read as modified by a regressing sea throughout most of the Pleistocene. The glacial and interglacial sea level changes left classic alluvial covers over low sea stand beaches and valley fills recording high sea stands. The latest coastal terrace alluvial covers over high sea stand beaches contain an archaeological record. The valleys have fills attributed to episodes of high sea stand, and an archeological record is found in these fills also. The record of human occupation runs from an interglacial time into the present.

Introduction

At San Diego a complex set of processes have preserved a very long record of man's presence and allow considerable insight into how much time is involved. There never was any glaciation at San Diego but the effect of the glaciers was felt in two ways: through climatic change and through sea-level changes. The climatic changes are recorded in soils and sediments and the sea-level changes are recorded in marine terraces and by valley fills. The variety of interrelationships allows a cross-checking set of observations.

The human record has been preserved by geological processes that left ancient landforms relatively little disturbed, and man's presence at San Diego was assured by the meeting of land and sea. Where these realms meet, man has the best of two worlds. The bounty of the land is supplemented by the wealth of the sea shore. Men with minimal equipment could gather roots and shoots and seeds on the land and the shell fish of the intertidal zone along the shore. The junction of land and sea was always of maximum attraction and it was this Man-Land-Sea interaction at San Diego that helped to create a remarkable record extending from the present back into Pleistocene time.

The Archaeological Record: Two Views

The generally accepted archaeological sequence at San Diego for nearly 50 years has been as follows. The record begins about 4000 years ago, later modified to about 9000 years B.C. (Rogers 1966) and presently to 12,000 years (Masters 1983). These were the San Dieguito people, as originally defined. Rogers (1966) later used San Dieguito as a catch-all term for everything from earliest to relatively late, using I, II, III for ill-defined phases. A very good review of Rogers' shifting terminology has been written by Warren (1967) and anyone interested in detailed discussion should consult this source. I will restrict the term San Dieguito here to the classic phase described by Rogers (1929). The classic San Dieguito used fine-grained volcanics for their stonework, made many extremely

finely made scrapers, some bifacially flaked knives and some odd crescentic stones. Whether they had the mano and metate is controversial. In my view, they did (Carter 1977).

They were succeeded by the La Jollan people after 8000 years ago. These people rarely used the fine-grained volcanics but instead depended on the inferior cobbles of quartzite and porphyry so abundant in the region. Instead of fine scrapers, they made crude ones. Bifacial knives of the San Dieguito type disappear. The metate was of great importance in their economy that emphasized seed gathering, much use of acorns, much small game, and moderate amounts of deer-sized game. On the coast there was much use of shell fish. (This is a cultural decline. Or, perhaps a replacement of the earlier people by a culturally less advanced group).

The historic people differed little from the preceding La Jollan people. They simply added pottery making and use of the bow and arrow. They took up the practice of cremation in place of burial. The original way of life simply was carried on with little change.

I have for some decades put forward a quite different picture (Carter 1950, 1951, 1952, 1957a, 1959, 1978, 1980). The Diegueno are the historic people, Yuman in speech and culturally enriched from the east, but otherwise little different from the La Jolla people who clearly preceded them in time. This, so far, is also the generally accepted view.

Differences appear in treatment of the San Dieguito problem. They seem to me to be a very weak impulse reaching this area from the east, a pale reflection of the Clovis-Folsom revolution with its production of beautifully made stone points and with some emphasis on big game hunting, though even for the Great Plains and the East it is probable that the hunting has been over-emphasized. Perhaps few people brought these advanced stone work techniques or perhaps it was only a weak flow of ideas. At any rate, it died out leaving little mark on the old life way.

It is my contention that the basic life way at San Diego for some tens of millennia was fundamentally that of the La Jollans. The San Dieguito phase was then a brief interlude that did not greatly change the La Jollan life way. That the La Jollan life way or cultural pattern is both earlier and later than the San Dieguito has been controversial among local archaeologists. Evidence testing the idea of great time depth for the La Jolla pattern will appear below. No one questions its later phase or its virtual continuum into the historic period.

This is a minor difficulty compared to the next step. My contention is that not only did the La Jollan pattern extend far back, but that it was preceded by still earlier people. No name has been given to these people, and their presence at San Diego is best known from sites in the lower valley of the San Diego River, the Mission Valley. The classic sites are the Texas Street site (Carter 1957) and the adjacent Buchanan Canyon site discovered by Herbert Minshall (1976). Reexamination of the evidence has led to some movement toward greater antiquity, indeed toward vast antiquity (Reeves, Pohl, and Smith 1986). The conflict in estimates of the cultural sequences and of their age can be tested by considering the geomorphology of the San Diego region. This requires a brief survey of some of the pertinent features of the region.

The Stability of the San Diego Area

The Mesas:

San Diego is marked by broad, relatively flat landforms called mesas. They are festooned with long sand ridges that run roughly north-south and parallel to the modern coast which today is also marked by long sand ridges, our modern beaches. The sand ridges on the mesa surfaces are the beach ridges of an ancient past, when the mesas were formed by marine planation of this area. Their preservation is one evidence of remarkable stability; a record primarily of slow uplift.

The sand ridges are progressively older as elevation increases to the east. One of the marks of their age are the soil phenomena associated with them. The older sand ridges are deeply weathered to bright red, and the weathering increases in intensity and depth as one goes from west to east, from roughly 300 feet to 800 feet elevation. These deeply weathered ancient soils have well developed iron concretions: up to walnut size. Beneath the red oxidized zone lies a pallid zone penetrated by root casts testifying to a past forest cover. These features indicate that a long period of weathering with accompanying climatic change followed the time of marine planation.

A measure of the age of these soils, that have to be younger than the landforms that they developed on, is the existence of an endemic flora and fauna that is found in the ephemeral ponds associated with the mima mound topography that characterizes the broad areas between the ancient beach ridges. Cemented hard pans are overlain by thin clay-based soils with thinner sandy topping. This sandy topping is piled up in mounds, the mima mounds, with shallow basins in between. The effect from the air is a quilt-like landscape.

In San Diego's brief rainy season the hollows fill with water and the impervious cemented floors of the hollows hold the water for weeks. Then there is an explosion of biota uniquely adapted to feast or famine and able to lie dormant for long periods, even years of little rainfall. Assemblages of endemic species adapted to such special circumstances require immense periods of time to develop. It is a million year type phenomenon, and has to follow the development of old age soils.

When I escorted Dr. Robert L. Pendleton over these sand ridges about 1955, he exclaimed, "I would expect to see such soils only in some area such as Panama, a land of high temperature and a rainfall of around 50 inches per year." (San Diego's present annual rainfall hovers around 10 inches). Pendleton earned a Ph.D. in soils science at UC Berkeley under the great Hilgard and was on the original soils survey of San Diego. Thereafter he spent his life in the humid tropics and was acknowledged to be one of the world's authorities on tropical soils and especially old tropical soils: laterites. His observations are not to be taken lightly. The implication is that these landforms, despite their youthful appearance in the Davisian cycle, are very old and their soils faithfully record past climates and a vast expanse of time. But this can only be true if certain geological facts are also true.

The San Diego area must be relatively stable geologically. These ancient landforms with their beach ridges preserved could not exist if this area were like the Los Angeles area where the San Andreas and the Garlock fault systems have combined to turn sedimentary strata up at giddy angles. Even casual observation at San Diego shows that Eocene strata are not greatly deformed and are covered by less deformed Pliocene strata which are overlain by Pleistocene formations that show almost no deformation except along the Rose Canyon fault line.

At or near the end of Pliocene time the region was uplifted to form the mesas. Then, or shortly thereafter, foundering of the blocks between Point Loma and the mesas occurred. The timing of this foundering, and the uplift of Mt. Soledad, have been little discussed, and needs investigation.

The point of all of this is to establish that San Diego is remarkably stable, that the principal thing that has occurred through most of Pleistocene time has been the slow uplift of the region. If Pleistocene time is something like 1.6 million years, then man is surely not present until toward the end of this time, but just when requires attention to younger but equally interesting features in the landscape.

Younger Terraces, Valley Fills and Alluvial Covers

The vast mesas have tended to hypnotize students of the geology of the area. This has led to neglect of lesser features that also are the work of the sea on a rising coastline. Mt. Soledad is so festooned with terraces that it looks, to a geomorphologist, almost like a wedding cake. It has high terraces that correspond to high levels on the Linda Vista Mesa, and these high terraces have equally weathered soils. At lowered elevations there are other terraces and the weathering phenom-

ena on them become progressively less as the modern sea level is approached. It is the younger terraces that need more work. The earliest observers tended to see only one.

Geologists tend to explain most everything in terms of crustal movements. For some areas and for vast periods of time this may be the best explanation. On a sea coast, however, a different situation prevails. Crustal movement, except on major fault lines, is relatively slow. Sea level on the other hand responds to glacial and interglacial changes with fluctuations around 300 to 400 feet from glacial lows to interglacial highs. On a coast line, multiple sea-level changes can be assumed. Crustal movements have to be demonstrated.

Thinking about this has changed hugely since my early work at San Diego. It was then thought there were but four glaciations with three interglacials, the present being a fourth interglacial marked by high sea stands. At that time, I could not explain the multiplicity of marine terraces in the area. It is now clear from theoretical considerations and the sediment record cored on the deep ocean floor that the Milankovitch solution is closer to the truth and that there were frequent glaciations and interglacials. This calls for much more actively rising and falling sea levels, and many terraces are expectable. Frequent sea level changes are now established. The best date for a young terrace at San Diego is about 120,000 years (Ku and Kern 1974). There are at least two younger terraces (Carter 1957).

With a model of a constantly rising land and a sea level fluctuating with amplitudes set by glaciation and deglaciation, the expectation is for many episodes of high and low sea-level stands with geomorphic consequences: wave attack of all headlands and drowning of all the river valley mouths during high sea stands. This must alternate with lowered sea levels at which time rivers will excavate their valleys to adjust them to the increased gradient caused by the lowered sea level. At the same time wave-cut platforms in front of the headlands will be exposed and thereafter covered with alluvium. This is generally accepted and has been applied even in so active an area as Los Angeles (Davis 1933; Birkeland 1972).

The foregoing has an interesting cross check in soils and sediments. During glacial times large shifts of climatic zones occurred in California. For example, redwoods extended south into the Los Angeles area. From soil phenomena it can be calculated that annual rainfall at San Diego probably was around 40 inches during glacial times. San Diego then probably had a Torrey Pine-Oak forest cover. The Cuyamaca Mountains must have had high rainfall and the San Diego River must have had a year-round flow with high volume and high velocity for its gradient is relatively steep. All of these factors are readable in the present landscape. The alluvium in the major river valley terraces alternates between heavy gravels with very coarse sand reflecting large volumes of water at high velocities (the glacial condition), and very fine silty sands, (the present interglacial condition).

We are now in a period of high sea stand due to most of the glaciers having melted and the lower parts of all the streams reaching the sea are sediment filled. Only a few thou-

sand years ago the rapidly rising sea level of de-glacial time flooded these valleys creating lagoons that rapidly silted up and were during that time exceedingly rich sources of shell fish. Clams galore! The human record of this is found in the extensive accumulations of Indian occupation marked by heavy accumulations of clam shells mixed with stone implements: choppers, scrapers, manos and metates for grinding wild seeds, and occasional spear or dart points, but no arrow points or pottery, for these items appeared at San Diego only belatedly. The interglacial relationship of land, sea, glaciers and man is obvious here and time begins to enter the human equation.

Man, Land, Time: The Clam-Rich Lagoons

The land, sea, glacial, sea level equation says that these shell middens (the accumulated debris of human occupation) should date to the time of rapid sea-level rise at the end of the last glaciation. The sea level rose rapidly after 10,000 years ago to reach its present level about 4000 years ago. This rapid rise was far faster than the rivers could fill their valleys by sedimentation even in the restricted areas of their lower narrow valleys. This was particularly true of the lesser streams. This was also a time of decreasing rainfall, and decreasing stream flow. These conditions should have occurred each time that the sea rose rapidly at the end of a glacial period and if man were present at such times the record should be in the older valley fills. This will be returned to later. When the rapid sea-level rise after 10,000 years ago created an ecological wealth, man immediately took advantage of this as is recorded by the extensive shell middens around these lagoons. Middens should date to this period of rapid sea-level rise, and at Batiquitos Lagoon one midden dated to 8000 years ago exactly as one would predict. This clam feast was short lived for the streams relatively quickly filled their narrow drowned valleys and the clam flats became dry, clay-floored valleys. This then is how the longish introduction on land-sea relationships comes to actual dating. The dates are in the broad terms of our understanding of land and sea and glaciers and will get broader and less precise as we move back in time.

The Rogers Legacy

Man's presence in the early recent and the terminal glacial time is not now controversial though 50 years ago it certainly was. A.L. Kroeber, who wrote the Bureau of Ethnology Handbook on the California Indians, taught in the 1930s at U.C. Berkeley that the first people to enter America did so about the time of Christ. Malcolm Rogers, the pioneer archaeologist and director of the San Diego Museum of Man, in the late 1930s thought that 4000 years could account for all the evidence. Concerning the fossil skull (frontal) from La Jolla Shores, he noted that either land or sea level had moved but he left it to others to explain the finding of human remains in a high sea-stand formation. Both of these men made great contributions to knowledge and both changed as new evidence accumulated. However, in part, their limited views still dominate thinking concerning the local archaeology.

Malcolm Rogers had the stronger earth science background and made important observations. In the San Dieguito area and about Escondido he noted that at one time the Indians had lived on sandy knolls with no apparent concern about water supplies. Their village sites were colorless, having lost the black coloring that characterizes late sites. Only lengthy weathering changes soils in this way. The time had to be sufficient that the climate was somewhat different from the present. In those days it was fashionable to invent post-glacial pluvial or warm periods as needed to account for such changes. On this see Rogers 1966.

Today this evidence is better read as due to time and climatic change with the time falling in the terminal period of the glacially wetter conditions at San Diego. This is subject to a cultural cross check. These people, the San Dieguito, lacked pottery and arrow points, made bifacially flaked heavy knives, and had small crescentic bifacially flaked objects of uncertain function. These crescents are important for they are also found in the Mojave Desert area where they overlap the appearance of fluted points. Fluted points mark the Clovis-Folsom period and this falls in minimal glacial time: roughly 9,000 to 12,000 years ago.

We have an abundance of late sites, those of the Diegueno people. They are, as Rogers noted, located near modern water sources. They are black, loose and fluffy in texture. They have arrow points and pottery and the people practiced cremation. They are a clear record of recency both culturally and in terms of climate and of soil phenomena. For the La Jollans the evidence from their shell middens indicates considerable age, for some middens are colorless, have strongly carbonate-cemented lower strata, and at times young Huerfuerro-type soils have developed on their village sites. These soils are characteristics of the soils of the intermediate aged younger terraces. This evidence would seem to put the early La Jollans at least into a time frame comparable to the San Dieguito.

If this seems to be beating the question of time and earth science records and the associated cultural evidence almost to death, it has a purpose. These relationships are unchallenged, non-controversial. Material to be presented now moves out into controversial realms, but the application of earth science observations will remain much the same. The times, however, will become lengthy and the involvement of man will enter controversial realms.

The Narrow Shelf and Submarine Archaeology

If man was living at San Diego as early as 12,000 years ago, the sea level would have been considerably lower than the present. It would be expectable that man would then have lived along the sea shore just as he did in later time. A favorable circumstance has actually made it possible to find some of this record. At La Jolla, submarine canyons extend almost into the outer breaker line. At these spots the shore line moves very little as the sea level changes, for a lowering of the sea level would only move the sea shore to the lip of the canyon. Whether sea level was high or low, man would be at-

tracted to this area, and the record should be clear, if obtainable.

For many decades, swimmers have found archaeological material on the ocean floor in this area. Stone bowls, metates, and eventually even stone tools were found (Moriarty and Marshall 1964, 1983). The deepest items were at a depth of 100 feet and virtually on the lip of the submarine canyon and some were found within the canyon. Man could live no further out at this particular spot.

Alluvial Covers Over Marine Platforms

If man was living at San Diego while the sea level was down due to the removal of water to feed the glaciers, where would one look for such evidence? The prologue briefly presented the case for a slowly rising, little faulted block at San Diego against which the rising and falling sea levels of the glacial period etched their record. What is the record of lowered sea level and under what circumstances is that record made available?

When the sea level is down, the platform cut into headlands by the previously existing high sea stand is exposed. This is a gently seaward sloping platform littered with the debris of the old sea floor. Just such a platform lies off the west side of Point Loma and La Jolla today. A returning glacial epoch would lower the sea and expose this area. Erosion of the land would then begin to cover this flat zone. If man were living at San Diego during the time of lowered sea level, then the record of his presence should be enclosed deep in the sedimentary accumulation on the old marine platform. To test this, one needs exposures through these alluvial covers for examination.

The present high and rising sea has truncated the alluvial covers that accumulated over the broad bench cut by the sea in the last glacial epoch and has exposed miles of cross sections. This is true not only at San Diego, but all along the California coast and on the off-shore islands. A classic example existed on the Scripps Institution of Oceanography campus just north of the pier and a lengthy exposure formerly was available for examination for a quarter of a mile to the south of the campus. Both areas are now hidden by sea walls and housing.

On the Scripps Campus the alluvial cover had a shell midden at the surface that was dated at 2000 years on the surface, and 7000 years at base. It was a typical La Jollan midden with a dearth of developed tools, but a quantity of percussively broken rock. Beneath this, hearths were exposed at varied depths in the alluvium. These were dated by C^{14} the limit of the C^{14} method at that time. That they actually were hearths was accepted by such experts as Alex Krieger, Luther Cressman and others. Luther Cressman has given a particularly useful description of his going to Santa Rosa Island as a skeptic and being converted by the evidence for man in the alluvial covers there. He then visited Carl Hubbs at the Scripps Institute of Oceanography and accepted the hearths there. Thence he went to Texas Street and examined a hearth, giving his reasons for considering it a hearth (Cressman 1977).

Collapse of the cliff dumped out a Pleistocene horse skeleton, rescued at risk of life and limb by Jeffrey Bada and his graduate students. This was dated by Bada using the protein racemization method to 50,000 years. Although Bada's method has been criticized, this date is in keeping with the C^{14} ages on the overlying hearths, and with the obvious geomorphic age of the formation.

Such finds are not unusual in the alluvial covers along the southern California coast. I have reported repeated findings of manos and metates in similar geomorphic positions around La Jolla and on Point Loma. Similar finds of flaked stone near mammoth bone have been made near Oceanside (Cerruti n.d.). The geomorphology here is simple. It is an alluvial cover over an interglacial marine platform. The only question concerns which interglacial beach it covers. Cooked elephant has been found in comparable alluvial covers on Santa Rosa Island (Orr and Berger 1966; Carter 1987; Berger 1971), despite challenges (Cushing et al. 1986; see Carter 1987 for a rebuttal). Berger reported finding a hearth with a mammoth leg in it that was accompanied by stone tools and abundant charcoal that was radio carbon deficient (greater than 40,000 years). The C^{14} confirms the Santa Rosa Island work, and fits exactly into the geomorphic picture at San Diego.

The material from all of these sites fits the La Jollan in a general way. Local cobbles are used for the production of flakes that are used with little modification. The metate is the basic food-processing instrument. It is abundantly clear that men of La Jollan cultural type occupied southern California during much of the last glacial epoch. But this implies that man was already south of the great continental ice sheet. While it has become evident that man could have followed a coastline pathway from Alaska even during glacial time (Fladmark 1979), there is evidence that man was indeed present in America, and at San Diego, even during interglacial time.

Interglacial Man at San Diego

At San Diego there is evidence that man was present not only during the last glacial times, but in interglacial times also. For this evidence we turn to the river valleys. Preservation of a record usually requires sequential deposition. For observation, one needs exposures. In river valleys near the sea, deposition occurs at times of rising and high sea levels. If in early post-glacial time the river valleys were areas of attraction to man, and this is evident from the location of the late Indian villages in the river valleys, they surely would also have been attractive during earlier similar times.

The present is a time of aridity at San Diego which actually has a steppe (semi-desert) climate, and water supplies are scarce and concentrated in the major river valleys. If man was present during a past episode of such conditions, it is in the major river valleys that one would have the best chance to find the record. The valleys at San Diego are or were (many have been removed by road and real estate developments) rich in valley-flanking terraces, the remnants of ancient valley fills. With a little bit of luck one could find in one of the engineering exposures evidence of man in the ancient valley fills pre-

served in the terraces. The situation would be exactly comparable to the alluvial covers over the interglacial beaches.

The Texas Street Site and Buchanan Canyon

I have described at some length the accidental discovery of evidence for man in a valley terrace of the San Diego river (Carter 1955, 1980). I entered the Bond Pit (a borrow pit used to obtain fill dirt for various works) to take advantage of an exposure of an interglacial valley fill. As a footnote to San Diego State University history, Alvena Suhl Storm marched her geography class of 1931 down Texas Street, then a little wilderness, and up over this obvious alluvial terrace. That was my freshman year and I was in that class. Nearly 20 years later, in pursuit of soils, terraces and time in relation to dating early man in America, I was to find here one of the most controversial archaeological sites in America.

This valley fill would be most interesting even if there were no human involvement. At the base, there are coarse sands and heavy gravels. This is clearly a record of a glacial-pluvial time. The San Diego River was then carrying a load totally out of keeping with the present. The present bed load is fine silty sand. Above the coarse sediments just such fine silty sand appears, clearly marking a climatic shift toward aridity. The deposit is at the mouth of a small steep canyon and coarse gravel from that canyon is interbedded in the fine silts. At some time the stream from the canyon cut a gully through the deposit. This would be an appropriate action to occur at a time when the San Diego River valley was deepened during a glacial period. But it could also have occurred due to a local cloud burst. Thereafter, a strong Huerohuero soil profile developed on the shoulder and flanks of the gully. It is not a young feature. The surface of the terrace, once freed from deposition, developed a weak mima mound topography never seen on the youngest terraces in the region.

There is a third riverine deposit that has never been adequately dealt with. This is a coarse red sand deposit. It probably represents a glacial-pluvial time when it was exposed to lengthy surface weathering in order to be oxidized. If it represents a glacial-pluvial river bed separate from the similar unoxidized and exposed layer at the base of the excavated zone and separated from these sands by fine silty deposits, then the age of the fine silty sediments with their enclosed human record would become even older than prior estimates. My failure to solve this problem is due to the site being but part of a larger study, and of my having lived either a whole continent or half a continent away for the past nearly 50 years.

The borrow pit was benched to control erosion when abandoned. There are three artificial levels and they are used as reference bases for the archaeology. The original owners were the Bonds and as boys they found manos and metates on the surface of the site. Amateur collectors since then have found dart points in the same area. No pottery or arrow points have been found. This indicates a late La Jollan type occupation of the type found around the lagoons, which can date to 8000 years ago. At a depth of 20 feet, hearths marked by circles of stone and with ash and charcoal-stained soil were exposed just east of

the church on this site. In one of them a typical La Jollan split cobble tool with unifacial flaking was found. Herb Minshall tells me of his finding other such artifacts at this level. These are clearly early La Jollan of some considerable age.

Artifacts and Hearths From Beneath the 20-Foot Bench

From the face of the second bench and the upper part of the third bench (the lowest of the three) hearths and artifacts occur widely both laterally and in depth. They are evidence that man lived on the valley floor as it built up, an interglacial phenomenon. The attraction may have been the gully with its supply of cobbles for making tools. The artifacts have been wildly attacked, but more often than not by critics who have never been on the site nor ever handled the objects in question. They were instantly accepted by John Witthoft (1955), a pioneer in lithic technology. More recently, Barney Reeves of Canada, after three field sessions in San Diego, has accepted both the dating and the artifacts and thereby the evidence for early man (Reeves 1977, Reeves, Pohl and Smith 1986). The characterizing artifact is a cobble with either a natural or prepared platform from which long parallel sided flakes, technically blades, have been struck. There are other artifacts, notably cleaver-like heavy items, resembling a tool called a skreblo in Siberian archaeology, a resemblance noted by Herb Minshall (1974, 1975, 1976, 1986). And there is much use of sharp-edged flakes and cores. There is a total absence of manos and metates, bifacially flaked points, or any other tool typical of any of the later people.

Archaeologist critics have at times questioned the age of the site. No geologist, geomorphologist or soils man that has been on the site with me has ever suggested that it was a recent deposit. Some have suggested that it could be older than my estimate of 100,000 years. It is a quite obvious valley fill, that has been left as a valley-flanking terrace. Its history may be more complex than I thought, and if so, it is somewhat older.

The artifacts are attacked as the work of fire on cobbles, the action of tumbling in a violent stream flow, the work of faults on cobbles cemented in indurated sediments. I did experimental work on fire and its effects on quartzites, a favored material for tools here. The action of natural fires is also obvious in the present landscape and spalls are created that are superficially like man-struck blades. But there are clear diagnostic differences. Fire reddens rock. The spalls tend to follow the contour of the rock, there are no prepared platforms, no striking platform, no errillures, force lines, or bulbs of percussion in fire-spalled rock. Human work is marked by the absence of the fire marks, and the presence of the attributes of percussive flaking, errillures, etc. The work of man and of fire are easily separated.

Tumbling in torrents is easily disposed of as a hypothesis. A survey of the geomorphic literature produces no support for such percussive breakage of rocks, but quite the contrary. The flat statement is found that a mountain torrent in full flood has one tenth the energy needed to do such work (reviewed in Carter 1980:87-132). Herb Minshall put this to the test in

nearby Buchanan Canyon. During a local cloudburst when the canyon was filled with the sound of roaring waters and the rattling of boulders in the torrent pouring down the steep gradient of the canyon, he stepped into the maelstrom and felt no impact more forceful than as if a fish had nuzzled his rubber boot.

Whence, then, the noise? Flume experiments (Carter 1980:102, citing Schumm and Stevens 1973) have shown that at a critical velocity cobbles become subject to lift. This is the same force that drives a sailboat. No one who has sailed has anything but great respect for the power generated by a curved piece of canvas in so light a medium as air. Immensely denser water flowing over the curved surface of cobbles lifts them. Since the water flow is turbulent the velocity varies greatly. The stones are then set to dancing up and down. By actual measurement they move great distances vertically while being displaced laterally hardly at all. They wear with great rapidity but they flake, break, shatter hardly at all. The reality is the opposite of the usual archaeological expectation. Instead of cobbles being broken to facsimiles of artifacts the reverse is true, artifacts entrained in such a mill are rapidly reduced to rounded gravel. For an extreme test of this, note sometime what happens to glass in a beach. This ultra brittle material is rapidly dulled, frosted, and turned into beach gravel.

That leaves the claim of fault action on cobbles cemented in indurated layers. It is an odd argument to advance in an area that in general lacks frequent evidence of faulting. The indurated areas are limited to the mesa surfaces. They are startlingly devoid of fault fractures. At the Texas Street site there are no known faults, and the deposits are unconsolidated. The claim has its amusing side. How easy for early man! He could haunt the minor faults in search of microblades, and when in need of macroblades he could visit the San Andreas fault. It is a nonsense argument without any observational basis.

Other Sites

There are or were many ancient sites at San Diego. The mesas retained on the surfaces every hearth and artifact ever dropped there. Huge collections could have been made, and an occasional vocational archaeologist has done so. Richard Ceruti probably has the best collection. The late Herb Minshall had a small but very select collection, now at the San Bernardino County Museum. The canyons were the easily accessible source of supply of cobbles for the early men as well as the later men. Buchanan Canyon, discovered and reported by Herb Minshall, is a classic example, but there are innumerable others. Many of the valley fills contained a record duplicating that at Texas Street. When the Fashion Valley Road in Mission Valley was built and the terrace in that area bulldozed away, the resultant disturbed area was strewn with cobbles worked in the identical fashion as those at Texas Street. As B.O.K. Reeves (Reeves, Pohl, and Smith 1986) has commented, a priceless record was lost through the studied ignoring of the evidence.

La Jolla Shores and Crown Point

No discussion of early man at San Diego can be complete without at least mention of two enigmatic sites, La Jolla Shores and Crown Point.

When Malcolm Rogers was first getting interested in archaeology and was still an orange grower in the Escondido area, word reached him that real estate development of La Jolla Shores was underway and that in the process skeletons were turning up at some depth and in an old landform. He visited the site as often as possible and the engineer in charge gave him every assistance. I have reviewed this material courtesy of the San Diego Museum of Man staff, particularly Rose Tyson, but have not published on it. I have vacillated in my analysis of this feature but would tend to place it in the high sea stand between the two Wisconsin Peaks of glaciation (20,000 and 60,000) and hence about 40,000 years ago (Carter 1957, 1980:169-170 for revised thinking). There are accelerator mass spectrometry dates for some of this material but critical discussion of them is too complex for this essay.

Crown Point has another such record. First, Crown Point is not at all a simple formation. Landward it has moderately old soils, indeed sequences of them. The outer end has two shell deposits recording repeated bay bar building southward from Mt. Soledad into the Mission Bay area during high sea stands. The older shell deposit is cemented and highly eroded. The younger shell deposit is not. The present sand cover overlies the later shell deposit and represents a time when much of the Mission Bay area was an embayment being filled with silts from the San Diego River, just as the present Mission Bay was being filled with sediments in recent times, until dams on the San Diego River decreased the river's flow and now dredging has reversed the filling. Mission Beach, of course, represents bay bar building at the present sea level.

I found a hearth (a circular arrangement of large fire-spalled boulders) at the base of the late sand deposit of Crown Point, and a mano cemented into the top of an eroded section of the cemented shell reef, obviously younger than the time of erosion of the reef but prior to the deposit of the upper sands of Crown Point. During installation of sewer lines two metates were found right on top of one of the shell deposits and reported to the San Diego Museum of Man. Malcolm Farmer, then the director of the museum, told me of these finds. There is further archaeology within the sands on Crown Point, and I located a burial site on the east side of the Point and showed it to Dr. Clement Meighan of U.C.L.A., but nothing was done. So, poorly studied, poorly reported but very definite evidence of the presence of man is or was observable at Crown Point at a time when the sea level stood higher than now. As the continuum of archaeology up through the upper sand indicates, man long continued to visit Crown Point. It was not an area of permanent occupation in later times for it had no water supply. It was handy to the rich clam flats of the Mission Bay, but the nearest water was at the mouth of Rose Canyon and a huge archaeological deposit of at least three ages is located there (Carter 1957:294). The tragedy is that few areas in the

Americas had so rich a record of early man and that this one has been so sadly neglected.

On Early Man in General

Our knowledge of the origin of man and of man's spread over the face of the Earth has been changing with great rapidity and some of this reflects on man and America, and San Diego. Stone tool making now seems to have appeared as early as three million years ago. Fire is most probably in use by at least one million years ago. Most startling and significant for man in America is the Russian claim that man was living near the cold pole of the northern hemisphere in northeast Siberia as early as one million years ago (Daniloff 1986). At this date, one has to be dealing with *Homo erectus*. The temperature at nearby Verkoyansk in January averages minus 58 degrees F. To survive, man would have to have fire, shelter, foot, hand and head gear. The tools illustrated are simply pebble tools, cobbles with a flake or two struck off. The site is said to be beneath the Bruhnes magnetic polar reversal. I have seen the artifacts. They are. The site is pre-perma-frost; very old.

We have never dreamed that *Homo erectus* had equipment such as I have noted above. But I am told that more such data is emerging in northwestern Europe on something like a 500,000 year time level. In southern California we have the as yet untested claim of the killing and dismembering of a mammoth in the Borrego paleontological beds at the seemingly incredible date of 400,000 years (L'Hommedieu 1988). For America it should be noted that Bering Strait would be like Miami Beach compared to Verkoyansk. The possibility of *Homo erectus* reaching America is very real, if these recent reports stand up. The absence of any *Homo erectus* skeletal finds is simply negative evidence, and given the American archaeologists' aversion to looking in early formations, weak evidence indeed.

There are indications that the winds of change are beginning to stir. There is some acceptance now of sites on the 30,000 and perhaps 50,000 year level (Dillehay 1986, 1989; Bryan 1991, Guidon 1987). But there are sites out there with suggestions of time on the 100,000 year scale, and the problem may become only that of determining how many 100,000 years.

I have for more than 25 years maintained an interest in the Calico site in the Mojave Desert. The artifacts there are so fine that it will be a classic study for someone to review their rejection over the past quarter century. Momentarily they are being accepted, but at times with the cry from some that "they are too good to be that old" (correspondence with Emily Haury). But this is demonstrably false, and how odd that objects that were only naturally broken rocks for decades have suddenly become too good to be true.

At the Calico site artifacts have been dated from their carbonate rinds at 200,000 years (Bischoff et al. 1981); this is a uranium series date. I have participated in recent years in three field trips into the Manix Lake beds in the Calico site vicinity. We found artifacts similar to the Calico site artifacts 20 feet

beneath a volcanic layer in the lake sediments. This layer has been dated by K/AV at 185,000 years. A very thorough review of the Manix Lake area in relation to this site and a great deal more is to be found in Fred Budinger's (1991) unpublished Masters thesis at California State University, San Bernardino.

In the Old World, Louis Leakey estimated the age of the Olduvai Gorge site as 200,000 years. A test of the lava at the base of the site yielded 1,750,000 years. This was greeted with incredulity. Fission tracking, a system completely independent from the K/AV dating method, was then tried and it gave a confirming date. This turned Old World archaeology around. The dates at Calico present a similar case. They are by unre-

lated systems but come out with comparable dates. If these dates are sustained, and they are seemingly unchallenged (indeed Oberlander 1982 has used other data that tend to confirm these data), then the whole picture of man in America is overturned. Texas Street and Buchanan Canyon and the record in the alluvial covers over the last interglacial beaches are *not* unexpected.

For San Diego it suggests that energetic work on the uniquely preserved ancient landforms datable by their relationships to the changing sea levels and preserved on a little deformed but slowly rising coast line could lead to important discoveries of the type foreshadowed by the Texas Street site.

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