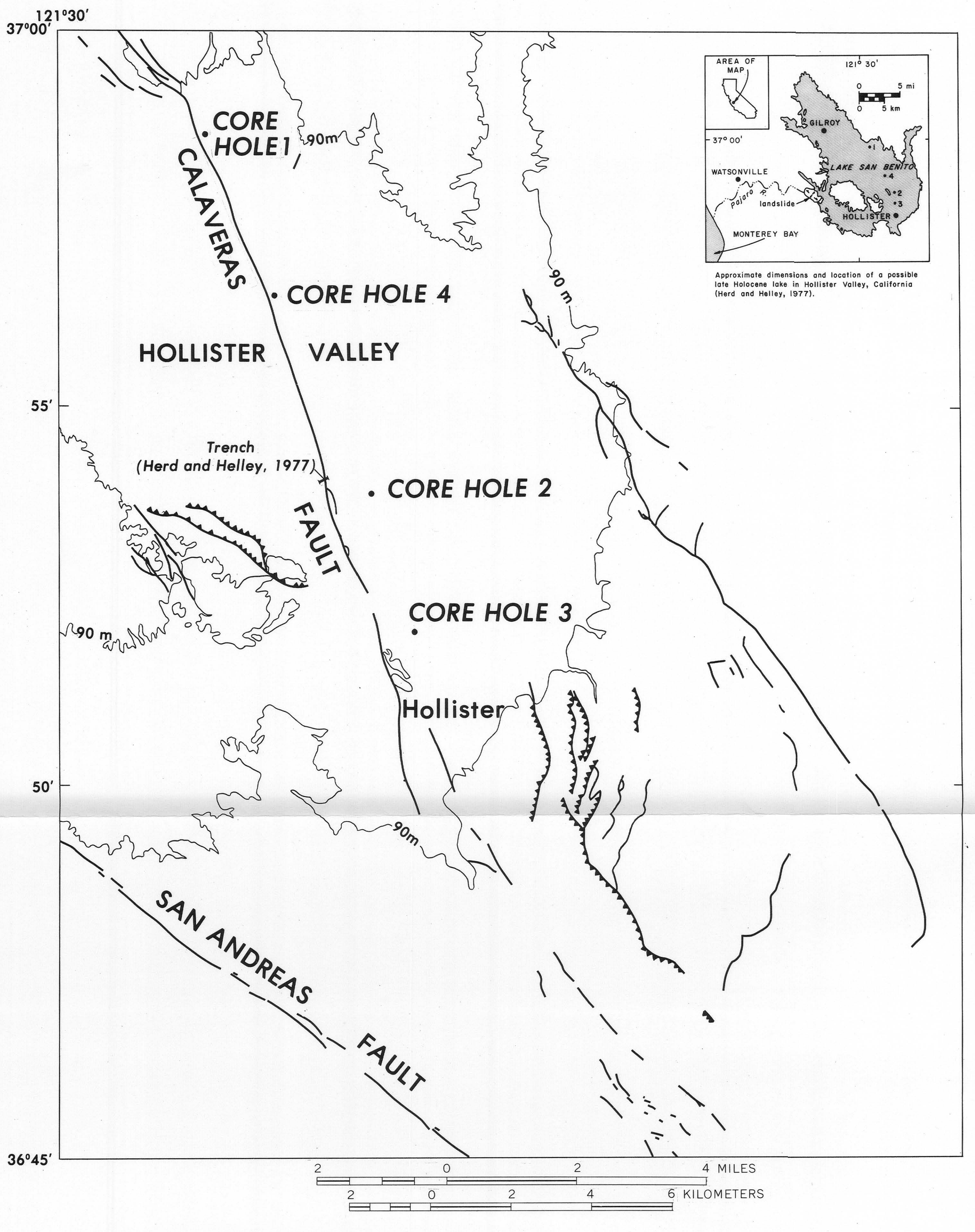
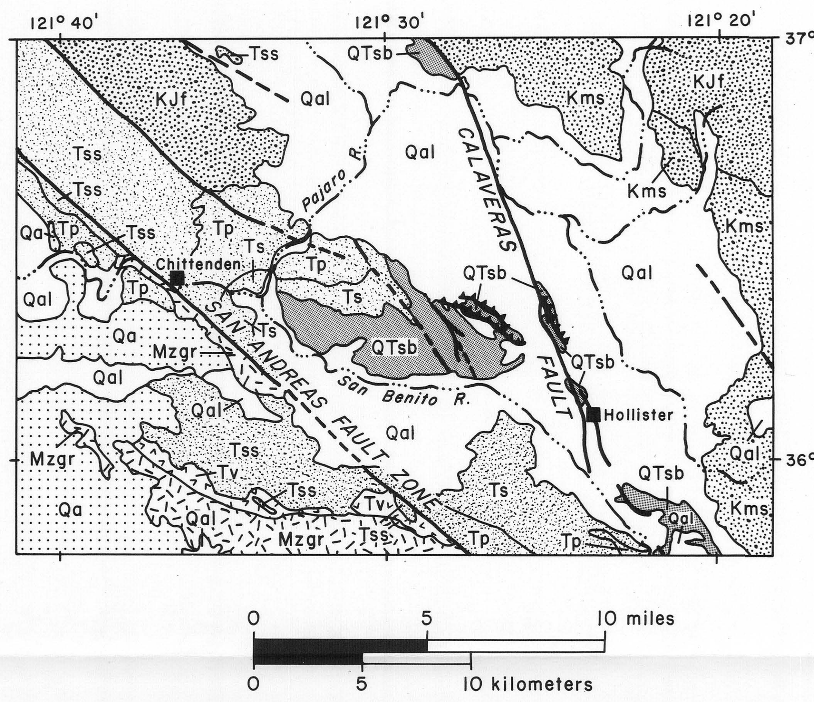


Figure 1.--Core locations in Hollister Valley, California. Solid dark line around edge of valley marks the maximum elevation in meters of a possible late Holocene lake in Hollister Valley (Herd and Helley, 1977). Fault lines from Darrell Herd (unpublished). See figure 2 for explanation of symbols.



EXPLANATION

Qal — Alluvial deposits, undivided (Quaternary)-- Floodplain deposits, channel gravel, and overbank silt. Locally includes river and stream terrace deposits and lacustrine silt and clay.

Qa — Aromas Sand (Pleistocene)-- Undivided marine, eolian, and lagoonal clay, silt, sand, and gravel.

QTsb — San Benito Gravels of Lawson (1893) (Pleistocene and Pliocene)-- Poorly consolidated gravel and clay and moderately consolidated clastic sedimentary rocks.

Ts — Sedimentary rocks (Pliocene)-- Undivided nonmarine, poorly consolidated, clastic sedimentary rocks.

Tp — Purisima Formation (Pliocene)-- Moderately consolidated marine and nonmarine sandstone, siltstone, shale, conglomerate, gravel, and sand.

Tss — Sandstone and siltstone (middle and lower Pliocene, Miocene, Oligocene, and Eocene)-- Undivided marine sandstone and siltstone.

Tv — Volcanic rocks (Miocene).

Kms — Marine sedimentary rocks (upper Cretaceous)-- Shale, sandstone, and conglomerate.

KJf — Franciscan Complex (Cretaceous and Jurassic)-- Marine sandstone, shale, chert, and conglomerate. Locally small areas of greenstone, limestone, basalt, and schist.

Mzgr — Granitic rocks (Mesozoic).

CONTACT

HIGH-ANGLE FAULT--Dashed where approximately located; dotted where concealed

THRUST FAULT--Sawteeth on upper plate

Figure 2.--Geologic map of Hollister Valley, California. Geology generalized from Jenkins and Strand (1958). Fault lines generalized from Darrell Herd (unpublished).

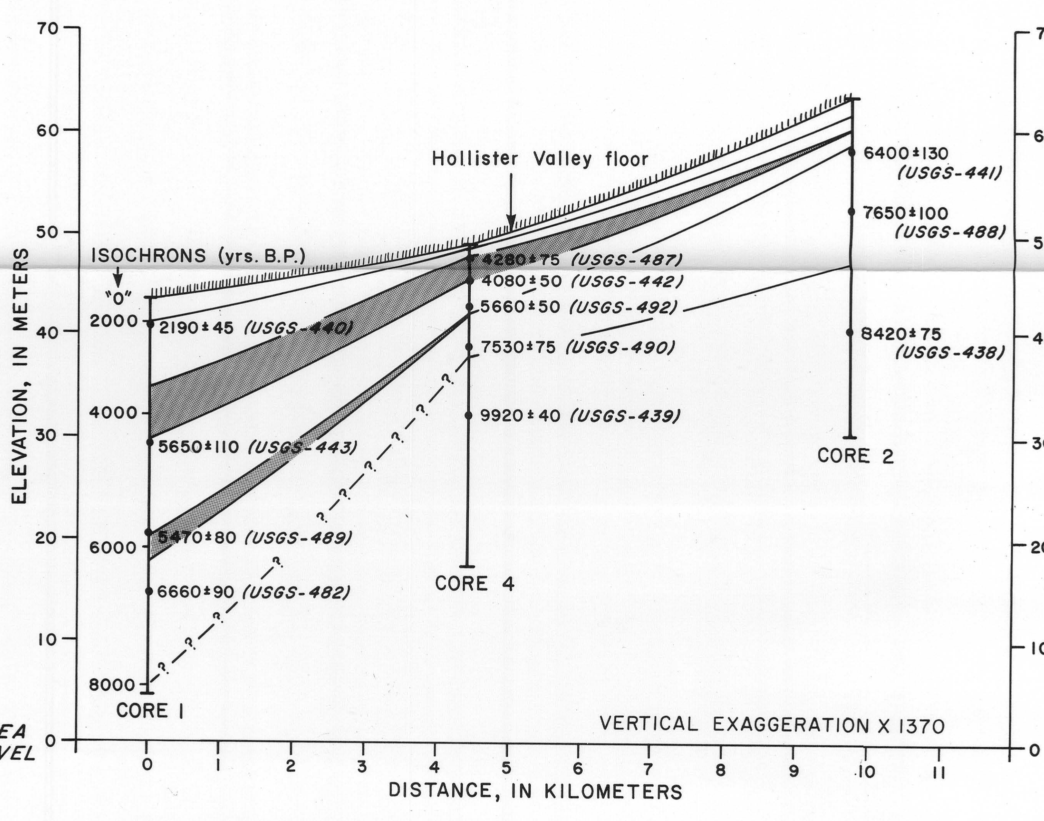


Figure 3.--Radiometric ages in years before present (yrs. B.P.) and interpolated subsurface isochrons (lines of equal age drawn between cores) from Hollister Valley, California. No dates were obtained from core 3. Shaded areas indicate isochron zones.

Introduction

In September 1977, four cores were recovered by shallow auger drilling from Hollister Valley, California, near the Calaveras fault. The wells were drilled to search for evidence that Hollister Valley may have been occupied by a large lake during the late Pleistocene or Holocene. This small valley, near Monterey Bay, may have been dammed by a large landslide on the San Andreas fault (Jenkins, 1973; Herd and Helley, 1977). The cores sampled the first 38 m of sediment below the valley floor, but no lacustrine deposits were found at these sites; a very detailed record of Holocene alluviation in a tectonically subsiding basin was recovered.

We provide here a detailed description of the stratigraphy and lithology of those four sediment cores. An absolute chronology of alluviation in Hollister Valley has been constructed through radiocarbon dating of buried soils and the correlation of similar sediments between holes. The historic vegetation of the cores has been interpreted from pollen recovered from sediments.

Hollister Valley

Hollister Valley is an elongate, flat valley about 50 km northeast of Monterey, California. The valley lies at the south end of the larger Santa Clara Valley and is separated from it by the Pajaro River. Hollister Valley is nearly surrounded by mountains. The valley is drained to the west by the Pajaro and San Benito Rivers which exit through a single passageway, Pajaro Gap, about 2 km northwest of Chittenden, California (figs. 1 and 2).

Hollister Valley has a Mediterranean climate and receives about 25 to 50 cm of rain annually. The valley is one of the principal vegetable-growing areas in northern California. Agriculture has greatly altered the natural vegetation. Mixed forest and grassland remain only in uncultivated areas.

Quaternary Geology

Hollister Valley is filled by a succession of gravels, silts, and clays of Quaternary age (fig. 2). The oldest beds crop out at the margins of Hollister Valley and along the Calaveras fault and were named the San Benito Gravels by Lawson (1893). They consist of beds up to about 425 m thick (Kilburn, 1972) of poorly consolidated gravel and clay and moderately consolidated conglomerate and sandstone that typically are oxidized. The gravels are folded and faulted and are presumed to underlie the late Quaternary valley fill. The San Benito Gravels are a major aquifer in Hollister Valley.

The San Benito Gravels are overlain unconformably by flat-lying gravels, silts, and clays that were deposited as channel gravels and overbank silts by streams during the late Pleistocene and Holocene.

Although most of the valley is underlain by gravelly deposits, the flat valley floor is capped by unconsolidated beds of clay, and fine silt and sand up to 80 m thick (Kilburn, 1972). These sediments were deposited as flood-plain, alluvial-fan, and slope-wash deposits. Locally there is late Holocene fine silt and clay that is interpreted to be lacustrine in origin. These most recent valley sediments were first exposed in a trench dug across the Calaveras fault in 1975 about 3 km northwest of Hollister (fig. 1; D. G. Herd, written commun., 1980). At this site, silts were found locally atop laminated clays and coarse, cross-bedded sands. A radiocarbon age of 3,750 ± 60 years (USGS-278), obtained on disseminated carbon in the laminated clays, suggests that the clay and sand beds were deposited in a lake that flooded Hollister Valley late in the Holocene (fig. 1, inset). Soils developed in these sediments covering the Hollister Valley floor have a minimal B-horizon development that is characteristically seen in deposits that are less than 10,000 years old in the San Francisco Bay area (Herd and Helley, 1977).

The San Benito River has cut down through the late Quaternary section; terraces along the river record at least four episodes of downcutting and alluviation.

Faults and Structure

The Hollister Valley appears to be a northwest-trending synclinorium that has been folded by right-lateral movement in the San Andreas fault system. The valley is bisected longitudinally by the Calaveras fault, a branch of the San Andreas fault system. The Calaveras fault is marked by a line of small sag ponds, sags, and both east- and west-facing scarps. San Felipe Lake at the north end of Hollister Valley is dammed by an east-facing scarp of the Calaveras fault, which also forms a subsurface ground water barrier (fig. 1). On the east side of the fault the water table is higher than on the west side; the difference in depth to the top of the water table across the fault annually varies as much as 30 m in some places (Kilburn, 1972).

The Cores

Recovery

The four cores were recovered by continuous sampling from Hollister Valley during several weeks in September 1977. Four sites each about 4-5 km apart were selected on the east side of the Calaveras fault (fig. 1). It was hoped that the relatively high groundwater table east of the fault would have preserved organic material.

The cores were collected in 2-ft (0.6-m) -long sections (slugs) in 2-inch (5-cm) diameter Shelby1/ tubes fitted inside a hollow-stem auger drill. Shelby tubes were used to recover the sediments without disturbing their stratigraphy. Each time after drilling through 2 ft (0.6 m) of sediment, the auger was brought up out of the hole, the Shelby tube was removed, and the undisturbed sediments were extruded into PVC tubes. The PVC tubes were then capped and sealed in plastic. The wrapped cores were placed in damp storage until they were split, described, and sampled in December 1977 and January 1978. Despite the use of the Shelby tubes, much of the sediment that we cored was lost (only 15% of the total cored sediment was recovered undisturbed) because of the collapse of gravel in the tubes or the friction of thick beds of clay and sand against the auger. The auger could only be driven to about a 20- to 40-m depth before drilling was halted.

Description

The texture, lithology, and color (Munsell) of each core are shown on sheets 2 and 3. All fossils and organic material were collected for further study. A total of 27 samples for radiometric dating and 186 samples for pollen analysis were taken from three of the cores. Twelve radiometric ages, ranging from about 2,000 to 10,000 years, were determined (fig. 3). These ages are also noted on the core logs.

1/ Use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

The following is a generalized description of the lithologies and radiometric ages of cores 1 through 4. The stratigraphic units within each core are not directly correlatable with the same units of each of the other cores (i.e., unit C of core 1 is not necessarily stratigraphically or lithologically the same as unit C in cores 2, 3, or 4).

CORE 1: Surface elevation of hole, 43.3 m; total drive, 37.8 m.

Core hole 1 was drilled at the southern tip of San Felipe Lake in northern San Benito County 0.2 km east of the Calaveras fault (fig. 1).

Six principal stratigraphic units are recognized:

Unit A: 0.0 - 4.0 m
Layers of very dark-grayish-brown silty clay and clay from less than 1 cm up to 50 cm thick.

Unit B: 4.0 - 8.6 m
Thick bed of dark-grayish-brown silty clay.

Unit C: 8.6 - 9.8 m
Layers of olive-gray to dark-gray silty sand and clayey sand from 2 to 50 cm thick.

Unit D: 9.8 - 23.3 m
Layers of olive-gray to dark-greenish-gray silty clay and clay from less than 1 cm up to 30 cm thick.

Unit E: 23.3 - 27.4 m
Layers of dark-greenish-gray silty sand and silty clayey sand up to 30 cm thick alternating with layers of dark-greenish-gray clay and silty clay from less than 1 cm up to 3 cm thick.

Unit F: 27.4 - 37.8 m
Layers of sand, silty sand, silty clayey sand, clayey silt, and silty clay from 3 to 40 cm thick.

Friction against the core barrel and caving of the wall of the hole halted drilling at 37.8 m depth. Four radiocarbon dates from organic-rich layers yielded radiocarbon ages ranging from about 2,000 years (at a depth of 2.1 m) to about 6,500 years (at a depth of 28.7 m).

CORE 4: Surface elevation of hole, 49.1 m; total drive 21.3 m

Core hole 4 was drilled just south of Shore Road, east of Tesquisquita Slough (fig. 1).

Ten principal stratigraphic units are represented:

Unit A: 0.0 - 1.6 m
Layers of very dark-gray clayey silt and silty clay from 3 to 45 cm thick.

Unit B: 1.6 - 2.6 m
Layers of very dark-grayish-brown sand and silty sand from 3 to 25 cm thick. Sand coarsens with depth.

Unit C: 2.6 - 6.7 m
Layers of very dark-gray clay and silty clay from 2 to 30 cm thick.

Unit D: 6.7 - 9.2 m
Layers of olive-gray to dark-greenish-gray clayey silty sand, sandy silty clay, and silty clay from 2 to 40 cm thick.

Unit E: 9.2 - 12.8 m
Layers of dark-greenish-gray silty clay from less than 1 cm up to 30 cm thick.

Unit F: 12.8 - 16.1 m
Layers of olive- to dark-greenish-gray sandy silty clay, clayey sand, silty clay, and sand from 2 to 45 cm thick

Unit G: 16.1 - 17.0 m
Layers of dark-greenish-gray to dark-greenish gray clay and silty clay from less than 4 mm up to 4 cm thick.

Unit H: 17.0 - 20.2 m
Layers of dark-greenish-gray silty clay from 4 to 25 cm thick fining downward to a massive bed of very dark-gray to dark-greenish-gray clay.

Unit I: 20.2 - 21.3 m
Dark-yellowish-brown gravelly sandy clayey silt.

Unit J: 25.9 m and below
Clayey gravel (?)

Drilling was halted at 21.3 m because of very compact sand and gravel. A second drilling attempt penetrated several meters farther. From 25.9 to 32.1 m, the sediment was probably clayey gravel, judging from the hydraulic pressure needed to rotate the auger. No sediments were recovered at this depth, however.

Five radiocarbon ages indicate that the core material is about 4,000 years old at just 0.9 m below the surface, but nearly 10,000 years old at only 16.8 m below the surface.

CORE 2: Surface elevation of hole, 63.4 m; total drive, 33.5 m

Core hole 2 was drilled just north of the Hollister Municipal Airport, between San Felipe Road (highway 156) and the Calaveras fault (fig. 1).

Eight stratigraphic units are recognizable:

Unit A: 0.0 - 3.7 m
Layers of olive-gray clayey silt and silty clay from 5 to 20 cm thick.

Unit B: 3.7 - 6.9 m
Layers of olive-gray to olive clayey sand, silty clay, sandy clayey silt, and sand from 2 to 23 cm thick.

Unit C: 6.9 - 10.3 m
Layers of olive-gray to olive sand and clayey sand a meter or more thick.

Unit D: 10.3 - 11.2 m
Layers of black to olive-gray silty clay 40 cm thick or more.

Unit E: 11.2 - 11.9 m
Layers of olive sandy silty clay, sand, and silty clay from less than 2 cm up to 30 cm thick.

Unit F: 11.9 - 21.3 m
Layers of olive to olive-gray sand and gravelly sand up to more than a meter thick.

Unit G: 21.3 - 33.5 m
Layers of dark-greenish-gray to olive-gray sandy silty clay up to a meter or more thick, and layers of silty clayey sand, sandy clayey silt, and sand from 2 to 15 cm thick.

Unit H: 33.5 m and below
Sand.

Hard sand layers below 33.5 m stopped the drilling. Three radiocarbon ages were obtained from carbonaceous material recovered from this hole. Ages in the core range from about 6,500 years at 5.2 m below the surface and about 8,500 years at 23.5 m depth.

CORE 3: Surface elevation of hole, 80.5 m; total drive, 29.3 m

Core hole 3 was drilled just southwest of Cottage Corners, between Bolsa Road and San Felipe Road (highway 156) just north of Hollister.

Five principal stratigraphic units are represented:

Unit A: 0.0 - 4.3 m
Layers of very dark-gray to dark-grayish-brown silty sand, clayey sandy silt, and minor clay from 2 to 25 cm thick.

Unit B: 4.3 - 7.4 m
Layers of dark-grayish-brown sandy clayey silt and sandy silt from 4 to 25 cm thick.

Unit C: 7.4 - 21.6 m
Layers of dark-grayish-brown fine to medium sand and silty sand from 2 cm to >30 cm thick. Minor clay in some layers near the top of the unit.

Unit D: 21.6 - 25.0 m
Layers of olive-brown sandy clay and clayey sand about 10 to 15 cm thick.

Unit E: 25.0 m and below
Dark-grayish-brown coarse gravelly sand.

No radiocarbon dates were obtained from this core.

Subsurface Stratigraphy

A total of 12 radiocarbon ages were obtained from cores 1, 2, and 4. These ages allow for the calculation of sedimentation rates at each of the core localities and the interpolation of isochrons between the cores (fig. 3).

Units deposited in the past 2,000 years are generally thinner than those of older age. However, the stratigraphic layers composing the units do not systematically thicken with age. Unit thicknesses vary throughout each of the cores as a function of both lithologies of the individual unit layers and of sedimentation rates. Some of the finer, softer sediments in the deeper, older stratigraphic layers may have been compacted also.

Sedimentation Rates

Sedimentation rates for cores 1, 2, and 4 were calculated using the sediment thickness and age difference between layers with two consecutive radiocarbon ages. That value was then reduced to a thickness (in centimeters) per unit age (in years). Where consecutive radiocarbon ages are transposed in the cores (younger below older), it was assumed that the ages were so close together than an average age value could be safely calculated. A continuous age bar between the two dates was then drawn, representing the average age of the sediments (fig. 3). From the calculated sedimentation rates, intermediate ages were interpolated in the cores. Lines of equal age (isochrons) were then drawn between the cores. The entire Hollister Valley floor surface here is assumed to be the same age and arbitrarily designated as the "zero-age" isochron.

Judging from the isochrons in cores 1, 2, and 4, a nearly uniform thickness of sediment was deposited on the Hollister Valley floor at holes 1 and 2 during the past 2000 years (~0.10 cm/yr). During this same period only about half of the sediment thickness at holes 1 and 2 was deposited at hole 4 (~0.05 cm/yr). At hole 4 from 6,000 to 2,000 years B.P., the sedimentation rate was also relatively constant at 0.20-0.30 cm/yr, but just about half that at hole 1. Hole 2 is assumed to have had a uniform sedimentation rate (~.10 cm/yr) from 6,000 to 0 years B.P., but there is no intermediate radiocarbon date to verify this. At hole 2, however, from 8,000 to 6,000 years B. P. there is a sixfold increase in the sedimentation rate to 0.60 cm/yr.

Correlation

Few of the stratigraphic units or lithologic layers in any of the cores are unquestionably correlatable among cores 1, 2, 3, and 4. There are enough similarities in lithology of some of the layers and their stratigraphic sequence, however, that a tenuous correlation among the cores can be attempted. The lithologies of cores 1 and 4 and of cores 2 and 3 are very similar, and their correlations are fairly obvious. The lithologies of cores 2 and 4 are strikingly different, however, making their correlation very difficult if not impossible.

North from core 3 to core 2, all stratigraphic layers thicken uniformly. Between cores 2 and 4, the layers both thicken and thin. Some of the sand layers in core 2 lense out completely to the north. There appears to be a crude interfingering of layers of different lithologies between cores 2 and core 4. The thinning and thickening could also be the result of the large variance in the sedimentation rates in core 2. Between cores 4 and 1 there is a consistent and marked thickening of the stratigraphic layers toward the north.

Interpretation

Tectonism vs. Deposition

The isochrons in figure 3 suggest that tectonism has contributed greatly to the shallow subsurface stratigraphy of Hollister Valley. Southeast of Hollister a sloping alluvial surface can be inferred from the concordant summits of interfluves in the older gravels there. This surface slopes northward (~2°) beneath the recent, nearly level (~.05°) Hollister Valley floor. If the younger valley floor is the result of simple alluviation on the older sloping Pleistocene surface, one would expect to see uniform thickening of the sediment layers to the north in the cores and a proportional expansion of the time intervals represented by the sediments in the cores. However, the section for the same time interval (10,000 to 2,000 years B.P.) is extremely short in core 4, but "expanded" in core 1. The associated steepening of the isochrons to the north between cores 4 and 1 suggests that there has been either relative subsidence at core 1 or uplift at cores 4 and 2 before the present. The uplift or subsidence would most likely be the result of vertical movement along the Calaveras fault. If the increased sediment thickness in core 1 were the result of uplift at core 4 and 2, coarser material should have been shed northward toward core 1. At core 1, there is an increase in the sedimentation rate compared to core 4, but no increase in sediment coarseness. There is only clay and fine silt and sand throughout the entire depth of the core 1. The fairly gradual increase in the sedimentation rate at core 1 with depth also suggests that there was never a sudden and extended increase in deposition there. Between cores 4 and 2, the steepening of the 6,000 year isochron to the north and the 8,000 year one to the north between Core 4 and Core 2 and the noticeable increase in the sedimentation rate between 8,000 to 6,000 years B.P. in core 2 may indicate vertical tectonic movement between cores 4 and 2 also. However, unlike core 1, core 2 does have a prominent amount of coarse sediment in this particular time interval.

Lake San Benito

In a trench dug across the Calaveras fault in 1975 just north of Hollister in the Hollister Valley (Herd and Helley, 1977; D. G. Herd, written commun. 1981), (fig. 1) lacustrine clay and silt at a depth of ~0.8 m have a radiocarbon age of 3,750 ± 60 years (USGS-278). Jenkins (1973) suggested that several sizeable lakes occupied the Hollister Valley during the late Pleistocene as the result of a landslide along the San Andreas fault which may have dammed the Pajaro River. He believed that the larger of two lakes, which he called Lake San Benito (fig. 1, inset), filled the Hollister Valley to an elevation of about 120 m before breaching the landslide dam. He thought that a second but shallower lake, Lake San Juan, impounded by the remnants of the breached dam, then persisted in the valley. From the geomorphic features in Hollister Valley and vicinity, including accordant flat-topped deltas, benches, and terraces, and the remnants of a great landslide at Chittenden, California, Herd and Helley (1977) concluded that if a lake had flooded the Hollister Valley, it filled it to an elevation of only about 90 m (fig. 1). The radiometric age from the trench and the young soil development in the Hollister Valley floor sediments furthermore suggest that the lake flooded the valley during the late Holocene.

The four cores from Hollister Valley contained no late Holocene lacustrine clay like that seen at the Calaveras trench site. However, The existence of a lake filling the valley cannot be dismissed totally on the basis that no typical lacustrine sediments were recovered in the four cores. The geomorphic evidence in Hollister Valley still stongly suggests the existence of a lake there. The lack of lacustrine sediments could be due to the possibility that the lake was much shallower than thought by Herd and Helley (1977), the lake was very short lived, or because the sediments from the lake have been stripped away.

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Summary of Pollen Data from the Hollister Valley Cores

By
Linda E. Heusser
New York University, New York, New York

Pollen samples were taken from cores 1, 2, and 4 from the Hollister Valley to identify the type of vegetation that existed in the valley at the time the sediments at the core localities were deposited. If there was a lake in Hollister Valley in the late Holocene, the subsurface pollen stratigraphy would represent assemblages of lacustrine plants.

The fossil pollen from the three cores does not indicate a deep lake environment during the last 10,000 years. Rather the pollen suggests that during this time, Hollister Valley was filled with small, shallow, ephemeral ponds. Their origin is uncertain.

Procedure

Tree, shrub, and herb pollens were identified and counted from 186 samples taken from organic-rich clays in cores 1, 2, and 4. Measured volumes (about 5 cc) were processed by Linda Heusser at New York University (New York, New York) using standard chemical and mechanical separation techniques. These included disaggregation by shaking 1-2 hours, removal of the coarse fraction (greater than 150 microns) by sieving, and flocculation and removal of clay-sized particles (less than 7 microns) by use of sodium pyrophosphate. Carbonate and silicate particles were removed by hydrochloric and sulfuric acids. The remaining processes included acetolysis, concentration of the residue by sieving through a 7-micron screen to remove undissolved particles, staining with safranin O, and the final mounting of the extracted pollen grains in glycerin gelatin.

Identification and Taxonomy

Identification of the pollen grains was often difficult as preservation of the pollen and spores in the strata of cores 1, 2, and 4 from Hollister Valley is poor. The pollen grains are highly corroded. This has made the classification of reworked or redeposited pollen and spores especially tenuous. The redeposited group may well include penecontemporaneous pollen grains which were so eroded that the grains stained in the same manner as pre-Quaternary pollen and spores.

Taxonomy of positively identified pollen follows Munz and Keck (1973). The basic pollen sum is based on 200 arboreal and nonarboreal pollen grains. Percentages of spores and redeposited grains are calculated separately:

Percentages of spores = [spores/(pollen + spores)] x 100
Percentages of redeposited grains = [(redeposited grains/(pollen + spores + redeposited grains)] x 100

Analysis

The initial numerical results of the pollen analysis are shown in frequency diagrams of selected common pollen types in each of the three sampled cores from Hollister Valley (fig. 4). The depths of the pollen samples are also marked on the core logs (sheets 2 and 3) for cross reference to the specific lithology and stratigraphy of the sites.

Nonarboreal pollens, primarily Compositae, Gramineae, Cyperaceae, and Chenopodiaceae-Amaranthaceae, dominate all three cores. Pinus and Quercus species are the principal arboreal pollens. Fern spores, mainly Polypodiaceae, occur in most samples. Other pollen types represented are Alnus, Salix, Corylus, Fraxinus, Pseudotsuga, Abies, Picea, Tsuga heterophylla, and members of Rhamnaceae, Rosaceae, Anacardiaceae, and Taxodiaceae-Cupressaceae-Taxaceae. Obligate aquatic types include Potamogeton, Typha, and Isoëtes. Charcoal fragments are abundant. Dinoflagellate cysts are present in a few samples in each core. Pollen concentration (number of pollen grains per cubic centimeter of sediment) is low, ranging from less than 10 grains to 1,000 grains per cm^3 and occasionally 15,000 grains per cm^3.

Before the southern Santa Clara and Hollister Valleys were cleared for agriculture, blue oak-digger pine (Quercus-Pinus) and valley oak-savannah (Quercus-Stipa) were the natural vegetation according to Küchler (1977). Mixed hardwood forest (Arbutus-Quercus) and redwood forest (Pseudotsuga-Sequoia) covered the higher western slopes of the valley. To the east, California prairie (Stipa spp.) occupied the neighboring San Joaquin Valley. Tule marshes developed adjacent to the San Joaquin River and in poorly drained parts of the valley (Küchler, 1977).

Discussion and Conclusion

The pollen diagrams mainly reflect variations in the local environments of the Hollister Valley. The prominence of heliophytes (such as the Compositae) and halophytes (Chenopodiaceae-Amaranthaceae) suggests relatively open and saline or alkaline conditions similar to those at San Felipe Lake at the north end of Hollister Valley. High percentages of Cyperaceae pollen, particularly when accompanied by Typha as in the upper 10 samples of core 1, are characteristic of modern tule marshes in California (L. E. Heusser, written comm., 1981; West, 1977). The large amounts of redeposited pollen (RD) may be indicative of intervals of greater erosion of the upland drainage basin (Heusser, 1978). Samples 4-6 in core 1 contain from 10 to 75 percent (inside pollen sum) Isoëtes spores. Isoëtes from low elevations occur in the water of vernal pools.

The frequent and rapid changes in the major pollen types probably reflect the succession of more developed sequences of ecologic communities in a changing aquatic environment. This type of succession is known as hydroseral succession. The changes also suggest that the deposition of pollen occurred shifting flood-plain environments including lakes, swamps, marshes, river channels, and flood plains. Differences in the composition and frequency of pollen and spores in the three cores also suggest deposition in a complex flat valley in which the local sedimentary environments changed frequently with space and time. The sedimentary and fossil data (sheets 2 and 3) are not incompatable with this interpretation.

The small amount of upland pollen in the samples is similar to the low percentages of pine and oak obtained from present surface samples from marshes and lakes which are bordered by pine-oak woodland. This suggests that the uplands of Hollister Valley may have been occupied by pine and oak forests during the time the sediments in cores 1, 2, and 4 were being deposited. Vegetation assemblages in the lowland drainage basin of the valley might have been quite different from the present pine-oak forest which borders the few areas of Hollister Valley unaffected by man. This cannot be determined from the amount of pollen available from cores 1, 2, and 4, however.

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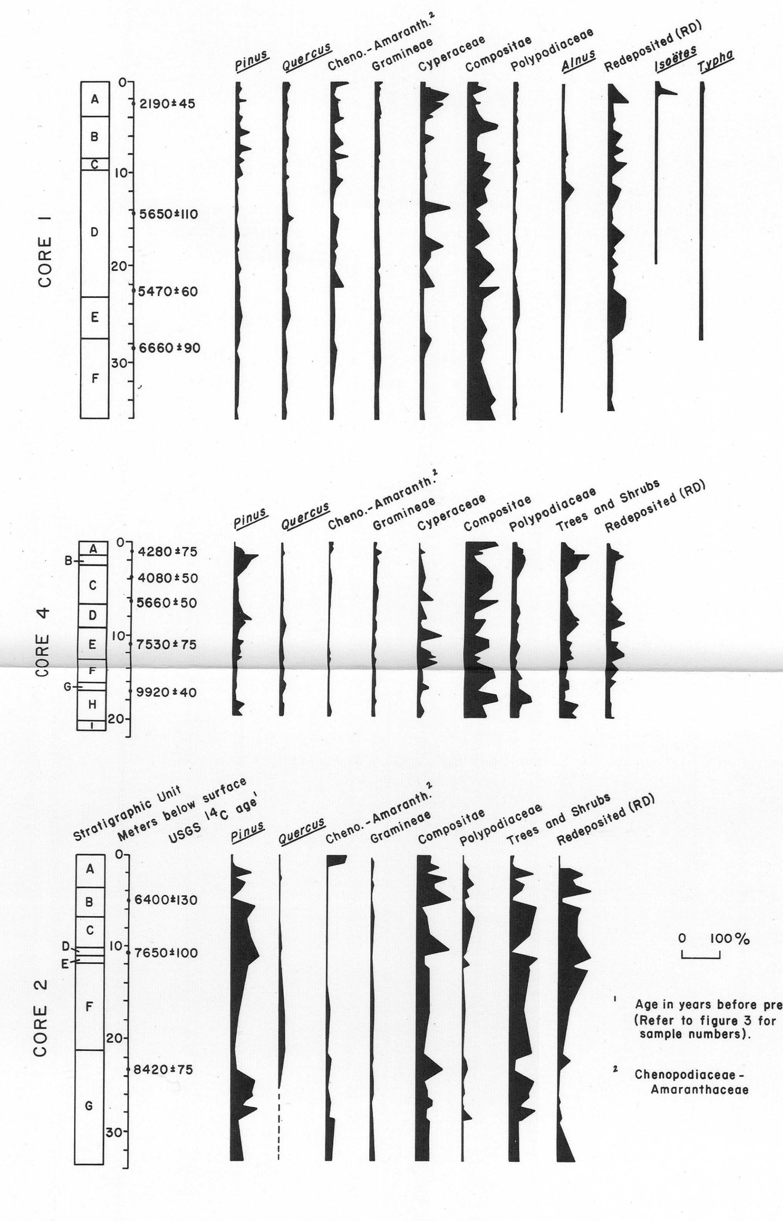

Figure 4.--Selected pollen diagrams from the Hollister Valley, California cores showing percent composition of common pollen types. No pollen samples were taken from core 3.

SUBSURFACE STRATIGRAPHY OF THE EASTERN HOLLISTER VALLEY, CALIFORNIA

By
Catherine R. McMasters, Darrell G. Herd, and Constance K. Throckmorton
with pollen analysis by Linda E. Heusser

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