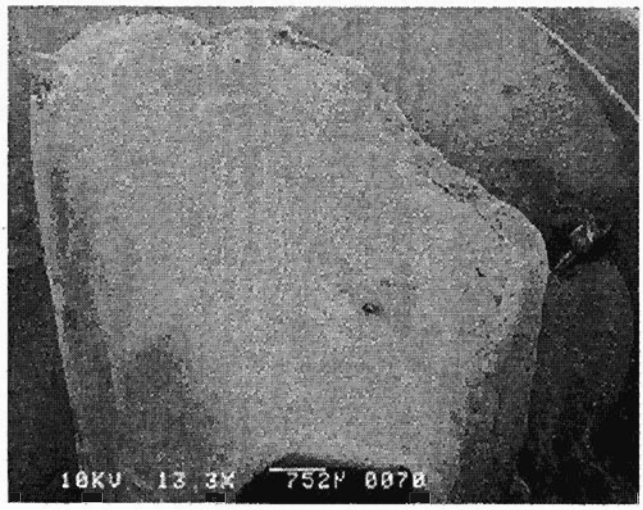

Fig. 1. Mandibular right lateral incisor of *Papio anubis*, age 18 months.

dentition of the Cercopithecidae is presently underway and will elucidate in more detail differences among the subfamilies, Cercopithecinae and Colobinae.

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DENTAL HEALTH AND DIET OF TWO PREHISTORIC POPULATIONS FROM CHILE'S SEMIARID NORTH

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ABSTRACT This investigation examines dental health and diet of two prehistoric populations from Chile's semiarid north. Trace element and dental paleopathological analyses have been conducted on skeletal remains of hunter-gatherers of the Archaic period (n = 99, ca. 1,800 BC) and agriculturalists of the Diaguita period (n = 82, 1,000-1,500 AD). Archaeological and historical evidence indicates that the Diaguita diet primarily incorporated cultivated and wild plants, but also included pastoralism and marine resources. By contrast, the subsistence of Archaic peoples was primarily based on marine resources. Concentration values of the elements strontium and barium (mean log ratio values for Archaic = -0.7985, n=38; for Diaguita = -0.5475, n= 53) support the archaeological evidence for subsistence mode, and thus for diet, of both populations. These concentrations fall within the ranges determined for various archaeological New World populations with similar subsistence and dietary patterns.

Based on the differences in subsistence and diet, the variations in dental health between the two populations were investigated. The analysis to date has revealed that both populations suffered from infectious (antemortem tooth loss, abscesses, caries, alveolar recession), degenerative (calculus deposition), and developmental (enamel hypoplasia) dental pathologies. The differences in frequencies of some of the infection processes are statistically significant between the two populations ($p < 0.05$), but overall do not seem to demonstrate, as many other studies have (Larsen, 1984; Schmucker, 1985; Murphy, 1993), a sharp decline in dental health from the hunter-gatherer population.

INTRODUCTION

This investigation examines the impact on health resulting from the transition to and adoption of farming in the semiarid north of Chile. A large body of paleopathological evidence (Cohen, 1977, 1989; Cohen and Armelagos, 1984; Larsen, 1984; Schmucker, 1985; Swedlund and Armelagos, 1990; Stuart-Macadam, 1989; Murphy, 1993) supports an accepted model for biological adaptation which states that the adoption of farming and concomitant sedentism, despite a positive effect these may have on population growth, may in fact have negative effects on health and life expectancy.

In general, sedentary agricultural populations show an increase in frequencies of infections (as evidenced from periosteal reactions on bone) and anemia indicating diets nutritionally deficient (as indicated by porotic hyperostosis and *cribra orbitalia*) when compared to the relatively more mobile gatherer-hunter populations. This increase results from the synergism between infection and malnutrition (deficiencies from blight, drought, and the reliance on few crops which may be deficient in essential nutrients) and increase in sedentism and population size. Increase in population size, density and unsanitary conditions increase the possibility of epidemic and chronic disease transmission.

Specifically, a clear association exists between increased use of agricultural foods, which contain high levels of carbohydrates and which promote growth of cariogenic bacteria, and high amounts of dental infections such as caries and abscesses (Turner, 1978; Larsen, 1983; Schmucker, 1985; Hillson, 1986). Archaeologists at the Museo Arqueologico of La Serena, La Saena, Chile, and Rosado would like to see if a similar situation exists for the sedentary, agricultural populations of the semiarid north with regards to dental health.

The model for biological adaptation is being applied to the paleopathology research. The general hypothesis being tested states that poorer health status and more nutritional problems are associated with agricultural populations of the semiarid north than with Archaic period populations. This communication summarizes the initial results of the trace element and dental paleopathological analysis for two northern Chile coastal populations of Coquimbo Bay: Archaic of El Cerrito-La Herradura and the Diaguita of La Serena-Penuelas.

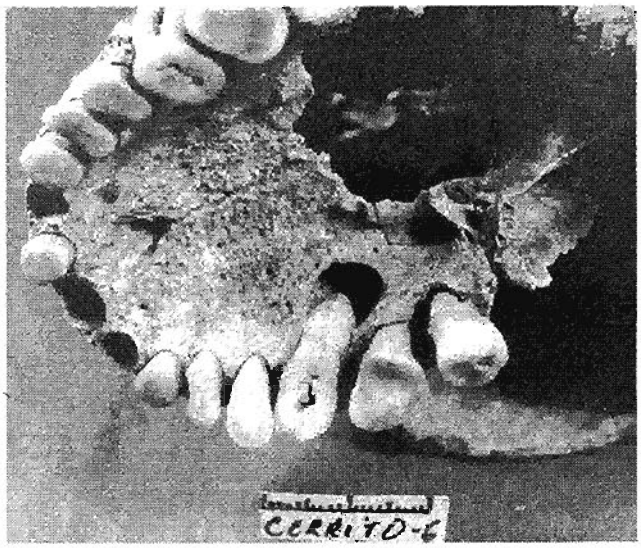

Fig. 1. Archaic adult male maxillary dentition from the site of El Cerrito-La Herradura, Coquimbo Bay, Chile. The individual exhibits dental wear and an abscess on the right first molar. (Photograph by M. Rosado)

MATERIALS

The Museo Arqueologico authorities made available for analysis two coastal skeletal samples of individuals who inhabited the area of Coquimbo Bay in the semiarid north. Ninety-nine individuals (31 adult females, 28 adult males, and 41 adults and subadults of unknown sex) are hunter-gatherers and represent the Archaic period with a radiocarbon date of 3,780±550 BP (Kuzmanic, 1986; Castillo, 1991). Eighty-two individuals (29 adult females, 24 adult males, and 29 adults and subadults of unknown sex) represent the Diaguita period. Various radiocarbon assays place the Diaguita populations between 500 and 1,000 BP (Ampuero, 1975, 1989; Biskupovic, 1982-85). The dentition of an Archaic male is shown in Fig. 1; the dentition of a Diaguita male, in Fig. 2.

Fig. 2. Adult Diaguita male maxillary dentition from the site of Penuelas 21, La Serena, Coquimbo Bay, Chile. The individual exhibits dental wear and caries on the left first molar. (Photograph by M. Rosado)

Shellfish, sea lion, and camelid bones found in burials and hearths and associated with human skeletons strongly indicate that these animals were consumed by Diaguita populations. The evidence of consumption of cultivated plants is provided by the chronicles of the first Europeans in the region of the semiarid north. They clearly described the Indians consuming and storing potatoes, maize, quince, beans, and squash (Bibar, [1555]1966; Ampuero, 1989). Archaic period hunter-gatherers seem to have consumed mostly marine resources, but also included some terrestrial mammals and birds. The evidence for this comes from the bones of fish, sea lion, chinchilla, and camelid, and the shells of various mollusks (e.g., *Conchalepas, Mytilus, Mesodesma*) also found in burials and hearths and also associated with human skeletons (Kuzmanic, 1986; Hidalgo, 1989; Castillo, 1991).

If Archaic period peoples consumed plants, the types are not clear yet. That marine and terrestrial plants were incorporated into the diet is likely. The grinding of these is suggested by the presence of mortars found in a cemetery of Archaic period peoples (Kuzmanic, 1986; Castillo, 1991).

METHODS

Determination of Age and Sex

Age at death within 10 year ranges was ascertained using gross osteological markers observed on the long bones, pubis symphysis, sacrum, ribs, auricular surface of ilium, cranium, and teeth (Steele and Bramblett, 1988; Iscan and Kennedy, 1989; Rose *et al.*, 1991; White, 1991). The category "adult" (trace element analysis) included individuals with the third molar present (18 years and older). "Subadults" (dental wear analysis) consisted of individuals 0-17 years of age. Sex (male, female, and unknown categories) was determined from gross osteological markers on the pelvis and cranium (Steele and Bramblett, 1988; White, 1991). Individuals were represented by most of the bones diagnostic of age and sex, as preservation of the skeletal remains ranged from excellent to good (entire skeleton represented to most parts of cranium and post cranium represented, respectively).

Trace Element Analysis

Ninety-one adults (Archaic, n= 38; Diaguita, n= 53), represented by adult cortical bone, either femur or tibia, were analyzed for trace elements (Table 1). Small pieces (0.25 in. by 0.25 in. minimum dimension) of bone were cut and sent to the Laboratory for Archaeological Chemistry, University of Wisconsin. At the laboratory, the bone pieces were analyzed by Dr. James Burton and colleagues according to procedures described by Burton and Price (1990a,b). Burton and colleagues determined concentration values (expressed in micrograms per gram of bone ash, parts per million) of the elements strontium and barium. Because the investigations on trace elements cited above provide values for trace elements in logarithmic form, the values determined in this study have been converted to logarithmic form for comparison. The statistical calculations used to compare concentrations between the two populations use the logarithmic values. The z test, inference about means, was used to determine if statistically significant differences in concentrations exist between the mean logarithm of Barium (mean log [Ba]) and the mean logarithm of strontium (mean log [Sr]) of the Archaic and Diaguita samples.

Dental Paleopathology

The skeletal remains were examined visually for the manifestation of non-specific dental paleopathological markers. The following were observed: enamel hypoplasia, antemortem tooth loss (AMTL), caries, abscesses, calculus deposition, and alveolar recession and resorption (AR). In addition, a comparative analysis of dental wear was accomplished. Scales used for scoring degree of pathology and wear include those of Hillson (1979) (caries and calculus severity), Brothwell (1981), Schmucker (1985), and Bass (1987) (abscess location, antemortem tooth loss, alveolar recession/resorption, enamel hypoplasia). Occlusal surface wear was assessed for the deciduous and the permanent posterior dentition using Schmucker's (1985) scoring technique. Molnar's technique was also used as an initial general assessment of wear. However, the ordinal scale (that approaches an interval scale) used by Schmucker was preferred because: 1) it scores all teeth (single and multi-cusped); 2) it is specific for very precise recognition of wear in each tooth category; and 3) the wear severity grades described for each category (grades 1-8) are gradual.

The z test of proportions was used to determine whether the differences in frequencies of dental pathology observed between the Archaic and Diaguita samples are statistically significant. The Mann Whitney U test was used to determine if statistically significant differences exist between the mean dental wear observed in the two populations. Schmucker's wear scale approximates an interval scale. Therefore, the Mann-Whitney U test can be accomplished.

TABLE 1. Mean log [Ba/Sr][1] by sample

	n	mean log	Std. Dev.
Archaic	38	-0.7985	+0.0743
Diaguita	53	-0.5475	+0.2064

z test (estimator of the mean of Diaguita minus the mean of the Archaic) = 8.120
One tailed probability = 0.000 ($p<0.005$)

[1]Mean logarithm of the concentration of barium to strontium ratio. n is sample size and includes males, females, and unknown sex. Std. Dev. is standard deviation.

RESULTS

Trace Elements

The archaeological and historical evidence for subsistence that indicates differences between the two populations in foods consumed is supported by trace element analysis. As demonstrated by Burton and Price (1990a,b), marine organisms have lower barium concentrations and lower barium to strontium ratios than terrestrial organisms have. The low barium concentrations and low barium to strontium ratio of marine organisms produce correspondingly low barium and low barium to strontium ratios in the humans that consume relatively higher quantities of marine organisms. The mean log ratio concentration values of the elements barium and strontium with z test (inferences about means) are provided in Table 1. Note the statistically significant ($p<0.05$) relatively low mean log [Ba/Sr] value for the Archaic sample.

According to J. Burton (personal communication), this indicates significantly more marine resources in the diet of the Archaic than the Diaguita. The mean logarithm of barium concentration (mean log [Ba]) and strontium concentration (mean log [Sr]) (2.1045 and 2.6414, respectively) for the Diaguita sample is within the range for the log [Ba] and [Sr] (1.7000-2.7000 and 2.5000-3.5000, respectively) identified by Burton and Price (1990a) for human populations with terrestrial diets. The mean log [Ba] of the Archaic sample of 1.9407 is slightly higher than the range of 0.7000 - 1.4000 determined by Burton and Price (1990a) for populations with predominantly marine diets. The mean log [Sr] of 2.7378 is within the upper limit of the range (2.4000-2.7000) identified for human populations with predominately marine diets. These values support the archaeological and historical evidence for diet. They indicate that Archaic period peoples relied primarily on marine resources and Diaguita period peoples relied primarily on terrestrial resources in a mixed agricultural-pastoral-maritime economy.

In order for trace elements to be useful in diet reconstruction of archaeological samples, the amount of these detected in the bones must reflect their antemortem concentration and not the amount resulting from, for example, soil contamination. Sandford (1993) provides extensive discussions on the factors which have an impact on diagenetic exchange. These include geochemical, biochemical, and organic processes that affect bone postmortem, thus altering the concentration of the elements. All human remains from archaeological contexts appear to have been exposed to some diagenetic alteration. Thus, investigators should implement strategies, according to Sandford (1993), that diagnose and delineate the mechanisms of diagenesis at any one particular site. These strategies include analysis of soil chemistry from burial and non-burial sites, comparisons between trace element concentrations in the soil and the bones buried therein, comparisons among different anatomical parts, and comparisons between human and animal bones within the same context.

The skeletal remains housed at the Museo Arqueologico will provide the opportunity to apply these strategies, and the concentration values provided in this study will be used as a basis for comparison. For now, the concentration values are provided for documentation purposes and they seem to support the historical and archaeological evidence for diets of the two samples analyzed in this investigation. However, diagenetic exchange has to be considered in future analyses.

Dental Paleopathology

Rosado conducted dental paleopathological analyses using non-specific stress markers and applied the model for biological adaptation. The hypothesis tested predicts that overall dental health declines from the hunting-gathering Archaic people to that of the agricultural Diaguita. Table 2 and Fig. 3 summarize the frequencies of the dental pathologies observed in the permanent dentitions (males and females pooled).

Caries

The caries observed in both samples most often occur on the occlusal surface. Most reach a severity whereby the enamel is destroyed and the dentine is left exposed. In many cases the infection followed a course of progressive destruction until the alveolar bone tissue was compromised by the formation of abscesses.

The Diaguita sample has a higher frequency of caries than that observed in the Archaic sample (more than twice the amount) (Table 2, Fig. 3). These results seem consistent with a diet containing high levels of carbohydrates, such as that of the agricultural Diaguita.

TABLE 2. Frequencies of dental pathologies

	Caries		Abscess		AMTL		Calculus		AR		Enamel Hypoplasia	
	+/n	%	+/n	%	+/n	%	+/n	%	+/n	%	+/n	%
Archaic	22/625	0.4	113/958	12.0	113/923	14.4	403/596	68.0	33/814	4.0	4/46	8.7
Diaguita	87/786	11.3	46/1073	4.0	167/1062	15.7	335/680	49.0	77/834	9.0	10/55	18.2
	z test=5.280		z test=6.290		z test=0.808		z test=6.628		z test=4.245		z test=1.320	
	p=0.000		p=0.000		p=0.209		p=0.000		p=0.000		p=0.0934	

Frequencies are based on tooth or alveolar space counts in the permanent dentition. AMTL is ante-mortem tooth loss. AR is alveolar recession for which + represents severe. + is present. n is sample size. % is the percentage of +/n. z test is the test of proportions (estimator of p1-p2). p is the two-tailed probability. 1 is Diaguita. 2 is Archaic.

TABLE 3. Wear grade (mean dentine exposure) on maxillary molars.

Age, sex	Teeth	Archaic n	Archaic Mean	Diaguita n	Diaguita Mean
0-9 years	m1	3	4.0	7	1.0
	m2	3	2.0	6	1.0
10-17 years	M3				
	M2	3	3.6	3	1.6
	M1	6	3.6	4	3.0
18-29 years, males	M3	8	2.5	2	1.7
	M2	12	3.5	6	2.6
	M1	12	5.5	7	3.4
18-29 years,	M3	4	1.5	2	1.0
	M2	4	3.2	4	1.7
	M1	6	4.5	6	2.8
30-39 years, males	M3	2	3.0	1	2.0
	M2	4	3.5	8	3.5
	M1	4	5.0	8	4.1
30-39 years,	M3	2	4.0	1	2.0
	M2	2	6.0	3	3.0
	M1	6	5.8	2	4.3
40+ years, males	M3	9	4.3	2	1.0
	M2	11	5.7	8	4.3
	M1	13	7.0	9	5.5
40+ years, females	M3	3	7.3	4	2.5
	M2	9	5.3	9	3.0
	M1	12	6.9	8	4.5

n is number of individuals in the sample. m1 is deciduous first molar. m2 is deciduous second molar. M1 is permanent first molar. M2 is permanent second molar. M3 is permanent third molar. Empty cells indicate lack of data. Wear grades are according to Schmucker (1985).

TABLE 4. Dental wear P1-M1 in the maxilla.

Age, sex	n	p value	Greater wear (>rank sum)
0-9 years	19	0.1226	no difference
10-17 years	24	0.1562	no difference
18-29 years, males	75	0.0473	Archaic
18-29 years, females	48	0.0473	Archaic
30-39 years, males	49	0.4173	no difference
30-39 years, females	29	0.0301	Archaic
40+ years, males	99	0.4773	Archaic
40+ years, females	90	0.0061	Archaic

n is number of individuals in the sample. P1-M3 is permanent first premolar to third molar. Analysis is based on mean dental wear values summed (ranked) over P1-M3. p is probability. the p value is the one-tailed probability. Dental wear was evaluated after Schmucker (1985).

Abscess

The Archaic sample has a frequency of abscesses (Table 2, Fig. 3) that is three times that observed in the Diaguita sample. Given the extent of the wear observed in the Archaic sample in which dentine and pulp chambers start to be exposed at a relatively younger age (Tables 3 and 4, Fig. 3), the abscesses observed may be the result of direct infection by bacteria. These results are consistent with those of other researchers (Schmucker, 1985), which determined that the formation of abscesses increases as dental wear becomes severe. Enamel wear exposes the relatively softer dentine to bacterial penetration and, when caries are formed, they proceed to the pulp comparatively more rapidly. This can occur even if the diet is not high in carbohydrates, as is the case for the Archaic sample in which marine resources, which are gritty and abrasive, and not resources high in carbohydrates, dominate the diet.

Antemortem Tooth Loss (AMTL)

The causes for antemortem tooth loss in both populations appear to lie in the formation of abscesses and calculus deposition of moderate to large size, which promoted gingival irritation and alveolar recession. No statistically significant differences between the two populations exist in the proportion of teeth lost antemortem, when the comparison is done for all tooth categories considered together (I1-M3) (Table 2). However, the Diaguita population's posterior teeth (P1-M3) displayed greater antemortem tooth loss (139 posterior affected out of 431 total posterior teeth = 32%) than the Archaic population (88 posterior affected out of 457 total posterior teeth= 19%). This difference is statistically significant ($p<0.05$, z test of proportions = 0.029) (Table 2). Possibly, a relationship exists between the relatively higher frequency of caries (mostly on the occlusal surface of the molars) in the Diaguita and the relatively higher frequency of antemortem tooth loss of posterior teeth. Caries promote infection of the dentine and pulp region of the tooth which may result in the formation of an abscess with subsequent evulsion.

Calculus

The Archaic population had a greater frequency of teeth with calculus deposition of moderate size than the Diaguita (Table 2, Fig. 3). Possibly, the greater emphasis of the Archaic than the Diaguita on maritime resources (relatively higher in calcium content from sand and shellfish) may have promoted calculus deposition. Some scientific evidence supports the role of calcium in promoting the formation of calculus (Stanton, 1969).

Alveolar Recession-Absorption (AR)

In contrast, the Diaguita population had a relatively greater frequency of teeth and alveolar spaces affected by severe recession-resorption (Table 2, Fig. 3). In both populations alveolar recession-resorption seems strongly to have had its origins in periodontal disease, other infectious processes, that

include caries and abscessing, or a combination of these processes. In this case, the severity of alveolar recession and resorption in the Diaguita population suggests these people were more affected by periodontal disease than the Archaic population was. Possibly, the increase in the distance between the cemento-enamel junction and alveolar bone observed in both populations was the result of tooth tilting and continuous tooth eruption as a response to excessive dental wear. This possibility needs to be taken into consideration in future dental analyses of the Diaguita and Archaic populations.

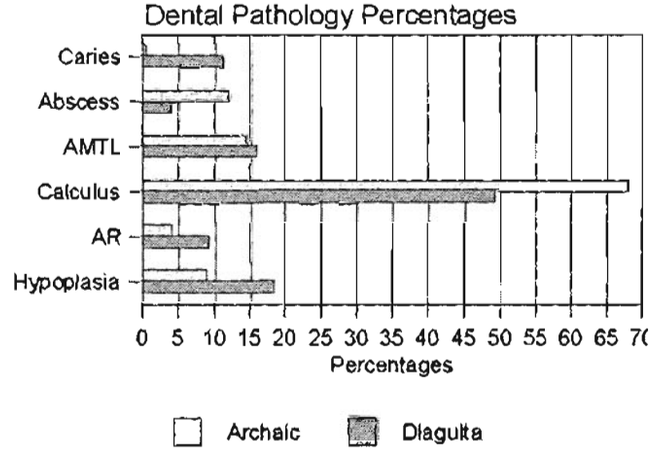

Fig. 3. Comparative frequencies of dental pathologies in the Archaic and Diaguita. Table 2 has the percentages. AMTL is antemortem tooth loss. AR is alveolar recession.

Enamel Hypoplasia

Of 46 Archaic individuals with available dentitions, four were affected by enamel hypoplasia. Out of 55 Diaguita individuals with available dentitions, ten were affected by enamel hypoplasia (Table 2, Fig. 3). In the Archaic sample, all individuals affected were male and in the Diaguita sample five were female; three were male; and two were of unknown sex.

Of 625 individual teeth examined in the Archaic period population, 2.4% (15 teeth representing four individuals) were affected by enamel hypoplasia. Of 768 teeth examined in the Diaguita population, 7.0% (52 teeth representing ten individuals) were affected. By using Brothwell's scheme it was determined that most of the teeth observed were affected by "slight" severity of enamel hypoplasia. The differences observed between the two populations in the frequency of persons affected is not statistically significant. However, the presence of the enamel defect does indicate that the persons affected suffered some type of growth disruptive stress during childhood.

Dental Wear

The dental system of both samples indicates excessive use throughout life, as observed from the severe wear. However, the greatest mean dental wear is found in the Archaic population for the maxilla (Tables 3, 4; Figs. 4, 5). Table 4 provides summary results of the Mann-Whitney calculations applied to mean dentine exposure values (mean dental wear) across P1-M3 for the maxilla. The results are separated by sample, sex, and age. The mandibular teeth yielded the same results regarding the sample with the greatest wear grade. Using Schmucker's (1985) dental wear scheme for the molar teeth, the Archaic sample reaches wear grades six and seven (entire tooth is surrounded by enamel and the roots are functioning at the occlusal level, respectively) by age forty (Table 3). In contrast, the

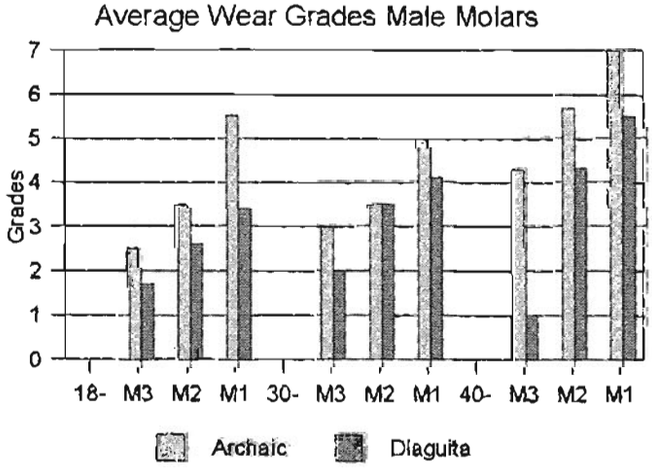

Fig. 4. Comparative mean grades (mean dentin exposure) of adult male molars for ten-year age spans (after Schmucker, 1985). 18- is the age interval 18-29. 30- is the age interval 30-39. 40- is individuals older than 40. Table 3 has the data.

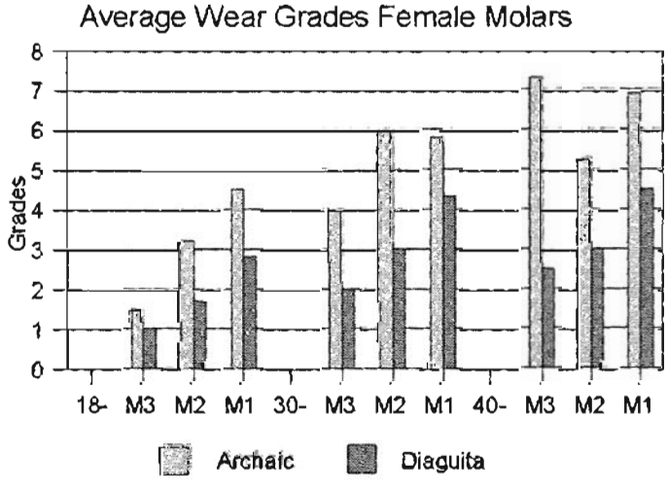

Fig. 5. Comparative mean grades (mean dentin exposure) of adult female molars for ten-year age spans (after Schmucker, 1985). 18-is the age interval 18-29. 30- is the age interval 30 to 39. 40- is individuals older than 40. Table 3 has the data.

Diaguita sample reaches wear grades four and five (the cusp pattern is obliterated and large dentine patches are visible, respectively). This difference is statistically significant in ten adult categories out of sixteen analyzed for both maxilla (Table 4) and mandible. These results are consistent with those of Schmucker (1985), whose California hunter-gatherer populations also had significantly more wear than the agricultural ones.

The wear observed in both populations is consistent with a diet containing gritty-abrasive components that could be obtained from sand and/or from the stone-grinding of foods. This would be expected, especially for the Archaic population whose members relied more heavily than the Diaguita on maritime resources. These marine resources have a high level of gritty components.

CONCLUSIONS

Of the eight non-specific stress markers used to estimate the dental health status in the Archaic and Diaguita populations in this study, four had frequencies that were significantly different between the two. These were dental caries, dental abscesses, dental calculus, and alveolar recession/resorption. The expectation was, however, as previous studies on health and agriculture have shown (Larsen, 1984; Schmucker, 1985; Murphy 1993), that relatively greater frequencies of all markers would be found entirely in the agricultural Diaguita population. However, this was not the case.

The Diaguita population has greater frequencies of dental caries and alveolar recession than the Archaic population. The Archaic population has greater frequencies of calculus deposition and abscesses than the Diaguita population. The higher amounts of carbohydrates in the diet of the Diaguita population than in the Archaic very likely promoted more caries formation and periodontal disease (contributing to the alveolar recession) than in the Archaic. Yet, alveolar recession may also have its origins in continuous tooth eruption. However, the numbers reported for caries in this study are still low compared to other published reports for agriculturalists (e.g., Murphy, 1993).

The severe dental wear in the Archaic may have promoted the relatively higher amount of abscess formation. The comparatively higher dental calculus frequencies are probably linked to calcium levels in a diet that emphasized maritime resources. The results of this study suggest that the differences in frequencies of dental pathology markers observed between the two populations are the result of day-to-day use and wear rather than solely due to diet. Also, if pathological effects did result from a diet high in carbohydrates, as that of the Diaguita, or from a diet which promoted great wear, as that of the Archaic, these were very likely quickly counteracted by high levels of fluorides found in marine resources and sea water.

Much work still needs to be done in terms of testing hypotheses about biological adaptation to environments, such as Chile's semiarid north, and diets of not only coastal populations but interior valley ones as well. Various sites are currently being excavated (personal communication with Museo Arqueologico authorities) and are yielding many skeletal remains and additional evidence for subsistence and diet from different time periods. The information presented here will be used as a baseline to guide future paleopathological studies.

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A UNILATERAL CONNATE INCISOR IN A CA. 2,000 YEAR OLD MANDIBLE FROM THE MIDDLE COLUMBIA RIVER PLATEAU

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INTRODUCTION

Examination of skeletal material from a Late Archaic cemetery site, Wildcat Canyon (35GM9), in the Middle Columbia River Plateau, Oregon, revealed the presence of a unilateral connate incisor in an Amerindian child's mandible (Fig. 1). This was the only case of connate teeth in this collection which represents at least 75 individuals. The individual derives from the main cemetery at the site dating between 100 BC and 1 AD (Dumond and Minor, 1983).

TRAIT DISCUSSION

Connate teeth, or more commonly referred to in the clinical literature as double teeth (Miles, 1954; Brook and Winter, 1970; Yenn *et al.*, 1987), include both dental fusion and gemination. Dental fusion is defined as the partial (at the root or crown) or complete union, during development, of two or more adjacent teeth (Pindborg, 1970; Duncan and Crawford, 1996). Gemination is the complete or partial division, during development, of a single tooth crown (Pindborg, 1970; Duncan and Crawford, 1996). Dental fusion can occur between two normal teeth and between a normal tooth and a supernumerary tooth, although the latter is difficult to distinguish from gemination (Nik-Hussein, 1992).

An attempt at distinguishing between dental fusion and gemination can be made in a number of ways, although none of the methods are foolproof. Fused teeth result in a diminished number of total teeth in the dentition, when fusion is between two normal teeth and the fused tooth pair is counted as one tooth. Gemination results in the normal