Table 1. Averaged composition and relative changes of pore water for top 4 m of sediments from the San Pedro basin.

Ion	Average composition (‰)			Changes due to temperature effect (A to B)	
	Group A	Group B	Bottom water	Change (%)	Change (meq/kg)
K	0.403	0.456	0.382	+13.3	+1.3
Mg	1.21	1.18	1.27	− 2.48	−2.4
Ca	0.24	0.23	0.40	− 4.87	−0.6
Cl	18.70	18.96	18.95	+ 1.39	+7.0

found a 1 percent enrichment of potassium per each 1.5°C temperature increase for a sediment containing equal proportions of bentonite clay and seawater (a typical average ratio for the upper few meters of deep marine clayey sediments). If we compare this to our 17°C difference (between *in situ* and laboratory temperatures) the predicted potassium enrichment would be 11.3 percent, which is rather close to our observation.

However, the samples squeezed at the *in situ* temperature display a 5.5 percent average enrichment of potassium over that of the bottom water, thus indicating there is a "true" *in situ* enrichment due to causes other than the temperature of squeezing effect. Work in progress on other cores from various locations indicates this "true" enrichment can reach 26 percent.

On the other hand, slight depletions of magnesium and calcium (Fig. 1 and Table 1) of 2.48 percent and 4.87 percent, respectively, occur during sample warming. Also, the general trend toward lower concentrations of magnesium and calcium with depth for both laboratory-equilibrated and refrigerated samples has been observed in reducing sediments (*5*) and is attributed to removal as magnesium and calcium carbonates during reduction of sulfate by bacteria. Chloride is rather strongly affected by the sample warming process, being enriched by an apparent 1.39 percent.

Ion-exchange capacities as a function of temperature have been only sketchily studied. Hofmann and Endell (*6*) found that heating montmorillonite to moderate temperatures changes the replaceability sequence of cations. The relative changes with temperature evidently depend very strongly on several variables including the type of clay mineral. Qualitatively, therefore, for sediment in the San Pedro basin, the ion-exchange capacity for K^+ decreases with temperature, thereby causing K^+ to be expelled to the pore water, whereas the ion-exchange capacities for Ca^{2+} and Mg^{2+} increase with temperature, thus allowing these ions to be taken up from the pore water. Since for K^+, Mg^{2+}, and Ca^{2+} the number of equivalents lost from the pore water is greater than the number added (Table 1), the gain in milliequivalents, to maintain electrical neutrality, is most likely provided by sodium. This would require an increase in Na^+ of 0.04 percent, which is beyond our analytical precision for Na and, therefore, difficult to test.

Changes in the concentration of chloride can be explained in terms of a similar temperature effect on anion-exchange capacities. Clay minerals exhibit considerable anion-exchange capacity, reaching 20 to 30 meq per 100 g for kaolinite and montmorillonite (*7*). Although temperature studies on anion-exchange capacities are lacking, one might expect behavior similar to that of cation-exchange materials. The observed Cl changes average 0.26 percent; if we assume a clay-water ratio of 1 to 1, this would be equivalent to a change in the exchange capacity of the sediment for Cl of only 0.7 meq per 100 g of sediment, a small change compared to the total capacity. Electrical neutrality is probably maintained by similar but opposite changes in sulfate or bicarbonate ions.

A quantitative prediction of the degree of change of pore water chemistry would be impossible, since ion-exchange capacities, and hence changes of capacities with temperature, depend on such variables as the type of clay mineral, crystal size, and the clay-to-pore water ratio. Therefore, we conclude that for an accurate analysis of pore water chemistry, extraction of the pore water must be accomplished at the *in situ* temperature of the sediment.

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Early Canid Burial from the Western Ozark Highland

Abstract. *A dog skeleton unearthed at Rodgers Shelter, Benton County, Missouri, came from a zone dating at approximately 5500 B.C. The animal, buried in a shallow pit beneath a tumulus of limestone rocks, is one of the earliest instances of canid interment to be recorded for North America.*

A few years ago the dog, *Canis familiaris*, was believed to have arrived in North America about 500 B.C. following its entry from Asia (*1*); since then, discoveries in earlier contexts have proved that both large and small varieties of *C. familiaris* were present much earlier, perhaps as early as 8400 B.C. (*2*). Evidence now suggests that the practice of interring dogs had been initiated by 5500 B.C., a trait that was later commonly performed by some American Indian groups.

This new date has been derived from the discovery of a small, adult dog, buried in a prepared grave, from the Archaic deposits of Rodgers Shelter in Benton County, Missouri (*3*). The skeleton, found during the summer of 1966, was covered by a small tumulus of dolomite stones beneath 2.7 m of later cultural deposits. The position of the rocks near the base, which were tilted down and inward, suggests that a shallow basin-shaped pit had been prepared for the burial before the rock covering was added.

The date of interment was deter-

Table 1. Metrical data for measurable elements from the Rodgers dog skeleton. Crown and alveolar lengths are measured from the exterior. Distances are measured along alveolus from front of M^1 or P_1 to back of tooth shown below. Heights and widths are taken at the center of the tooth indicated.

Measured element	Right (mm)	Left (mm)
Crown length P^4		19.4
Alveolar length P^4		18.5
Distance M^1–M^2		20.4
Crown length P_4	11.6	11.7
Alveolar length P_4	10.1	10.5
Maximum width P_4	6.0	6.1
Crown length M_1	20.7	21.1
Alveolar length M_1	19.8	20.0
Maximum width M_1	8.6	8.6
Width of mandible at P_4	11.0	
Height of mandible at M_1	11.5	
Width of mandible at M_1	26.2	
Distance P_1–P_2	13.7	
Distance P_1–P_3	24.6	
Distance P_1–P_4	37.3	
Distance P_1–M_1	56.3	

mined by radiocarbon dating on carbonized wood from the same level as the feature; the sample came from a burned area 0.9 m east of the burial. The date was 5540 ± 170 B.C. (GAK-1172). Wood charcoal that was 10 cm higher dated at 5060 ± 160 B.C. (GAK-1171). Cultural materials from this horizon will be reported elsewhere (*4*).

The dog's skeleton was crushed; most of the breaks were undoubtedly caused by the weight of the capstones and the pressure of the overburden (Fig. 1). Also, only parts of the animal were present; these parts included portions of both ulnae, the radii, a humerus, a femur, portions of the skull, and the lower jaw. There were also a few fragments of the vertebrae, the ribs, and the feet. The disappearance of some elements can probably be attributed to disturbance by small rodents in the tumulus during the years following the burial. A few dental measurements were recorded (Table 1), but, because of the fragmentary condition of the skeleton, the size of the skull and postcranial bones had to be estimated.


Fig. 1. Dog burial subsequent to excavation. Notice the many breaks in the bones due to pressure from covering rocks and overburden.

Some of the leg bones were complete enough so that their lengths could be extrapolated by comparison with complete specimens in the faunal collections at the Illinois State Museum. On this basis the stature of the Rodgers dog was estimated to be about that of a fox terrier; that is, at the shoulders its height was between 40 and 50 cm. For a dog of its size, its muzzle was unusually massive, as demonstrated by the height and thickness of the mandible. The height at the center of the right carnassial (alveolus rim to ventral margin) averaged 4 to 5 mm more than the same measurement taken on six modern dogs of comparable size; a transverse section of the mandible at the right carnassial measured 1 to 2 mm more than any in the modern dogs. Extensive wear on all the teeth indicates the animal was a mature adult, although dental attrition may have been accelerated in some aboriginal dogs owing to their dietary habits.

Additional descriptions of this mode of interment are absent in the literature; dog burials at this time are rare, if not unknown, in the eastern United States. Perhaps as much as 1500 to 2000 years later, dog burial was commonly practiced by Archaic peoples in the southeastern United States (*5*) and as far to the northeast as New York State (*6*). In Kentucky, pits containing dog burials are a very common feature of the later Archaic peoples. These burials were sometimes covered, usually with freshwater mollusk shells (*7*).

The Rodgers dog was an animal with about the stature of a fox terrier but with a more robust muzzle than is present in modern dogs of comparable size. The burial may mark an early expression of a cultural pattern that was later practiced throughout much of eastern United States. This pattern apparently became the rule among some of the later, more sedentary, Archaic groups such as those who occupied the shell mound sites of Kentucky, Tennessee, and Alabama.

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Chromosome Pairing within Genomes in Maize-Tripsacum Hybrids

Abstract. *When the ten chromosomes of maize were inserted into a polyploid* ($2n = 72$) Tripsacum dactyloides *background they formed up to five pairs at meiosis. Two plants that each contained 36* Tripsacum *and 14 maize chromosomes were deprived from the* F_1 *of maize* × Tripsacum. *Chromosomes of these plants frequently formed 25 bivalents, 18 between* Tripsacum *chromosomes and seven between maize chromosomes. Maize chromosomes could be distinguished from* Tripsacum *chromosomes on the basis of size. The within-genome pairing is probably induced by the genetic background.*

Maize chromosomes normally form ten pairs at meiosis. In haploid cells, one or two pairs may be formed by what is generally considered nonhomologous pairing (*1*). It is also common in the haploid for chromosomes to fold back on themselves so that pairing takes place between arms of the same chromosome. In hybrids of maize and diploid ($2n = 36$) *Tripsacum floridanum*, the maize chromosomes show some affinity to *Tripsacum* chromosomes, and a small amount of pairing occurs between them (*2*). Within the haploid maize complement in similar materials one or two maize pairs may be formed.

Nevertheless, we found that, in some hybrids between maize and polyploid ($2n = 72$) *Tripsacum dactyloides*, the maize chromosomes frequently associated into five pairs. There is a considerable difference between F_1 plants