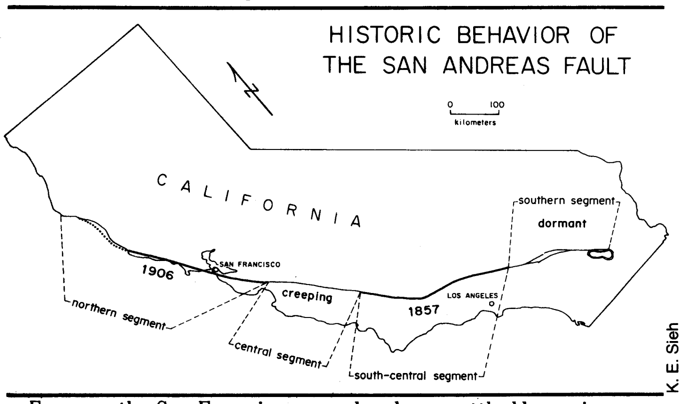
EARTH SCIENCES

Remembering the 1906 quake

April 18 marks the 75th anniversary of the devastating 1906 San Francisco earthquake. Probably the best-known California quake, the Richter magnitude 8.3 event was certainly not the state's last. Herewith are some updates from the U.S. Geological Survey on California's seismic situation.

In a 1980 study for the National Security Council, the USGS estimated that there is a 50 percent chance of a "catastrophic" earthquake — one that measures magnitude 8 or more — occurring somewhere in California in the next 20 to 30 years. But the next 1906-type trembler is most likely to occur in southern California, the agency says. Along the southern part of the San Andreas fault, the huge geologic seam that splits the state along its length, the USGS estimates a 2 to 5 percent chance per year of a great quake in the region 30 miles north of Los Angeles. Noting that geological evidence shows that the L.A. end of the San Andreas experiences a magnitude 8 quake every 140 to 150 years, and that the last such quake occurred in 1857 — 124 years ago — the geologists give the region a 50 percent probability of a great quake in the next 30 years.

By contrast, the annual probability of a magnitude 8 event along the fault near San Francisco is about 1 percent. Geologists estimate that a 1906-size quake occurs near San Francisco every 130 to 150 years, indicating that such a quake is not expected "in this century," according to one scientist.



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Even so, the San Francisco area has been rattled by an increasing number of smaller-than-1906-size quakes in the past 25 years, and may be looking forward to more of the same (SN: 6/7/80, p. 363). In addition, the Survey notes, the rest of the state has been picking up seismically. Moderate to large quakes (magnitudes 5 to 7) have struck during the past 18 months from Eureka in the north to El Centro in the south and from Mammoth Lakes in the east to the Bay region in the west. The largest of these, magnitude 7.4, struck on Nov. 8, 1980, in the Pacific Ocean off Eureka. The most recent — measuring nearly magnitude 5 — occurred in late January in the Sierras. This, combined with the cluster of quakes near Mammoth Lakes in May 1980 (SN: 6/7/80, p. 356), "raises the possibility of another earthquake of M 7 or greater in the near future on the east flank of the Sierras," according to Robert Wallace of the Survey's Menlo Park, Calif., office. In response to this heightened activity state-wide, the Survey reviewed and in July 1980 reissued a "hazard watch" for the southern part of the state. Federal, state and local agencies in southern California also began an earthquake preparedness project in 1980.

If the 1906 quake were to do a rerun today in San Francisco, the Survey estimates 11,000 deaths and 44,000 hospitalizations would occur and buildings would suffer about $38 billion damage. A magnitude 7.5 quake 30 miles north of Los Angeles could cause 23,000 deaths, 91,000 hospitalizations and up to $69 billion in damage.

PHYSICAL SCIENCES

Unpressured organic superconductor

The discovery of an organic material that can be made electrically superconducting under certain conditions was announced about a year ago (SN: 4/5/80, p. 212). The announcement caused great satisfaction. Until then it had seemed that being a metal was a necessary condition for being a superconductor. Organic superconductors open the possibility of a better understanding of the nature of superconductivity, which is the resistanceless flow of electric current through the substance, more versatile applications of it and last but not least a new approach to that long-sought end of the rainbow, superconductivity at temperatures that don't need liquid helium refrigeration.

In the March 30 PHYSICAL REVIEW LETTERS some of the people who collaborated in the finding of that organic superconductor report a second one. They are Kim Carneiro, Malte Olsen and Finn Berg Rasmussen of the University of Copenhagen and Claus S. Jacobsen of the Technical University of Denmark in Lyngby. The compound with which they have been working is di-(tetramethyltetraselenafulvalenium)-perchlorate or $(TMTSF)_2ClO_4$. It exhibits superconducting behavior at temperatures between 1 and 2K.

The previously announced organic superconductor is di-(tetramethylselenafulvalenium)-hexafluorophosphate or $(TMTSF)_2PF_6$. This compound requires not only the same sort of temperatures for the onset of superconductivity but a pressure of 6 times the earth's atmosphere. That raised the question whether pressure as well as chilling was necessary to make organic compounds superconductors. (Pressure is not generally necessary in the case of metals.) The case of $(TMTSF)_2ClO_4$ seems to indicate that pressure is not always necessary in the case of organics. This is a point of great scientific interest, and it may someday be of technological interest. Both compounds are of the same family, designated $(TMTSF)_2X$, and this supports the researchers' original hope that systematic investigation of this family might turn up compounds that are superconducting under more favorable conditions yet.

Cosmological stretch marks

Cosmologists would like to believe that the universe is homogenous and isotropic, that is relatively smooth over-all and the same in all directions. Among other things this means there are no privileged points in space: The laws of physics apply to all locations in space and time in the same form without requiring any special adjustments.

Philosophically, mathematically and physically this is the easiest kind of universe to deal with. Our evidence for isotropy is the microwave radio radiation, the so-called 3K blackbody, that pervades space and seems to be a relic of the very beginning of time. It used to seem to be the same in all directions.

Not any more. Five or six years ago we began to hear of a possible dipole anisotropy. Then at the beginning of 1980 came hints of a quadrupole anisotropy. In a recent issue of ASTROPHYSICAL JOURNAL LETTERS (Vol 243, p. L113) Stephen P. Boughn, Edward S. Cheng and David T. Wilkinson of Princeton University report further observations of the dipole anisotropy and a new hint of a quadrupole one.

A dipole anisotropy can be attributed to motion of the observer along a certain line: The background radiation is Doppler shifted before and behind and looks different there. A quadrupole isotropy (difference in four directions at right angles to each other) has to belong to the substance of the radiation or the universe itself. The two hints, this and the earlier one, are not the same, so this is not a confirmation, but if the trend is toward a quadrupole anisotropy, then someday we may have to say that all directions are equal but some are more equal than others.