SOCIETY FOR CALIFORNIA ARCHAEOLOGY

COCCIDIOIDOMYCOSIS
An Occupational Hazard For Archaeologists

By
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Special Report No. 2
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Coccidioidomycosis (Valley Fever) Report Form

TO: J. C. Loofbourow, M.D.
Office of Occupational Medicine
Cowell Health Center
University of California
Davis, California 95616

FROM: NAME _____

ADDRESS _____

PHONE _____
(Where can be reached for further information)

LOCATION OF SUSPECTED SITE _____

DATE OF FIRST EXPOSURE _____

DATE OF LAST EXPOSURE _____

HOW WAS DIAGNOSIS MADE?

		DATE	RESULT (if available)
SKIN TEST CONVERSION:	NEGATIVE TEST		Millimeters of induration
	POSITIVE TEST		Millimeters of induration
SERO CONVERSION:	NEGATIVE TEST		
	POSITIVE TEST		

OTHER: _____

SHOW DATE OF SYMPTOM IF PRESENT.

SORE THROAT _____ FEVER _____ TIREDNESS _____ COUGH _____
CHEST PAIN _____ RASH _____ ARTHRITIS _____
OTHER SYMPTOMS: _____

PHYSICIANS NAME: _____

ADDRESS: _____

PHONE: _____

Request for Serum *Coccidioidomycosis* Studies

The physician should send 5 to 10 ml serum to: Dr. Demosthenes Pappagianis
Department of Medical Microbiology
U.C.D. School of Medicine
Davis, California 95616

The specimen should be preserved by adding 1.0ml aqueous merthiolate (1:1,000) per 9.0 ml. The service will be provided without cost to the physician.

NAME (Patient) AGE SEX RACE
(If this is repeat specimen, give our previous report NO._____)

Name, address of Physician:

_____

_____

_____

Report to be sent to:

_____

_____

_____

Date of onset of illness: Day_____ Month_____ Year_____
Skin test results and dates (give dilution of antigen):
Coccidioidin_____ Tuberculin_____ Histo_____
*Symptoms and findings: (Give current information with dates)

*Laboratory findings
Chest X-ray_____
Sedimentation rate_____ Total and differential WBC____
*If meningitis suspected:
Spinal fluid (Lumbar, Cisternal, Ventricular?)_____
Glucose_____ Protein_____ Cells_____ Pressure____
*If Amphotericin Administered:
Total dose given (give date)_____
Route (I.v., lumbar, cisterna, intraventricular)_____

*Current information; if previously given, information need not be repeated.

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John C. Loofbourow, M.D.*
Demosthenes Pappagianis, M.D.**

December, 1971

SPECIAL REPORT NO. 2
SOCIETY FOR CALIFORNIA ARCHAEOLOGY

*Cowell Health Center, University of California at Davis
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PREFACE

The California archaeologist who has not been afflicted with *Coccidioidomycosis* or "Valley Fever" is today almost a rarity. With the exception of those fortunate few who have entirely restricted their fieldwork activities to the seacoast or the high Sierra, almost everyone who has worked widely in the California field has experienced at least the mild flu-like symptoms of garden-variety Valley Fever, and horror stories of more drastic cases are colorful elements of dig mythology. It is appropriate that archaeologists be provided with up-to-date information on Valley Fever as it applies specifically to our profession, and it is appropriate that the Society for California Archaeology, the organization uniquely concerned with the condition of archaeology and archaeologists in California, should provide it. Drs. Loofbourow and Pappagianis have been kind enough to permit us to publish this monograph as a service to fieldworkers throughout California and adjacent areas.

The bulk of the editorial preparation involved in production of this Report was done by former Publication Committee Chairman Keith Johnson, Chico State College, with the assistance of his Committee members Makoto Kowta, David Fredrickson, and Fred Reinman. Responsibility for the finished product, however, must rest with the current Publication Committee. I am grateful to Mr. Johnson and his Committee for their excellent preparation work, and to Roberta Greenwood and Mary King for editorial assistance.

TOM KING, Publications Committee
University of California at Riverside

COCCIDIOIDOMYCOSIS: AN OCCUPATIONAL HAZARD FOR ARCHAEOLOGISTS

Description of the Disease

Coccidioidomycosis, often called Valley Fever, is an infection of the lung or other parts of the body by the fungus organism *Coccidioides immitis*. This organism grows in soil at low elevations where the climate is characterized by wet, mild winters and dry, hot summers. The infectious organism forms tiny spores which lodge and then grow in the finer bronchioles of the lung.

In most cases the disease is mild and recovery occurs spontaneously; it may be so mild as to be undetected. Occasionally it is so severe as to become a chronic lung disease or spread to other parts of the body, leading to severe illness or death.

The typical mild symptomatic case is like a chest cold lasting three to five days with tiredness, aching, sore throat, headache, fever and cough. It usually occurs about one to two weeks after dust exposure although late onset one or two months afterwards is occasionally seen. In slightly more severe cases, chest pain is common when breathing deeply or coughing, and pneumonia often accompanies this.

In 5 to 10 per cent of cases, skin rashes occur. These vary from a measles-like rash to a series of tender, red, itchy, swellings on the shins, or patchy red itching areas on the upper body. Occasionally arthritis of the ankles, knees, hips or other joints occurs with the rash. Although these rashes are not usually serious, they help in revealing the presence of the disease.

The disease picture described above usually resolves by itself in one or two weeks. Care by a physician is important, first, to confirm the nature of the infection, and second, to discover complications or progression so that more aggressive treatment can be initiated when indicated. Among Philipinos and Blacks, the risk of fatal disease is greater than among Caucasians.

Conversion of a skin test from negative (no significant reaction) to positive (5mm induration or more) and conversion of serologic tests from negative to positive confirm infection. In very mild cases the skin test conversion from negative to positive may be the only proof of infection. In more severe cases, conversion of the serologic tests provides further confirmation of disease. Subsequent blood tests also measure the degree and rapidity of recovery and are very helpful in determining risk of relapse. Once an infected individual has recovered completely and his serologic tests have returned sufficiently toward normal, relapse or reinfection from natural exposure is very rare.

This brief description is meant to explain the nature of the disease, to emphasize the need for medical attention when disease is likely and to provide reasons for the preventive measures outlined below. For a more comprehensive description, Marshall J. Fiese's text entitled *Coccidioidomycosis* (1958) is recommended.

Endemic Areas

Infection usually occurs in the dry seasons of the year; a high incidence of new cases may follow an especially heavy rainy season. *C. immitis* in soil has been found only within roughly defined geographic regions of the Western Hemisphere (California, Arizona, New Mexico, southern Nevada, southwestern Utah, western Texas, northern Mexico, Baja California, Argentina, Paraguay, Bolivia, Venezuela, Guatemala, and parts of the Honduras). Within and around endemic areas, development of *coccidioidomycosis* in humans, dogs, cattle and other animals is likely. Drainage areas of the San Joaquin, Colorado, Salt, and Rio Grande Rivers roughly define the known endemic region in the southwestern United States. Fiese (1958:54) provides a map of endemic areas; for more detail see his accompanying text and Section V of the Second Symposium on *Coccidioidomycosis* (Ajello 1967). Unfortunately, the risk of infection at any one site is not predictable except in a general way. Infection appears to be most likely in certain soil "pockets", but the conditions that make growth of the fungus possible remain unidentified. We do know that dispersion of dry soil and inhalation of spores are necessary for lung infection.

Because of these variables, an accurate description of endemic or high risk areas is not possible. It is recommended that archaeologists working in the above mentioned geographic regions in the dry season be aware of the possibility of contracting Valley Fever, even when their sites have not previously been proven to be infected. The map at the end of this report shows the general areas and the specific archaeological regions where *coccidioidomycosis* has been reported in California.

Although Northern California was not previously shown to be an endemic area, the Sacramento Valley is now suspect. An archaeological crew contracted the infection in 1968 while excavating near Brooks in Yolo County (Loofbourow, Pappagianis and Cooper 1969). During the summer 1970 Archaeological Field School at Chico, more than 60 students from New York were infected with Valley Fever at a site near Richardson Springs, Butte County.

Several other episodes of infection among archaeological and anthropological groups in California have occurred in recent years (Huberty 1963, King 1968, Loofbourow, Pappagianis and Cooper 1969, Plunkett 1955, Plunkett and Swatek 1957, Schmidt and Howard 1968, Swatek 1967). Unfortunately, *coccidioidomycosis* among archaeologists usually has not been widely published or documented completely.

The Yolo County Outbreak

As an example of this illness in an archaeological crew, the Yolo County outbreak of 1968 is described briefly below. (See also Loofbourow, Pappagianis and Cooper 1969).

An archaeological class from the University of California at Davis explored an Indian burial site near Brooks, California, in the period 16 June 1968 through 26 July 1968. On 9 July, a student member of the class reported pleuritic pain, fever, malaise and cough, and was found to have middle lobe pneumonia. *Coccidioidomycosis* was suspected on the basis of clinical manifestations and positive skin test response to 1:10 *coccidioidin*. The entire archaeology group was then tested with 1:100 dilution *coccidioidin*. Those who did not react to the first test were retested with a 1:10 dilution. Surveillance was maintained for the duration of the archaeology course and, where possible, continued by mail with cooperating physicians thereafter. Eleven cases of clinically apparent *coccidioidomycosis* occurred among the group of 23 archaeology students. Eight of the cases were confirmed serologically and three by skin test conversion alone.

Four case descriptions may help to illustrate the typical mild case infection.

Case 1: A 21-year-old Caucasian man was first seen at the Student Health Center 9 July 1968 with a two-day history of cough with painful breathing, fever, chills and malaise. He had had heavy exposure to dust in the above described archaeological effort since 19 June. An X-ray film showed segmental right middle lobe pneumonia. A skin test with 1:100 *coccidioidin* was read at 48 hours as equivocal (4 to 5mm induration and very faint erythema). The patient's symptoms lessened decidedly by 11 July, but a repeat skin test with 1:10 *coccidioidin* resulted in a reaction 40mm x 25mm. On 18 July precipitins (antibodies) were detectable. The patient recovered uneventfully and by November 1968 was asymptomatic and an X-ray showed the chest had cleared completely.

Case 2: A 21-year-old Caucasian woman was seen on 16 July with pleuritic pain of five days duration which had been preceded by a sore throat occurring about one week earlier. A skin test (1:100 *coccidioidin*) was negative at this time but an X-ray film showed pneumonia in the superior segment of the left lower lobe, and she was admitted to the hospital. A repeat *coccidioidin* skin test with a 1:10 dilution on 17 July was positive with 14mm x 15mm of induration. This patient had a previous history of acute glomerulonephritis (inflamation of the kidneys), and with the current illness albuminuria (protein in urine) and hematuria (blood in urine) developed. These conditions cleared completely by 13 August 1968. At present there is a residual X-ray density in the area of the previous pneumonitis, but the patient is in good health.

Case 3: A 20-year-old Caucasian woman was found to be skin test negative in the original survey, had a clear X-ray film of the chest, and showed a negative serological test on 19 July. The patient finished her course of study on 26 July. She was provided with information about *coccidioidomycosis*, and was given a letter of instruction for her physician in case of illness. She was asked to have serologic and skin tests repeated in August in any case. On 28 July pleuritic pain developed on the right side. She was seen by a

physician and a "spot" was noted on an X-ray film of her chest. Penicillin was given, but chills, cough, fever and more severe pleuritic pain and erythema nodosum (red skin rash) developed. The patient returned to her home and was seen there by her personal physician, who made a tentative diagnosis of *coccidioidomycosis*. Because it was felt necessary that she be isolated (incorrectly, in our opinion), and no private isolation room was available, she returned to the Student Health Center at U.C. Davis and was admitted on 5 August after a chest X-ray showed a pneumonia of the right upper lung region. *Coccidioidin* skin test (1:100 dilution) produced 5mm of induration and erythema, while the 1:10 dilution yielded a 10mm reaction. She recovered uneventfully in the following week and was returned to the care of her physician.

Case 4: A 19-year-old Caucasian male student had no reaction to 1:100 *coccidioidin* when originally skin tested on 16 July 1968. He was retested on 18 October with 1:100 *coccidioidin* and showed a 15mm reaction. In the interim he had had a chronic rash lasting about one month and presumed to be caused by poison oak. The rash was treated with cortisone and he subsequently became asymptomatic. *Coccidioidal* serologic tests remained negative through 18 October 1968. He apparently had a mild case of *coccidioidomycosis* with rash and recovered quickly.

In archaeological excavations, infection rates are high, probably because of the heavy dust exposure and the susceptibility of the crew. Outbreaks are dramatic where students are involved, since they are less likely to have had previous exposure than more experienced archaeologists. Museum personnel have occasionally been infected through handling bones or artifacts, although this is uncommon.

Prevention

Prior infection confers protection, and reinfection after cure is rare. No vaccine for humans is yet known though an effective vaccine has been developed for experimental animals. Preventive measures still center on dust control, which is difficult; operating in slightly damp soil or moistening of soil is effective. Protective masks may reduce exposure if used properly, though experience is limited. The quality of the mask is important, and filters should be changed often in heavy dust conditions. A washable mask with disposable filters (such as the American Optical Company mask, catalogue #R 2900 or its equivalent), costs less than $3.00, filters less than 10¢ each. This mask is ineffective if the fit of the mask against the face is obstructed by a beard. Museum personnel should avoid working with possibly infected material in poorly ventilated rooms and should employ modifications of dust control measures outlined above. The use of a hygroscopic agent such as calcium chloride has been used in the eastern United States for control of dust on roads, and although no use in archaeology is known to the authors, this might be practical in some soil conditions.

The material should be applied each evening in an amount adequate to keep soil slightly moist. Another suggested but unproven control measure is the use of a fumigant-fungicide. Chloro - 2 Nitro Propane has been studied experimentally and suggested for use as a surface soil spray (Elconin 1967).

Suggested Procedure

For individuals working in endemic areas or suspected endemic areas, the following measures are recommended:

1. Arrange for medical care and skin testing ahead of time. This is best done by the director of the dig through a local physician. Skin testing should be done before exposure if funds are available. Generally, if testing is done in a group and those tested take care to come in for testing or reading in a group, the physician will be able to reduce the cost considerably. In making the original contact with the physician, this publication may be useful.

   1:100 dilution *coccidioidin* must be used, and the test must be read at 24 and 48 hours; if that test is negative, it should be repeated using 1:10 dilution. These tests are read in millimeters of induration. More than 5mm is positive.

2. If working in an area where risks are known to be high, select a crew of skin test-positive individuals (perhaps from the local area).

3. When digging, exercise dust control through means outlined under the preceding section titled "Prevention" and by other simple means such as not working down wind or in adverse conditions. Sleeping away from the dig site in relatively dust free surroundings is desirable.

4. If symptoms develop, stop exposure and contact a physician familiar with *coccidioidomycosis*. Depending on symptoms the doctor may:

   a. Repeat skin tests.

   b. Take chest X-rays.

   c. Draw blood for serum specimens. (He may wish to use the enclosed form in ordering serologic tests.)

5. If you have had Valley Fever in the past or if you contract it in the future, please fill out and return the report form included in this publication. It is part of a reporting procedure that has been set up with the help of the Davis Center for Archaeological Research in an effort to keep informed about *coccidioidomycosis* in archaeologists. When new areas of infection are discovered, information will be disseminated through the S. C. A. Newsletter.

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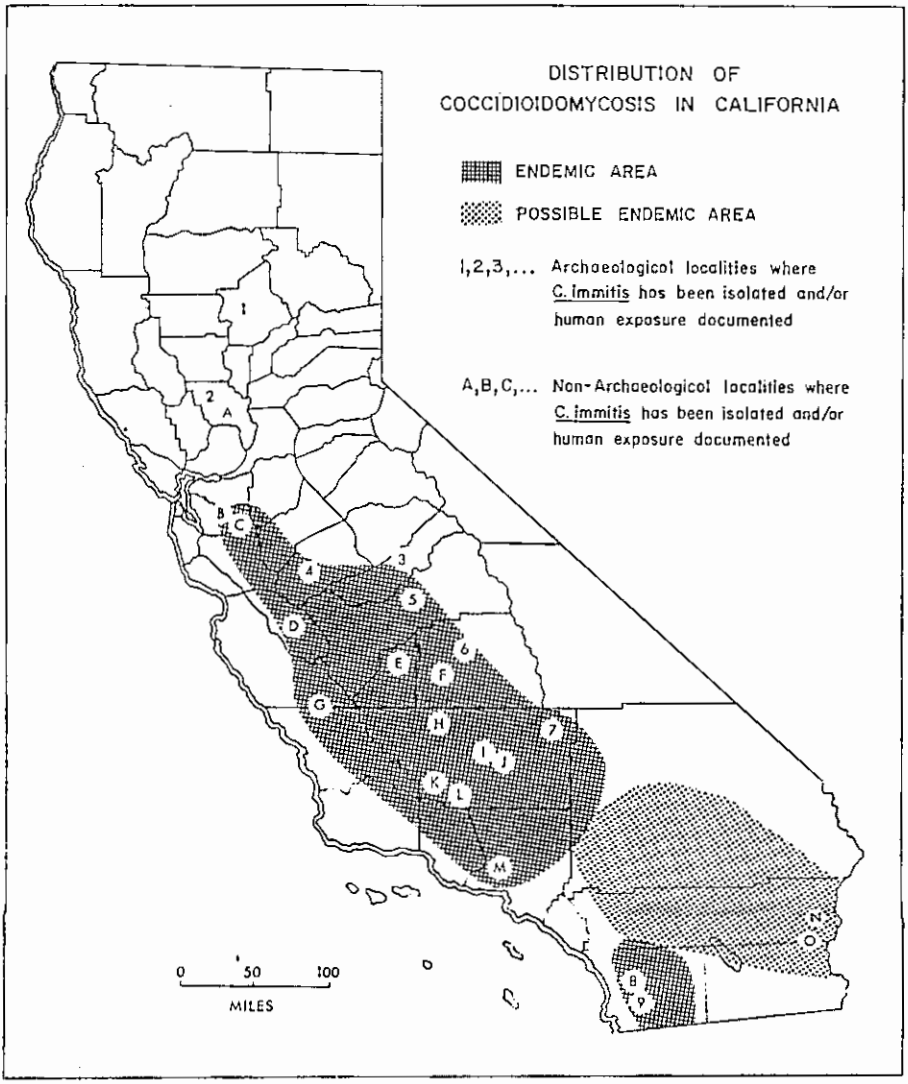
KEY TO LOCALITIES ON MAP

1. Richardson Springs
2. Brooks
3. Buchanan Reservoir
4. Los Banos
5. Clovis-Auberry
6. Kaweah Lake
7. Inyokern
8. Lakeside
9. Santee

A. University of California at Davis
B. Livermore
C. University of California A.E.C. Test Site 300
D. Panoche
E. Lemoore Naval Air Station
F. Woodville
G. Camp Roberts
H. Delano
I. Oildale
J. Bakersfield
K. McKittrick-Buttonwillow
L. Maricopa
M. Canoga Park
N. Blythe
O. Palo Verde


DISTRIBUTION OF
COCCIDIOIDOMYCOSIS IN CALIFORNIA
ENDEMIC AREA
POSSIBLE ENDEMIC AREA
1,2,3,... Archaeological localities where C. immitis has been isolated and/or human exposure documented
A,B,C,... Non-Archaeological localities where C. immitis has been isolated and/or human exposure documented
0 50 100
MILES