SANTA CRUZ PUBLIC LIBRARIES
Local History

Mineral Survey of Santa Cruz County

By C. McK. Laizure

Mining Engineer of the California State Mining Bureau

In the Santa Cruz Chamber of Commerce Annual Report for 1926, the chairman of the industrial committee, George H. Cardiff, wrote:

> "In an effort to develop the industrial future of Santa Cruz, and recognize the importance of building our industries from with the community, the industrial committee was successful in having a survey made of the mineral resources of the county by the California State Mining Bureau....Your committee has deemed it advisable to print this report in full believing that by so doing considerable publicity will be given to the many possibilities of industrial development and expansion."

All sections of the report are available here. The survey gives us a good idea of the mineral resources available and the industries of sixty years ago; it also tells us the general locations of those resources and may explain ruins of mining that we may find today. [Editor]

The Mineral Survey of Santa Cruz County was printed in the Santa Cruz Chamber of Commerce *Annual Report*, 1926. Reproduced by permission of the Santa Cruz Area Chamber of Commerce.

CONTENTS

INTRODUCTION

Numbered among the original twenty-seven counties created February 18, 1850, Santa Cruz County was first known as Branciforte. (Coy, Owen C., California County Boundaries, California Historical Survey Commission, Berkeley, 1923) An amendment passed later during the first session of the legislature gave it the name of Santa Cruz, signifying 'Holy Cross.' With the exception of its northern boundary, which originally extended from the ocean due east through a point at the head of San Francisquito Creek to the summit of the Santa Cruz Mountains, the original boundaries of the county were the same as they are at present. In 1868 the northern line was moved southward and a portion of what had been Santa Cruz County was annexed to San Mateo, which had been created in 1856. The new dividing line began on the ocean shore near Point Ano Nuevo, trending northeasterly to the summit of the mountains in a broken line of east and north bearing segments. Since this move in 1868 the county's boundaries have remained unchanged.

Geography

Santa Cruz County borders on Monterey Bay and the Pacific Ocean, its curving coast-line extending from the mouth of Pajaro River, where it enters the bay, northwesterly for 40 miles. San Mateo County bounds it on the north; Santa Clara County lies to the northeast, and Monterey adjoins on the south.

The area of the county is only 435 square miles, making it, exclusive of the city and county of San Francisco, the smallest county in the state. Its population is 26,269 (1920 census). The city of Santa Cruz, the county seat, situated on the north shore of Monterey Bay, is one of the most attractive seaside resorts of California. It is noted for its long strand of bathing beach and equable climate, and is easily reached from San Francisco, 78 miles north, by rail or highway.

The county is traversed by a line of the Southern Pacific railroad from San Jose, via Los Gatos, to Santa Cruz. From there this line continues south-easterly near the coast to Watsonville, the second city in size and principal shipping center of the rich Pajaro Valley, connecting with the main line at Watsonville junction. There is a branch line from Felton that follows San Lorenzo River northward and another from Santa Cruz, running northwesterly along the coast to the plant of the Santa Cruz Portland Cement Company at Davenport.

A municipal pier at Santa Cruz permits the docking of ocean-going vessels. Good highways make the county readily accessible to motorists.

Pajaro Valley is noted as an apple growing district. The cultivation of fruits, berries and vegetables and the operation of packing plants and canneries are the principal industries. Poultry raising, commercial fisheries and mining are also important. The later industry, however, is confined almost entirely to the production of nonmetallic structural and industrial minerals.

Topography

The greater part of Santa Cruz County is rugged and mountainous. Castle Rock Ridge, which forms the eastern boundary, trends in a northwest direction, approximately parallel to the coastline at an average distance of 20 miles inland. It rises to elevations of over 3000 feet and forms an escarpment with a steep northeastern slope on the Santa Clara County side. To the southeast, between the summit and the ocean, the slope is more gradual but the region is cut by many deep gulches formed by streams flowing westward to the sea.

Ben Lomond Mountain, which rises between Castle Rock Ridge and the ocean, also presents a steep escarpment to the northeast and a long gentle slope on the southwest to the ocean. The parallel arrangement of valleys and ridges characteristic of much of the Coast Range is not prominently developed in this county. Old sea terraces are noticeable at many places along the coast. The hillsides are generally deeply soil-covered and unusually steep, there being many V-shaped canyons in the Monterey shale areas.

In the region of San Lorenzo River and Boulder Creek the hills are heavily wooded and several redwood groves contain trees of gigantic size. The drainage basin of San Lorenzo River includes nearly one-third of the county. Pajaro River drains the southern portion, flowing westward and forming the south boundary of the county. Numerous small perennial streams flow down the west side of Ben Lomond Mountain to the sea.

Geology

The Santa Cruz Quadrangle, the geology of which has been mapped and described by J. C. Branner, J. F. Newsom and Ralph Arnold, (U.S. Geological Survey Santa Cruz Folio No. 163) includes the greater portion of the county. The reader is referred to this folio for a detailed geological history of the area and description of the formations.

That half of the county lying northwest of the Southern Pacific railroad (excluding only the Ben Lomond Mountain block) and Castle Rock Ridge along the eastern boundary are composed of Tertiary (Miocene) marine sandstones and diatomaceous shales. The area east of Santa Cruz and extending to the base of Castle Rock Ridge is also composed of Tertiary (Pliocene) sedimentary formations including marine and freshwater sandstones, shales and gravels. Quarternary sands, gravels and clays predominate along the southern boundary and Pajaro River Valley. Ben Lomond Mountain is an upward tilted granitic block, the core of which is quartz-diorite but containing relatively small areas of metamorphic schist, marble and limestone. All of the sedimentary formations have been much folded, crushed and broken and numerous faults have been noted.

Mineral Resources

Records covering the variety, amount and value of the minerals produced in Santa Cruz County extend no farther back than 1894, but there was considerable production before that time, especially of gold, bituminous rock, limestone and lime.

Although it was 44 years after the organization of the county and 46 years after mining became an established industry in the state before any segregated county record of output was begun, in the succeeding interval of 31 years between 1894 and 1924, inclusive, the total recorded value of minerals produced has amounted to nearly $50,000,000. This large total includes no metals except a negligible amount of magnetite (iron ore) from black sand; no petroleum, the most valuable nonmetallic found in the state; and no 'war minerals,' the production of which materially increased the mineral output of many of the counties from 1915 to 1918.

In 1924 the mineral output of Santa Cruz County was valued at $4,339,233, giving it tenth place among the fifty-eight counties of the state. As will be noted by referring to the table of mineral production, the variety of commercial minerals is small and practically confined to the structural materials, bituminous rock, cement, clay, lime and limestone, sand, gravel, and crushed rock. A number of other minerals are known to occur in the county, but they are of minor importance at their present stage of development. Among these are coal, gold, granite, iron, mineral water, and petroleum. Still other varieties mainly of mineralogical interest are cinnabar, graphite, gypsum, melanterite, and talc. Magnetite, chromite, ilmenite, garnet, olivine, zircon, quartz, and platinum are constituents of some of the beach sands.

Further development may place some of these on the commercial list, but the future production of Santa Cruz County will no doubt continue to be made up chiefly of the common structural and industrial nonmetallics which have contributed most to its mineral production in the past.

The last general report on the mines and mineral resources of the county is contained in State Mineralogist's Report XVII, 1920. The oil possibilities were discussed in Bulletin No. 89, 'Petroleum Resources of California,' 1921 (out of print).

In order that these data might conform to the new series of county reports, begun in State Mineralogist's Report XXI, 'Mining in California,' 1925, and continued in succeeding numbers, the county was visited in January, 1926. New developments, corrections and changes noted since the former reports were published are included herein.

The courteous assistance rendered by local chamber of commerce officials, property owners and operators is gratefully acknowledged.

Table of the total recorded output, 1894-1924, inclusive.

BITUMINOUS ROCK

The deposits of asphaltic and bituminous rock in Santa Cruz County have long been known and utilized. The material is a porous, loose, fine to fairly coarse-grained sandstone, impregnated with asphaltum. These so-called bituminous rock deposits are extensive, but they have been developed at only a few places. As described by H. W. Fairbanks, (Fairbanks, H.W., *U.S. Geological Survey Folio 163*)

> "The bituminous rocks are sandstone beds lying near the base of the diatomaceous shale, which is referred to as the Monterey. Most of the sandstone beds which immediately underly or are intercalated with the diatomaceous shale of this locality are more or less bituminous. The structure is monoclinal, with a gentle southwest dip, hence the asphaltic-bearing strata crop out along the sides of the southwestward-flowing streams, where these have cut down nearly or quite to the bottom of the shale.
>
> The zone of the bituminous rock is exposed near the base of the diatomaceous shale from Santa Cruz northwestward as far as the western side of the Big Basin, a distance of more than 20 miles. Throughout this distance the dip of the lower part of the diatomaceous shale and of the immediately under lying sandstone is gently to the west and southwest. At many places through this district the sandstone beds are more or less bituminous, but at only one locality have they been found to be of commercial value."

City Streets Improvement Company's Mine

Under various names, including Walrath Mines, Pacific Improvement Company's Mine, Santa Cruz Bituminous Rock Mines, and more recently City Streets Improvement Company's Mines, this property has been operated for more than 35 years. Operations have been on a reduced scale in later years, the City Streets Improvement Company having gone out of business and control of the property passed to the Bank of California, N. A., San Francisco. Since February, 1923, it has been operated under a working agreement by T. W. Moore, Box 433, Santa Cruz.

The property contains 479 acres, located low down on the southern slope of Ben Lomond Mountain at an elevation of 800 to 900 feet. The workings are three miles northeasterly from Gordola, the shipping point on the Davenport branch of the Southern Pacific, and about five miles in an airline northwest of Santa Cruz.

There are three distinct beds of bituminous sandstone lying practically horizontal on the property. The lower stratum is about seven feet thick and has not been developed to any extent, as work has been confined to the upper and heavier beds. About eight feet of sand, containing a very low percentage of bitumen, separates the lower bed from the middle one. The latter is a rather coarse-grained sandstone averaging 30 feet in thickness containing from 10% to 14% of asphalt. The 'soft' Bituminous rock is mined from this bed. Above this there is a bed of diatomaceaus shale 50 to 60 feet in thickness, on top of which is the upper stratum of bituminous sandstone. The upper bed is a little thinner than the middle one, varying from 6 to 22 feet in thickness. It is finer-grained and harder, but contains from 14% to 18% asphalt. The

'hard' rock is mined from this bed. In use, a varying mixture of the 'hard' and 'soft' rock is used, according to the character of the work.

In early days the material was hauled to the loading station at Gordola by an immense steam tractor, hauling four or five large trailers with solid wooden car wheels holding ten tons each. Much of this old equipment is still on the property.

At the present time the bituminous sandstone is mined by boring holes with augers, and blasting; the large pieces being broken to man-size with sledge and chisel. It is then loaded on 2-ton cars by hand and trammed to a loading bunker from which it is taken by 5-ton trucks to Gordola.

Many thousands of tons of this material have been produced here in the past 35 years; the entire top of Rattlesnake Hill having been cut down to a level floor representing the base of the middle bed of bituminous sandstone. The beds are still exposed in open cuts for over 1000 feet on adjoining hills, and an immense tonnage still remains readily accessible. When properly placed, the excellency of this material has been demonstrated by pavements laid 30 years ago which is still in good condition. Two to five men are employed.

Bibliography:

State Mineralogist's Reports XII, p. 28; XIII, p. 43; XVII, pp. 230-232; XVIII, p. 228.

U. S. Geol. Survey 22d Annual Report, Part 1, pp. 384-394;

Santa Cruz Folio 163;

California Journal of Technology, August, 1913.

Cowell Mine

This quarry is situated six miles northwest of Santa Cruz on the extensive land holdings of the Henry Cowell Lime and Cement Company, owners. It is about one-half mile east of the City Streets Improvement Company's Mine, but on the opposite side of Baldwin Creek, which necessitates hauling direct to Santa Cruz for shipment. It has only been worked occasionally in a small way, and was idle at the time of visit.

Bibliography:

State Mineralogist's Reports X, p. 621; XII, p. 28; XIII, p. 44; XVII, p. 230; XVIII p. 228.

U. S. Geol. Survey 22d Annual Report, Part 1, pp. 399-404;

Santa Cruz Folio 163

Thurber's Mine

This property is north of and adjoining the City Streets Improvement Company's Mine. The bed of Bituminous sandstone here varies from 10 to 30 feet in thickness. It has not been extensively developed. Idle. Owner, Consolidated Bituminous Rock Co., Nevada Bank Building, San Francisco.

Bibliography:

State Mineralogist's Reports VII, P. 96; VIII, p. 554; XII, p. 29; XIII, p. 44; XVII, p. 232; XVIII, p. 228

U. S. Geol. Survey 22d Annual Report, Part 1, pp. 393-396

Santa Cruz Folio 163

BLACK SAND

There are extensive stretches along the coast of California where the heavier constituents of the beach sands have been concentrated by wave action into deposits of so-called *'black sand'*. The composition of this heavy concentrate varies somewhat with the locality. In general the following commercial minerals are present in greater or less amounts: gold, magnetite, ilmenite (oxide of iron and titanium), garnet, zircon, hematite, chromate, and the platinum group metals.

Could each of these minerals be readily and completely separated from the others and from the olivine, quartz and other worthless constituents, they would be readily marketable. Gold and platinum are found in relatively minute amounts only, but on account of their high value, practically all past efforts to work these sands have been confined to the recovery of these metals.

Besides the uncertain profitable production of gold and platinum from this source, the use of black sand in the manufacture of artificial iron castings, where great strength is not required, has been suggested. Some experimental work has been carried on along this line including the making of sashweights by moulding or briquetting the material into the desired form with oxy-chloride (magnesite) cement, portland cement, or other binder. Black sand may also be utilized in concrete mixes where a concentrated weight is wanted, as in concrete balance-weights used on bascule-type bridges and similar structures.

By subjecting the magnetite in black sand to an oxidizing roast, it may be changed to the ferric state, producing a red oxide (Fe_2O_3), which forms when finely ground a mineral pigment suitable for the manufacture of paint. The pigment so made is said to be superior to ground hematite or the natural soft red oxide.

Magnetite in the black sands is obviously also an ore of iron. With reference to this, Day and Richards (Day. David T. and Richards, R.H., Useful Minerals in the Black Sands of the Pacific Slope, U.S. Geological Survey Mineral Resources, 1905, pp. 1175-1258) in their report on the useful minerals in the black sands of the Pacific slope state,

> "It was found that the magnetite contained in the black sands of the Pacific slope constitutes a greater supply of useful iron ore than any other available source known on the Pacific slope. This magnetite usually contains from 5 to 10 per cent of titanium. It was found that this titanium offered no obstacle to the production of high-grade cast iron in the electric furnace and that in a modification of this electric furnace this cast iron could even by decarburized to a very soft iron of high quality."

Well-known deposits of black sand occur in Santa Cruz County along many of the beaches, particularly on the northern shore of Monterey Bay from the mouth of Pajaro River to Soquel point. The deposits are found both on the present beaches and on the older marine terraces back from the present shore line. They occur in strata form a few inches to several feet in thickness, interstratified with light beach sand. They are said to carry small amounts of platinum, as well as gold, and have been washed in the vicinity of Leonard Station near Aptos at

intervals for many years, though probably with little if any profit. Typical analyses of the natural black sand near Aptos, according to Day and Richards, [see previous cite] show their content in the following minerals to be:

[Mineral]	Per ton
Magnetite	502 to 1120 pounds
Ilmenite	224 to 576 pounds
Chromite	8 to 126 pounds
Garnet	1 to 80 pounds
Quartz	216 to 1046 pounds
Zircon	18 to 26 pounds
Unclassified	104 to 189 pounds
Gold	none to 62 cents
Platinum	none

At the time of visit, no one was found attempting to extract gold or platinum, but there is now a plant near Aptos utilizing the black sand as an iron ore. For a description of this plant see under “Iron.”

CEMENT

Cement is the most important single structural material in the mineral output of California. As a cement producer, the state ranks third in the United States, being surpassed only by Pennsylvania and Indiana.

California now has ten operating portland cement mills, one partly constructed mill upon which work has temporarily ceased, and another plant which is nearing completion and which will probably start production during 1926.

Of these, the largest single cement mill is in Santa Cruz County.

Santa Cruz Portland Cement Company

Home office, Crocker Building, San Francisco; plant at Davenport, Santa Cruz County; officers, George J. Cameron, president; W. K. Berry, secretary; George R. Gay, manager; Fred Davis, plant superintendent.

This company's mill site is at Davenport near the northern terminus of the marine terrace which borders the ocean northwesterly from Santa Cruz for 15 miles. The plant is within sound of the surf about one-half mile north of San Vicente Creek canyon and 13 miles from Santa Cruz. A branch line of the Southern Pacific Railroad from Santa Cruz serves it. A good paved highway closely parallels the railroad.

The first shipment of cement was made on May 17, 1907, since which time the company has been in continuous production, although not always at full capacity. The mill at present has a capacity of 10,000 barrels per day, and 350 men are on the pay roll. Electric power furnished by the Pacific Gas and Electric Company is used throughout, the connected load being 12,000 horsepower.

Limestone and a considerable portion of the clay used is obtained from the company quarry three miles up San Vicente Canyon. Additional clay is mined near Glendale and shipped to storage at the plant (see under “Clay”). The gypsum used comes from Nevada.

Additions to and changes in equipment and methods of operation, both at the mill and the quarry, have been adopted from time to time and some radical changes in the mill flow-sheet are now under way.

Additional equipment being installed will increase the mill capacity to 14,000 barrels per day. It will also permit an intimate and uniform mixture of the raw materials closely approaching or equalling that obtained in 'wet-process mills,' at the same time preserving the advantageous feature of the 'dry-process.' (U.S. Geological Survey Mineral Resources, 1905, p.1188)

The accompanying plan shows the general layout of the mill and equipment approximately as it will appear when alterations are completed, but it does not indicate the conveyor distributing system with its automatic weighing and mixture control arrangement and many other details. A low-pressure oil-burning system has replaced the high-pressure system formerly used.

Hummer-screens, rolls and Hardinge mills have been added, in part replacing tube and ball mills.

The most important change at the quarry has been the abandonment of the original open quarry, worked by a single bench with steam-shovel loading, and the substitution of a new method of quarry operation designed and put in operation by Mr. Robert A. Kinzie, Mining Engineer, San Francisco.

The quarry and new method of working have been recently described in great detail in an illustrated article by George J. Young, (Young, George J., *Mining Limestone by Glory Holes In California,* Engineering and Mining Journal-Press, Vol. 120, No. 7, August 15, 1925) of which the following is a brief resume.

The plan of working is a combination of glory holes, transfer raises, bulldozing chambers, chute loading and adit transportation. Since it was put into operation, over 500,000 tons of limestone have been delivered to the mill at a greatly reduced cost.

Operations are divided into stripping and quarrying. Stripping is done by steam shovel mounted on caterpillar tractors. The overburden is loaded into dump cars which are hauled in trains by a 20-ton steam locomotive to the dump. Three trains are in operation. Stripping is carried on sufficiently in advance to provide four years' supply of limestone. About thirty men are employed on the stripping crew.

On the quarry loading-out level two haulage drifts 9 by 12 feet on 60-foot centers extend along the principal axis of the deposit. Between these drifts at an elevation of 30 feet above the haulage level are a series of bulldozing chambers. Each chamber is 80 feet in length, and 50 feet in width. Their bottom is hoppered out and connected to six chute raises, three on each side. The chute raises, 6 by 8 feet in section, are driven at an angle of 50 degrees with the bottom angle reduced to 37 degrees and are fitted with underswung arc-gates. Thirty-three chutes are now available for loading. The haulage cars have steel bodies of 253-cubic feet capacity and are loaded to 12 tons. Three storage battery locomotives are used for handling the cars in the drifts. They are handled in 8 to 10-car trains, both locomotives and cars being equipped with air brakes. The cars are made up in 200-ton trains in the yard at the quarry and ten trains per day are dispatched to the mill. Two 18-ton trolley-type electric locomotives are used for this work. Cars are dumped at the plant by a revolving tipple operated by compressed air.

From the top of each bulldozing chamber, referred to previously, a raise 10 by 11 feet square extends to the floor of the quarry. These raises establish the position of the surface glory holes, They are spaced 120 feet apart. Six raises have so far been extended to the quarry level. A glory hole is started by coning out the top of the raise to an angle of approximately 60 degrees. During the coning out the broken rock in the raises is drawn down to expose the benches that are cut. Bulldozing is done with 40% powder in the bulldozing chamber whenever necessary through man-way raises, intermediate and sub-drifts. The cones, transfer raises, bulldozing chambers and chute raises are kept full of rock, the subsidence being gradual as the chutes are drawn. The capacity of a bulldozing chamber, raise and cone is about 5000 tons of broken rock, so there is considerable storage in addition to the broken rock in the pit. No serious hang-ups in

the system have occurred even though one raise is drawing from a portion of the quarry that contains a good deal of clay mixed with the limestone.

A total of 75 men are employed at the quarry, including 30 in the stripping crew, for the present output of 2000 tons per day, which is equivalent to 27 tons output per man-shift.

The deposit extends over a width of 1200 feet for approximately three-quarters of a mile. It is an homogeneous close-grained light gray to white limestone free from magnesium carbonate. The area was diamond-drilled prior to the adoption of the glory hole method and its extent found to be greater than anticipated, the tonnage being sufficient for a long period of operation.

CLAY

Up to the present time the clay deposits in Santa Cruz County have been only superficially studied. Common clays, suitable for brickmaking and similar uses, are known to occur along San Lorenzo River and at other points and there is no doubt a plentiful supply of such low-grade clays. In the early nineties two brickyards were in operation near Santa Cruz, but these have long since been dismantled. Deposits of cream-colored pottery clay are also said to be known, but their exact locality was not divulged to the writer. (Since the above was written the Mining Bureau has been informed that there is a "fine large deposit of pottery clay" on the property of J.B. King, Skyland; P.O. Wrights Station. This information was received too late for confirmation by personal examination)

The only clay now produced in the county is that used by the Santa Cruz Portland Cement Company. It is mined near Tank Siding, 1.8 miles southwest of Glenwood and at their Limestone quarry, and used in the manufacture of cement at the company's plant at Davenport. Operations at Tank Siding are not carried on continuously; their annual requirements being taken out during the most favorable season by a few months' intensive mining operations.

Further data relative to the clays of this county will be contained in a new bulletin of the State Mining Bureau on the clay industry of California, now in course of preparation by W. I. Dietrich, Ceramic Engineer.

Bibliography:

State Mineralogist's Reports X, p. 625; XII, p. 383; XIII, p. 619; XVII, p. 234; Preliminary Report No. 7, p. 97.

COAL

Several small veins of lignite coal have been found in Santa Cruz County. Prospecting for coal north of Watsonville was active during the early eighties and a little coal was mined on Corralitos Creek about that time. During the past year one of these veins in the vicinity of Corralitos was reopened and the coal sold for domestic purposes in Santa Cruz.

As much of the coal in California is lignite, or of such low grade that it cannot be used to advantage as a steam coal, investigations have been under way in various quarters looking to a more economical method of utilizing the deposits. Research has taken the form of its possible utilization in the direct production of sponge iron and steel in the electric furnace. Others have investigated the low-temperature distillation process with the production of a semi-coke briquette, said to be an ideal smokeless domestic fuel, and various by-products. Experiments which give promise of success have been made to purify lignites and low-grade coals by some process such as the Trent method, which consists in agitating together powdered coal, water and oil. This produces a partly de-ashed plastic fuel called 'amalgam', the oil selecting the coal particles and largely excluding the water and ash. In one experiment on a California lignite, the ash reduction amounted to 26.8%, the combustible recovery was 95%, and the sulphur reduction was 12% after treatment. Others have considered the manufacture of calcium carbide (CaC2) from lime and lignite coal. Still other investigators have undertaken to show how these coals may be utilized in powdered form, either alone or with oil in 'collodial' fuels; to make them into briquettes without the use of an expensive binder; to manufacture producers gas from them; and to obtain for commercial use their other constituents, including ammonia, benzol, toluol, solvents, drugs, oils, and other coal tar products.

One of the newer developments is a process for extracting oil from coal, in which powdered coal held in oil is subjected to high temperature with agitation in an atmosphere of hydrogen. Under these conditions it is reported that 10 to 45 per cent of the coal will become soluble. After removal of the carrying oil there remains a pitch of asphalt-like product possibly capable of further hydrogenation.

These various possibilities lend additional interest to the development of any coal beds within the county in addition to the ordinary use of the coal for domestic fuel.

Look Coal Mine

This property comprises 10 acres situated on Redwood Canyon in Sec. 30, T. 10 S., R. 2 E. Owner, C. R. Look, 44 Clay street, Santa Cruz. There is a good road to the mine from Corralitos, the nearest town. It is approximately 9 miles from the mine to either Watsonville or Aptos, the nearest railroad points, and 19 miles to Santa Cruz. Elevation at the mine, 800 feet. The surface rises steeply from Redwood Creek toward the west, and is thickly covered with redwood, tanbark oak and brush.

The existence of a vein of coal on this property and croppings on adjacent tracts have been known for many years, but were considered of little importance. The showing here was the

most prominent and the present owner acquired the land about ten years ago, but only started work on the coal vein in 1924. Development was continued in 1925, the old adits being cleaned out and extended. A raise is now being put up on the vein from the lower to the upper adit. Between 75 and 90 tons of coal removed in doing this work was sold in Santa Cruz and vicinity. One man is employed.

The vein appears to strike east-west and dips 45 degrees south, but is exposed only near the creek level where the canyon cuts across it. Both adits are driven in on the vein and run almost due west. The lower one is in 200 feet and the upper one, about 20 feet higher and 20 feet northerly, is in 100 feet. Both roof and floor are sandstone. The vein is fairly regular but varies in width from three to four feet. The coal is a fair grade of lignite, black in color, but showing some laminations, and inclined to slack on exposure, though this slacking is not pronounced if the coal is protected from the weather. It has not proved to be a satisfactory fuel in an open fireplace, but the writer saw it burning freely with no soot in an ordinary kitchen range, giving a bright hot fire. The ash is fine, reddish gray in color, but may amount to as much as 20 per cent. No analyses have been made. The owner states that where the coal has been burned in a stove with a grate and good draft, users report it very satisfactory.

There are indications of some parallel veins nearby, but no work has been done on them. On another ranch, about one-quarter mile east of the Look workings and approximately on the strike of this vein, there is another exposure in a road cut. This may be an extension of the Look vein, but at the latter point the dip is exactly opposite, being about 45 degrees north. Possibly this is only a localized fold of break-over. No work has been done here.

Leonard Ranch Coal Deposit

A vein of lignite from 6 to 18 inches in thickness, lying approximately horizontal between sandstone walls, is exposed in the bluffs facing the ocean beach on the P.M. Leonard ranch, two miles southeast of Aptos. The property is under lease as a ranch to Bontadelli and Son. In a small creek some distance back from the beach a hole about six feet deep shows 18 inches of the coal. It is black in color but laminated and friable due no doubt, in part to long exposure, as no fresh material was exposed. The bed is thicker here than on the beach, indicating that still farther inland a workable vein might be developed.

GOLD

Gold occurs in Santa Cruz County in auriferous black sand deposits, in placer deposits in a number of creeks and gulches on the sides of Ben Lomond Mountain, and in small quartz seams on Ben Lomond Mountain. During the eighties there was considerable activity both in working the black sand deposits near San Andreas and the placers and veins in the vicinity of Felton. The principal placers were on Waddell Creek, Majors Creek and Gold Gulch. Colors of gold are not difficult to obtain in the gravels along Gold Gulch and some placer mining was done here as late as 1920. Former operations are described in early reports of the State Mineralogist and in the *History of Santa Cruz County*, by Harrison.

The industry, if it could ever have been called one, gradually diminished and it is now a matter of history, about the only reminder being a large sign Gold Gulch Drug Store over a new building on the highway to Felton, near the site of some of the early workings. The larger land holdings in this vicinity are being subdivided for summer homesites and residence purposes and it is doubtful if any tracts would be sold or leased for mining purposes.

The black sand deposit being worked near Aptos by the Triumph Steel Company for its magnetite, ilmenite and chromite content is stated by this company to carry about 20 cents per ton in gold, but so far no effort has been made to recover it. See under Iron and Black Sand.

Bibliography:

State Mineralogist's Reports VIII, pp. 550-553; X, pp. 622-624; XII, pp. 243-244; XVII, pp. 235-236.
History of Santa Cruz County, Harrison, P. 203.

GRANITE

Granite has been quarried from Ben Lomond Mountain in the past. The rock, which is classified as quartz diorite, is a fair building material but is not being used at present.

There is a deposit of granite on Branciforte Creek in Sec. 29, T. 10 S., R. 1 W., which is said to present a face 700 feet high, from which large blocks could be easily quarried for rip-rap or similar use. The rock is reported to be of excellent quality, and transportation would not be difficult. It is undeveloped.

IRON

Triumph Steel Company

This company utilizes the black sand (magnetite) accumulated on the ocean beach, for producing sponge iron, alloy steel and briquetted magnetite. D. M. Crist, president; J. Harris Mackenzie, secretary; L. H. Stowell, plant superintendent. Home office, 112 Market street, San Francisco; plant, Box 252, R. F. D. No. 3, Watsonville, Calif.

The property of the Triumph Steel Company is situated at sea level two miles southeast of Aptos. Trains, however, also stop at the plant, the station being called Cristo.

Research and experimental work on the black sands has been carried on here for several years. Originally a red iron-oxide paint pigment was produced. Later the plant was expanded and the direct production of sponge iron from magnetite begun.

The company owns a site of five acres and 1 3/4 miles of adjacent beach. The process of reducing the magnetite is patented and much of the apparatus in the unit in operation is of original design and manufacture.

The gray-black beach sand is taken by a dragline scraper, operated by an electric hoist and delivered to a bin feeding an elevator. The elevator delivers the sand through a screw feeder to a rotary oil or gas-fired kiln which is used as a drier. After passing through this rotary, the thoroughly dry sand is run to another elevator which discharges into a revolving screen at the top of the plant. This screen, which is about 12-mesh, removes all pieces of shell and coarse gravel which go to the dump.

The fine sand discharges to a hopper feeding the special design magnetic separator. This machine consists of a series of horizontal troughs mounted on a frame standing at an angle of about 80 degrees from the horizontal and reaching from the lower floor to an elevation of about 40 feet. The sand from the hopper at the top is distributed in a thin film over the top trough and falls by gravity from top to bottom of the separator. In dropping from one trough to another, it passes over magnetic fields of various intensities designed to remove the separate constituents.

Practically all of the magnetite is obtained in the first four troughs. As the sand flows over these, the circuit to the electromagnets is automatically broken three times per second, pulling out and dropping the magnetite into a compartment. As the sand continues to cascade over the remaining sectors the ilmenite and chromite are segregated by regulation of the magnetic fields, each going to separate bins. The quartz garnet and other minerals constitute the tailing which is discharged.

Either pure magnetite, or a combination of magnetite with ilmenite or chromite as desired, is then elevated and fed to a special revolving electric-heated muck-bar tube or kiln, approximately 3 feet in diameter and 35 feet in length. The lining of this tube has nicrome heating elements imbedded, connection being made by two annular copper bands at each end, which revolve with the tube and dip in mercury troughs. Crude oil is sprayed into the feed end

of the hot tube as the magnetite passes through it. The oil does not burn but is immediately gassified, the gasses reducing the iron oxide to a metallic condition as sponge iron. The sponge iron is discharged at the lower end into a briquetting press, which delivers the muck-bar billets ready for the market. Gases from the muck-bar tube are drawn off and go to a dephlegmator, which extracts crude oil from them, and delivers an excess of CO gas, for use under the boilers or dryer.

A large amount of direct electric current is used, four days being required to bring the muck-bar tube up to operating temperature after a shut-down. All electricity is generated at the plant which is equipped with a 500-h.p. Babcock and Wilcox boiler and generators having a total of 2000 horsepower. Only a portion of the latter are used in this unit. It is said that no other process will directly produce ferro-titanium.

The plant includes a machine shop, laboratory and housing facilities. Twenty-one men are employed; the full capacity of the present unit being 50 tons of muck-bar per day. An electric furnace for the production of alloy-steel is contemplated.

The development of this direct iron-reduction process has required considerable investment in plant and research. Metallurgically it appears to be workable, but its commercial and economic success has not as yet been definitely proved.

LIME

The burning of lime is one of the earliest industries established in Santa Cruz County, the first lime kiln having been built in 1851 by I. E. Davis and A. P. Jordan. This afterwards became the property of Henry Cowell, and the old pot kilns may still be seen on the Cowell Ranch alongside the road from the limestone quarry to their present kilns at Rincon.

Henry Cowell Lime and Cement Company

S. H. Cowell, president; W. H. George, secretary; home office, 2 Market Street, San Francisco. The Cowell quarry is two miles northwest of Santa Cruz and one mile up the canyon from the old quarry first worked by Davis and Jordan and later by Henry Cowell. Limestone outcrops in this canyon in many places. The rock is both coarsely-crystalline and fine-grained, white to bluish-white in color; the coarse-crystalline variety being the most abundant.

The limestone is quarried by hand drilling and shooting down with giant powder. It is all trucked from the quarry 1.9 miles to the kilns at Rincon station on the Southern Pacific railroad. Formerly the coarse-crystalline limestone was burned in three pot kilns near the ranch house and the dense and fine-grained variety in four 34-foot Standard continuous kilns at Rincon. In 1920 three new pot kilns were added to the Rincon plant and the ones near the ranch house abandoned. The Standard continuous kilns did not work well except on the dense fine-grained rock. This variety required a greater heat for complete calcination, and the use of the continuous kiln also necessitated selective mining of the limestone to provide a suitable feed. For these reasons they are not now used and all the limestone is now burned at the Rincon plant in three pot kilns.

Each kiln has a capacity of 1600 barrels and is provided with four draw doors and four burners. Fuel oil is used with steam atomization. It requires from 4 to 4 ½ days to burn a charge, 36 to 48 hours for cooling and 2 days to draw the burned lime. The barrels in which the lime is packed are made in a cooper shop at the Rincon plant. Twenty-five men are employed at the kilns in addition to several at the Cowell quarry.

I. X. L. Quarry

This quarry, also owned by the company, is situated 2 ½ miles northwest of Felton and one-half mile north of the Holmes Lime and Cement Company's quarry. There are three pot kilns on the property. No limestone has been quarried or burned here for the past seven years.

Holmes Lime and Cement Company

W. E. Buck president; W. J. Feary, secretary. Home office, No. 2 Pine Street, San Francisco. George N. Ley, plant superintendent, Box 7, Felton, Calif. This company owns and operates a limestone quarry two miles northwest of Felton. The limestone is exposed along the strike

northwestward from the base to the top of the mountains, about 1000 feet. At the present time the quarry is opened on three faces. There is considerable overburden which is hauled off in dump carts. Air-drills are used, an electric motor and compressor being installed at the workings. The limestone is trained from the quarry to the kilns and hydrating plant in 8-ton cars which are hauled back with horses. The rock is a white crystallized limestone, both coarse and fine grained.

At the plant which is situated below the quarry near the town of Felton five pot kilns are in use; one of 1000 barrels capacity and four of 500 barrels. There are also two patented continuous kilns not in use. Oil with steam atomization is used for burning. In addition to the burned lime, the plant is equipped with a Clyde hydrator having a capacity of 25 tons of hydrate per day. The hydrate is bagged by a Bates valve-bag sacker. The lime is barrelled at the kilns in barrels made on the property.

Thirty-two men are employed; twelve at the quarry and the others at the kilns and hydrating plant. The quarry is an old one and has been operated over 45 years.

LIMESTONE

Miller Quarry

This property, formerly known as the Thurber Quarry, contains 23 acres, situated two miles northwest of Santa Cruz, adjacent to holdings of the Pacific Limestone Products Company. The rock varies from a coarsely-crystalline white or bluish-white limestone to a finer-grained hard siliceous limerock. There is a small crushing plant containing a 9x14-inch Blake crusher for preparing the stone for macadam and concrete work, the only purposes for which it is used. The quarry has been worked up to the property line on one side and, as there is increasing overburden on the present face, the owner is considering starting a lower bench near water level. The quarry is worked in a small way only, an average of two men being employed the year round. Owner, W.E. Miller, 81 Church Street, Santa Cruz.

Pacific Limestone Products Company

Home office, plant and quarry at Santa Cruz; sales office, Postal Telegraph Building, San Francisco. Officers: F. W. Johnson, president; D. L. Martin, vice-president; W. C. Johnson, secretary.

This company was organized in 1923 and took over the old Caplatzi Quarry which had been operated on a small scale by former owners for many years. Since the property was taken over by the Pacific Limestone Products Company, the number of raw limestone products prepared for specific purposes has been greatly increased and they are now being used for terrazzo, stucco dash, chicken grit, roofing grit, commercial fillers, glass manufacture, motor sand, concrete brick, cattle lime, poultry lime, fertilizer, macadam, and other uses. By the installation of additional equipment at the plant and sales promotion work carried on among prospective users of raw limestone products, the company has succeeded in quadrupling the output of the quarry in the past two years.

The property comprises 14 ½ acres located at the end of Spring street, Santa Cruz, two miles northwest of the Southern Pacific depot, at an elevation of 250 feet. The deposit is a limestone rock, medium hard with very fine to very coarse crystals. The rock is shattered and broken in large masses and is bluish-white in color. The average face is 52 feet high with an overburden of from 2 to 8 feet of soil and red clay. The overburden is removed by shooting with black powder to the floor of the quarry, or else it is trapped in a 10-yard bin chute. If the overburden is shot to the quarry floor, it is picked up by a Haiss loader and loaded into wagons or trucks. A good deal of this overburden is sold for fill material. All that is not sold is hauled to a waste dump.

Rock is blasted down with 10 to 14-foot toe holes averaging 8 to 10 feet from the face with 40 per cent L. F. Extra Giant 7/8 x 8 dynamite. Due to the many vertical seams a large amount of the rock is broken down without drilling. Air from a 6x7-inch single-stage Sullivan compressor furnishes power for a Sullivan 'Junior' rotary jack hammer. Pieces over 24 inches are plug shot. All rock is broken with 16-pound rock hammers to sizes less than 6 inches.

Because of mixed impurities of magnesium and silica all rock is hand-picked for its color, crystals and impurities. The piles of 6-inch rock are hauled to a No. 4 Austin gyratory crusher in 1 ½-yard one-horse dump carts or in one-ton Ford trucks. This crusher is about 500 feet from the present quarry face. Three men are used to fill the carts, and there is a driver for every two carts. While the driver is hauling one cart to the crusher, the other cart is being filled.

The Austin crusher reduces the stone to 2 ½ inches or smaller. This stone is then elevated by a bucket conveyor a distance of 50 feet to three gravity screens. The bucket elevator has 9x12-inch buckets spaced 12-inch centers. The screens separate out ¼, 1/8, and from 1/8 to 30 mesh sizes. The dust, if limestone is being crushed, drops into a bin directly below the screens and is sold as fertilizer. The 1/4 and 1/8-inch sizes drop to bins below the screens and in front of a No. 2 Williams hammer mill, or if desired, directly into another elevator that carries them to the grit screens.

Stone larger than ¼-inch goes to a storage bin. Stone is drawn from this storage bin and conveyed horizontally 20 feet to a 30-inch by 14-foot revolving screen. This screen has its cloth in four sections, and separations are made as the trade demands. Flux stone is made in two sizes from ½ to 1 ½ inches and from 1 ½ to 2 ½ inches. The oversize from this screen drops to a No. 2 Eureka jaw crusher. The discharge from this crusher is elevated 15 feet to a 30-inch by 6-foot revolving screen. This screen removes the dust and smaller sized crushed rock for special demands.

The discharge from the Williams mill is elevated 45 feet to a double cloth 30-inch by 10-foot revolving screen. This screen separates out four sizes. The tailings fall through a chute to a storage bin for recrushing. Each size is separated out from the screen and drops to separate storage bins. The separation from the outer screen drops to a No. 9 Rotex screen. The oversize from the Rotex screen passes to a storage bin directly over a No. 2 Williams pulverizing mill which grinds the material to fertilizer limestone. The discharge from this Williams mill is elevated 35 feet and passes

[A section of text is missing from the original publication at this point.] …special products can be produced without any difficulty.

The plant operates the entire year. Sixteen men constitute the average working force. Four men are employed in the mill and sacking department, four men handle all hauling, and the rest are used in the quarry. During rush periods the force has been increased to 36 men.

Bibliography:

State Mineralogist's Report XII, p. 395; XIII, p. 631; XVII, p. 237.
Pit and Quarry, Vol. 10, No. 5, June 1, 1925, pp.55-58.

MINERAL WATER

Although several small mineral springs occur singly and in groups within Santa Cruz County, no mineral water is bottled or commercially produced. There is little improvement at any locality except St. Francis Springs which was formerly a popular resort, long known as Chittenden Springs and later as El Pajaro Springs, where hotel accommodations were available.

Hinns Sulphur Spring

This is a small unimproved cold sulphur spring, located near the top of Hinkley ridge about one mile east of Olive Springs. A number of other small unnamed seepages or springs of mineralized water also occur west and northwest of Olive Springs.

Olive Springs

This picturesque property, which still remains practically in its natural state, comprises 100 acres, located on Hinkley Creek near its junction with Soquel Creek and extending to the top of the ridge between the two streams.

The property is in T. 10 S., R. 1 W., and varies in elevation from 300 feet at the camping ground to 1200 feet on the ridge. It is six miles north of Soquel with which it is connected by a good road. Owner Elizabeth J. Corcoran, Box 81, Seabright, California.

Hinkley Creek flows through a deep canyon here, the walls of which stand nearly vertical. Seepages and springs occur at numerous points in the creek bed and from the sandstone formation, which forms the canyon walls. The rock is very soft in places and in process of decomposition.

Of probably a dozen springs on the property, five have been somewhat improved by constructing small concrete basins around them. These five are known as the 'White Sulphur,' 'Sulphur.' 'Sulphur and Iron,' 'Magnesium,' and 'Magnesium and Iron' Springs, but the names mean little. All are cold.

The so-called 'magnesium and iron' spring has a flow which more than fills to capacity a 2-inch open pipe line, with a fall of 100 feet or more in a few hundred yards, leading from it to the camp grounds.

No water is sold but visitors are permitted to carry away as much as they desire.

Analysis of the 'White Sulphur' spring water by G. A. Bangs, M. D., Chemist:

Reaction:	Constituents in parts per million
Primary salinity	29
Secondary salinity	2
Tertiary salinity	0
Primary alkalinity	0
Secondary alkalinity	62
Tertiary alkalinity	?

Constituents	By weight	Reacting values
Carbonate (CO3)	390	12.98
Sulphate (SO4)	234	4.80
Calcium Ca	180	9.00
Sodium Na	156	6.90
Phosphate (PO4)	0	0.00
Chloride Cl	104	2.98
Magnesium Mg	86	6.92
Potassium K	2.5	.06
Total	1152.5	
Carbon dioxide (CO2)	present	
Hydrogen Sulphide (H2S)	8.2	

The soft decomposed sandstone in the vicinity of the springs has been investigated with a view to utilizing it in the preparation of a cleansing compound or soap, as it is claimed to have

remarkable qualities as a 'chemical clay.' It has a soluble potash content, and a small plant was erected on the property during the war period for the production of potash. A steel leaching tank and parts of what appear to be a concrete calcining furnace or evaporator remain on the ground, but as this work was carried on before the present owner took possession, the results obtained are not known. It is said that some potash was produced.

According to an analysis by E. W. Rice, of Santa Cruz, the decomposed sandstone has the following composition:

	Per cent
SiO2, Silica	72.680
Fe2O3, Iron Oxide	.755
Al203, Aluminum Oxide	13.575
CaO, Lime	4.305
MgO Magnesia	.325
K2O Potash	3.265
Na2O Soda	1.925
Loss on ignition	3.125

St. Francis Springs

This property contains 37 acres located on the banks of Pajaro River at Chittenden Station. At least 12 cool, strongly sulphuretted springs issue at this locality along a sloping bank near the river. The springs were long known locally as Chittenden Springs. In 1909 they were improved and opened to the public as Shale Sulphur Springs. Later the name was changed to El Pajaro Springs.

The property is now owned by the Franciscan Fathers, 133 Golden Gate Avenue, San Francisco, and is called St. Francis Springs. It has reverted to private use and probably will never again be opened as a public resort. The conversion of the buildings into a seminary is contemplated.

Bibliography

State Mineralogist's Reports: VIII, p. 555; XIII, p. 519; XVII, pp. 239-241.

U. S. Geological Survey Water Supply Paper 338, pp. 272, 274- 276.

MOULDING SAND AND PEAT

Moulding Sand

During the past year moulding sand has been added to the list of commercial minerals produced in Santa Cruz County.

Daniels Transfer Company, 23 Front Street, Santa Cruz, is producing this material from a deposit at Twin Lakes. It is being used in local foundries.

This information was obtained after the completion of field work in the county and subsequent to the collection of samples of California moulding sands by the State Mining Bureau for testing by the American Foundrymen's Association, so that, as yet the deposit has not been visited nor the sand tested to determine its particular characteristics and adaptability for different foundry purposes.

Peat

Peat is said to occur in Santa Cruz County near Felton. Small deposits may possibly be found in the vicinity of Watsonville also, as the log of an artesian well bored near the outskirts of the town showed 12 feet of peaty bog underlain by blue clay. There are probably no extensive deposits.

PETROLEUM AND POTASH

There has been no commercial production of petroleum in Santa Cruz County, although small seepages of crude oil have been found and a number of wells drilled. According to J. C. Branner, J. F. Newson and Ralph Arnold, (*"Geology of the Santa Cruz Quadrangle"*, U. S. Geological Survey Folio No. 163, 1910), who reported only upon that portion of the county within the Santa Cruz quadrangle,

> "apparently the most promising locality for, prospecting for oil is that along the coast west and southwest from the outcropping bituminous rock beds, since those beds pass down under overlying shale in that region. Wells drilled here, however, failed to find oil, and it is supposed that the oil which must formerly have existed in the sandstones of the region has been drained off through large fractures which extended from the surface of the shale down to the underlying sandstone. Many sandstone dykes, some of them of large size, occur along the coast in this region. These were formed from the underlying oil-bearing sandstones and the larger ones probably represent the channels through which the oil from the underlying strata escaped."

The geology and oil possibilities of the county are further discussed by Vanderleck, (Vanderleck, Lawrence. "Petroleum Resources of California", *State Mining Bureau Bulletin*. No. 89, 1921.) who says,

> "In the area around Ben Lomond Mountain, running from Little Basin to the town of Santa Cruz, the formations consist of granitic rocks, together with areas of ancient crystalline schists. In the region to the north of this crystalline area there are outcrops of the San Lorenzo formations, the Vaqueros sandstone and the diatomaceous shale of the Monterey. These have been all sharply folded and faulted. The Monterey contains numerous seepages, but there is an almost total lack of an overlying formation which could act as a reservoir. This, together with the unfavorable structural conditions, make the possibility of obtaining oil in paying quantities in this area remote. In some cases, by reason of faulting, the oil has migrated from the Monterey into the underlying beds of the Vaqueros and San Lorenzo. It is possible that wells drilled in this area in either the Monterey, or the underlying Tertiary beds will encounter small showings of oil, but not of sufficient size to be of commercial importance.
>
> "In the area between Ben Lomond Mountain and the coast, the Vaqueros and Monterey lie in a monocline, dipping about 25' to the southwest. The Monterey is heavily bituminized and has been extensively quarried for asphaltum.
>
> "The remainder of the county, which embraces the district lying between Santa Cruz and Watsonville and southwest of the Santa Cruz Mountains, may be likened to a coastal plain. In the country north of Aptos this likeness is not generally apparent, as the hills frequently rise to a height of 1500 to 1800 feet. Between Aptos and Watsonville, however, the county is characterized by low rolling hills, varying in elevation from 100 to 500 feet. The northeast boundary is marked by the steep escarpment of the west side of the Santa Cruz Mountains, formed by the San Andreas Fault. The greater portion of the

district is covered by loose incoherent sands and clay, varying in color from yellow to brown and having no distinctive strike or dip. The age is not definitely known, but very probably they belong to the Merced formation (upper Pliocene). With the exception of an area about three miles northeast of Watsonville (which will be discussed below) no distinctive structure could be made out in these beds.

"Near the town of Santa Cruz, the Monterey shale apparently dips under the Merced beds and very probably it underlies this entire area. Between the San Andreas fault and the Santa Clara County line is an area of Monterey shale, referred to in the article on Santa Clara County. The shale apparently lies in a synclinal trough; the eastern limb resting on the Franciscan; the axis of the syncline approximately coinciding with the county line and the west limb is faulted against the Merced beds by the San Andreas Fault.

"On the Mount Madonna road, about four miles north of Watsonville and about one-half mile south of the Casserly school, is the axis of a small anticline in the Merced beds, the west limb of which is sharply compressed against the Monterey shales by the San Andreas fault. It is in this area that the indications of oil occur. On the Webb Ranch, it is reported that two shallow wells were drilled and obtained gas. In the canyon just back of the ranch house there is apparently a dry seepage of black oil. On the Hughes Ranch, one well was drilled up the canyon just back of the house. A depth of 700 feet was reached and considerable gas was encountered. At the present time (1921) the Cymric Oil Company is drilling a well at this location. This area may be considered as worthy of being tested. As regards the remainder of the area under discussion it is worthy of being thoroughly investigated for structure before being condemned. It is apparently underlaid by bituminous shales of the Monterey and should detailed mapping reveal any favorable structure in the Merced beds, the locality would be worth testing."

The following data regarding prospect wells drilled within the county from 1914 to 1924, inclusive, are from records compiled by the State Oil and Gas Supervisor. (Bush, R.D. "Result of Wildcat Drilling in California, 1914-1924, Summary of Operations," *California Oil Fields*, Vol. 11, No. 1, July 1925.)

Company	Well	Location			Date started	Depth
		Sec.	T.	R.		
Cymric Oil Co.	1	14	11S	2E	1921	1500
Danish Oil & Development Co.	1	22	11S	2W	1922	1200
Danish Oil & Development Co.	2	22	11S	2W	1923	2400
Rhoads and Schmitt	1	17	9S	1W	1918	1000
Santa Cruz Laveaga Trust Oil Co.	1	5	11S	1W	1924	800
United Royalties Co.	1	Hughes Tract			1924	

Sec. 23, T. 11 S., R. 2 W., was reported ready to drill subsequent to the above compilation.

Potash

There is a small annual production of sulphate of potash, which is recovered from the flue dust and gasses from the kilns at the plant of the Santa Cruz Portand Cement Company at Davenport. During the war period there was also reported to have been some potash produced from a deposit of decomposed sandstone containing soda and potash feldspar located at Olive Springs (see under “Mineral Water”).

STONE INDUSTRY: CRUSHED ROCK, SAND AND GRAVEL

Except at the plant of the Pacific Limestone Co., where a small tonnage of a siliceous dike rock is sorted out for macadam and concrete, there are no commercial rock-crushing plants within the county; also at the Miller Quarry (see under “Lime” and “Limestone”) a small amount of limestone is crushed for macadam and concrete. The latter output is used by the owner on road and street contract work. There is but a single producer of washed and sized sand and gravel; all other material of this kind produced being 'bank run'.

Roach Sand and Gravel Plant

Owner E. S. Roach, 67 Peyton Street. Santa Cruz. This plant is situated on the east bank of San Lorenzo River just north of Soquel Avenue Bridge in Santa Cruz. The property contains 1 1/3; acres. Sand and gravel are recovered from the stream bed by pumping. An 8-inch Byron Jackson centrifugal pump, with 20-foot suction pipe mounted on a barge anchored in the stream, pumps the material against a 40-foot head to a trommel screen at the top of the plant. The pump discharge-line is 8 inches in diameter and at the present time the point of discharge is 450 feet from the barge. The pump is driven by a 75-h.p. electric motor and delivers 1800 to 2000 gallons of water, sand and gravel per minute. Another 15-h.p. motor drives the revolving screens.

Two sizes of sand are produced, a coarse sand for concrete and a fine sand for plaster. The coarse gravel is graded into ½-inch, 1-inch and 2-inch sizes. These are delivered to bunkers or stock piles. The plant has an average capacity of 200 yards per day. Water pumped with the material serves for washing. Short delays occasionally occur due to slides burying the pump suction, but as a rule little trouble is experienced. The barge and pump replace a drag-line excavator formerly used. Four men are employed.

Gibson Sand Pit

E.L. Gibson, 10 Leonard Street, Santa Cruz, owns and operates a sand pit at the mouth of a small lagoon on the beach between Santa Cruz and Capitola near Black Point. The beach sand is excavated with a drag-line scraper, a Fordson tractor mounted on sills furnishing the power. The scraper dumps into a bunker from which trucks are loaded. The material is a quite uniform and fairly clean gray sand which is neither screened nor washed. About 120 yards per day can be taken out.

Taylor Sand Pit

R. S. Taylor, 246 Mission Street, Santa Cruz, has a bunker and drag-line scraper for excavating river sand from the bed of the San Lorenzo River. This pit is adjacent to the Roach Sand and Gravel Plant near Soquel Avenue Bridge. It is operated intermittently according to demand.

In addition to the above, other firms and individuals occasionally dig sand and gravel from various points on the river or beach, loading direct to wagons or trucks. Among them are:

Owens Bros. Transfer and Storage Company, 256 Pacific Avenue, Santa Cruz. Daniels Transfer Company, 23 Front Street, Santa Cruz.

TABLE OF MINERAL PRODUCTION:

SANTA CRUZ COUNTY, 1894-1924

Year	Lime		Limestone		Bitumious Rock		Misc. Stone
	Barrels	Value	Tons	Value	Tons	Value	Value
1894	167,000	138,200	4,000	$5,000	20,782	$79,980	$79,980
1895	145,000	133,750	12,055	12,055	32,067	102,486	4,000
1896	116,000	95,500	27,827	28,663	48,843	109,536	4,000
1897	149,600	111,800	10,688	8,005	43,179	123,056	. . . . .
1898	151,000	151,000	7,912	5,738	40,598	113,898	. . . . .
1899	161,893	176,893	4,135	3,730	27,503	70,569	200
1900	163,985	131,288	1,669	1,213	21,960	58,590	. . . . .
1901	161,500	161,500	3,845	3,595	13,580	30,654	. . . . .
1902	185,223	161,302	1,850	1,850	31,700	41,084	. . . . .
1903	220,835	185,442	3,000	2,725	18,426	45,190	20,750
1904	293,207	306,775	*	. . . . .	*	. . . . .	2,925
1905	218,084	199,974	7,325	52,125	17,583	42,500	1,750
1906	255,469	347,490	11,431	55,242	13,544	38,860	3,500
1907	213,599	241,179	6,370	6,000	21,955	64,707	14,800
1908	119,996	119,996	1,178	2,167	25,041	85,123	19,736
1909	228,875	296,785	3,457	5,273	31,392	110,067	20,717
1910	214,137	230,513	4,361	6,770	35,565	124,195	23,425
1911	216,508	206,225	22,622	44,591	24,815	80,371	7,627

1912	169,646	159,505	7,308	7,553	32,146	80,439	22,710
1913	75,000	60,000	39,494	30,994	26,932	67,330	10,511
1914	173,282	157,011	14,666	25,082	40,540	115,500	4,276
1915	191,643	177,873	2,047	4,873	17,399	60,728	6,794
1916	176,263	225,485	4,318	9,820	*	. . . . .	2,815
1917	213,104	173,778	6,527	11,378	*	. . . . .	2,368
1918	182,083	285,316	7,132	15,313	*	. . . . .	9,107
1919	150,271	234,039	5,527	12,690	*	. . . . .	17,074
1920	141,633	202,908	5,062	20,101	*	. . . . .	23,379
1921	122,907	242,869	*	. . . . .	*	. . . . .	22,895
1922	174,490	235,802	4,581	20,534	*	. . . . .	7,398
1923	157,660	203,632	6,733	14,242	*	. . . . .	15,363
1924	127,830	212,540	*	. . . . .	*	. . . . .	29,217
Totals	5,437,723	$5,732,411	*237,119	*$614,561	*580,550	*$2,225,363	$277,337
* See under 'Unapportioned' in table below.							

Year	Miscellaneous and Unapportioned		
	Amount	Value	Substance
1894	. . . . .	. . . .	-
1895	75 M.	$375	Brick.
1896	497 M.	2,485	Brick.
1897	300 M.	1,500	Brick.
1898	. . . . .	. . . . .	-
1899	. . . . .	. . . . .	-
1900	. . . . .	. . . . .	-
1901	10 tons	30	Clay.
1902	106 tons	1,060	Asphalt.
1903	700 cu. ft.	140	Granite
1904	. . . . .	. . . . .	-
1905	. . . . .	. . . . .	-
1906	. . . . .	. . . . .	-
1907	. . . . .	. . . . .	--
1908	450 cu. ft.	336	Granite.
	28,400 tons	28,400	Clay.
1909	63,541 tons	13,800	Clay.
	. . . . .	1,794,294	Unapportioned, 1900-1909.
1910	52,970 tons	15,981	Clay.
	. . . . .	2,096,031	Unapportioned.

1911	. . . . .	2,448,339	Unapportioned.
1912	. . . . .	879,437	Other Minerals.
1913	. . . . .	1,647,970	Unapportioned
1914	. . . . .	1,341,089	Unapportioned
1915	. . . . .	1,331,263	Unapportioned.
1916	. . . . .	1,440,991	Cement, marble, bituminous rock.
1917	. . . . .	1,480,800	Cement, potash, bituminous rock.
1918	. . . . .	2,599,717	Cement, potash, bituminous rock.
1919	. . . . .	1,981,253	Other Minerals.
1920	. . . . .	2,834,750	Bituminous rock, cement, iron ore, mineral paint, potash.
1921	. . . . .	3,815,121	Bituminous rock, cement, limestone, mineral paint, potash.
1922	. . . . .	3,345,071	Cement, bituminous rock, potash.
1923	. . . . .	3,992,668	Cement, bituminous rock, potash.
1924	. . . . .	4,097,476	Cement, bituminous rock, potash, limestone.
Total Value		**$37,190,287**	-

Source

The Mineral Survey of Santa Cruz County was printed in the Santa Cruz Chamber of Commerce *Annual Report*, 1926. Reproduced by permission of the Santa Cruz Area Chamber of Commerce.

It is the library's intent to provide accurate information, however, it is not possible for the library to completely verify the accuracy of all information. If you believe that factual statements in a local history article are incorrect and can provide documentation, please contact the library.