VOLUME CXIV NUMBER TWO

THE NATIONAL GEOGRAPHIC MAGAZINE

AUGUST, 1958

British Columbia: Life Begins at 100 147
With Map and 34 Illustrations
27 in Color
DAVID S. BOYER

Dogs Work for Man 190
With 32 Illustrations
19 Paintings in Color
EDWARD J. LINEHAN
EDWIN MEGARGEE and
R. E. LOUGHEED

How Old Is It? 234
With 19 Illustrations
LYMAN J. BRIGGS and
KENNETH F. WEAVER

California's Ranches in the Sea 256
With 26 Illustrations
19 in Color
EARL WARREN, JR.
BATES LITTLEHALES

The Vibrant Heart of France 284
15 Illustrations and two-page map

Sixty-four Pages of Illustrations in Color

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C.

SUBSCRIPTION $8.00 A YEAR
SINGLE COPIES $1.00 EACH

NATIONAL GEOGRAPHIC Society

16th & M Streets N.W. Washington 6, D. C.

National Geographic Magazine

ORGANIZED IN 1888 "FOR THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLED

To increase knowledge, the National Geographic Society has conducted 150 scientific projects and exploring expeditions literally to the ends of the earth. The Society diffuses knowledge through its monthly National Geographic Magazine and its books, 16 million large color maps a year, bulletins for schools, and news releases on world events for press, radio, and television.

MELVILLE BELL GROSVENOR, President and Editor
THOMAS W. McKNEW, Executive Vice President and Secretary
ROBERT V. FLEMING, Vice President and Treasurer
MELVIN M. PAYNE, Vice President and Associate Secretary
FREDERICK G. VOSBURGH, Vice President
ROBERT E. DOYLE, Associate Secretary

Committee for Research and Exploration

LYMAN J. BRIGGS, Chairman
ALEXANDER WETMORE, Vice Chairman
LEONARD CARMICHAEL
Vice Adm. EMORY S. LAND
Rear Adm. L. O. COLBERT
WILLIAM E. WRATHER
HUGH L. DRYDEN
A. REMINGTON KELLOGG, Director, U. S. National Museum
CHARLES F. KETTERING
and the Senior Officers of The Society

Board of Trustees

GILBERT GROSVENOR, Chairman of the Board, formerly President, National Geographic Society, and Editor of its Magazine (1899-1954)

JOHN OLIVER LA GORCE, Vice Chairman of the Board, formerly President and Editor, National Geographic Society (1954-1957)

LYMAN J. BRIGGS
Director Emeritus, National Bureau of Standards

LEONARD CARMICHAEL
Secretary, Smithsonian Institution

L. O. COLBERT
Rear Admiral, U. S. Coast and Geodetic Survey, Retired

HUGH L. DRYDEN
Director, National Advisory Committee for Aeronautics

ROBERT V. FLEMING
Chairman of the Board
Riggs National Bank

MELVILLE BELL GROSVENOR
Editor, National Geographic Magazine

ELISHA HANSON
Lawyer and Naturalist

CHARLES F. KETTERING
Consultant and Director
General Motors Corporation

EMORY S. LAND
Vice Admiral, U. S. Navy, Retired, formerly President Air Transport Association

CURTIS E. LEMAY
Vice Chief of Staff, U.S. Air Force

H. RANDOLPH MADDOX
Vice President, American Telephone & Telegraph Company

GEORGE C. MARSHALL
General of the Army
Former Secretary of Defense

BENJAMIN M. McKELWAY
Editor, The Washington Star
President, Associated Press

THOMAS W. McKNEW
Executive Vice President
National Geographic Society

LAURANCE S. ROCKEFELLER
President, Rockefeller Brothers, Inc., and Jackson Hole Preserve

JUAN T. TRIPPE
President, Pan American World Airways

EARL WARREN
Chief Justice of the United States

ALEXANDER WETMORE
Research Associate
Smithsonian Institution

LLOYD B. WILSON
Honorary Chairman of the Board
Chesapeake and Potomac Telephone Companies

CONRAD L. WIRTH
Director, National Park Service
U.S. Department of the Interior

WILLIAM E. WRATHER
Director, U. S. Geological Survey, Retired

Assistant Secretary: VERNON H. BREWSTER; Assistant Treasurers: HILLEARY F. HOSKINSON, WILLIAM H. McCAULEY

Herman J. A. C. Arens, Executive Assistant, and Carol J. Cramer, Secretary to the President and Editor; Lenore Williams, Secretary to the Executive Vice President; Sibyl Peck, Assistant to Chairman, and Leon J. Canova, Assistant to Vice Chairman, of the Board

MELVILLE BELL GROSVENOR, *Editor*
THOMAS W. McKNEW, *Executive Vice President*
FREDERICK G. VOSBURGH, *Associate Editor*

EDITORIAL STAFF

Senior Assistant Editor: Frank Shor
Assistant Editors: Beverley M. Bowie, Robert L. Conly, George W. Long, Mason Sutherland
Senior Staff: Andrew H. Brown, Allan C. Fisher, Jr., Nathaniel T. Kenney, John Scofield, Paul A. Zahl (Natural Sciences)
Text Editor: Samuel W. Matthews
Foreign Staff: W. Robert Moore (Chief); Thomas J. Abercrombie, David S. Boyer, Walter Meayers Edwards, Luis Marden, Jean Bowie Shor, Howell Walker, M. Woodbridge Williams
Editorial Staff: William P. E. Graves, John R. Hoopes, Jay Johnston, Stuart E. Jones, Howard LaFay, Edward J. Linehan, Hobart K. McDowell, Jr., Carolyn B. Patterson, Kenneth F. Weaver, Peter T. White, Rose T. MacBryde (Asst.), Dorothy M. Corson (Indexes)
School Service: Ralph Gray (Chief); Susie Hart, Edwards Park
News Service: Windsor P. Booth (Chief); Lonnelle Aikman, Matt C. McDade, Frank Sartwell
Book Service: Merle Severy (Chief); Howard E. Paine
Editorial Research: Margaret G. Bledsoe (Chief); Ann K. Holcomb, Werner Janney, Lavenia Loder
Geographic Research: George Crossette (Chief); Louise F. Althoff, Newton V. Blakeslee
Library: Esther Ann Manion (Librarian); Julia F. Banks (Asst.), Katharine P. O'Donnell

ILLUSTRATIONS STAFF

Illustrations Editor: Herbert S. Wilburn, Jr.
Asst. Illus. Editors: Charles Allmon, Robert L. Breeden, Wilbur E. Garrett, Leonard J. Grant, Andrew Poggenpohl, Kip Ross
Picture Editors: Mary S. Griswold, Gilbert M. Grosvenor, Gifford D. Hampshire, Geraldine Linder, Thomas R. Smith, Caro Stillwell (Librarian)
Engraving & Printing: Dee J. Andella, Joe M. Barlett
Artist & Naturalist: Walter A. Weber
Photographers: B. Anthony Stewart (Chief), Willard R. Culver, Bates Littlehales, Kathleen Revis, Joseph Baylor Roberts, Robert F. Sisson, Volkmar Wentzel
Photo Lab: Edwin L. Wisherd (Chief); Richard H. Stewart (Asst. Chief); John E. Fletcher, Donald McBain. *Film Editor:* Joseph M. Rideout

CARTOGRAPHIC STAFF

Chief Cartographer: James M. Darley
Assistant Chief Cartographer: Newman Bumstead
Irvin E. Alleman, John J. Brehm, Wellman Chamberlin, Richard Darley, Athos D. Graziani, Apphia Holdstock, Ralph E. McAleer, Walter K. Morrison
Typographer: C. E. Riddiford. *Cartographic Artist:* William Palmstrom

SECRETARY'S STAFF

Personnel: Herbert T. Henderson. *Membership:* Sheldon Cary. *Payroll:* Esther M. Lahrer. *Accounting:* F. Charles Brown, C. Vernon Sanders. *Statistics:* Everett C. Brown. *Cashier:* Frank S. Delk. *Cash:* Sargent C. Elliot. *Purchasing:* John P. M. Johnston. *Administration:* William T. Bell, Charles P. Althoff. *Membership Fulfillment:* Roy J. Klockenbrink. *Account Records:* Della M. Hutt

ADVERTISING

Gilbert G. La Gorce (Director); John F. Connery (Manager); *Regional Offices*—*New York:* Harley L. McDevitt; *Chicago:* Leslie R. Gage; *San Francisco:* Donald F. Mikkelsen; *Los Angeles:* Jack V. Sheehan. EUROPEAN OFFICE: W. E. Rotcher (Director) Hulton House, Fleet Street, London E. C. 4, England

A view of the French Riviera

Traveling Overseas?

Home is as near as the telephone

Bound for the Brussels Fair? Planning a business trip abroad? There's nothing like the telephone for fast, *low-cost* communication with home and office.

A telephone call is warm, personal, two-way. You can give and get information quickly, share the news, find out if everyone is well.

It's so satisfying actually to talk with folks back home. You know immediately how things are.

Telephoning overseas is easy. Just give the operator your call.

TELEPHONE EUROPE FOR $12

$12 is the daytime rate for the first three minutes from anywhere in the United States to 29 countries in Europe, including:

Austria	Great Britain	Portugal
Belgium	Greece	Spain
Denmark	Holland	Sweden
France	Ireland	Switzerland
Germany	Italy	Turkey
	Norway	

In most cases the rate is even lower at night and all day Sunday. Add the 10% federal excise tax.

BELL SYSTEM OVERSEAS TELEPHONE SERVICE

You can telephone all over the world

Viva La Fiesta del Pacifico!

THERE'S EXCITEMENT in the air in San Diego during Fiesta del Pacifico time. You feel it at the street dances or as you watch the crowds in Spanish costume.

And there's a very special kind of excitement that runs through the audience at performances of "The California Story." The score of this pageant was written by Meredith Willson, composer of the hit, "Music Man." This year's Fiesta is August 29 to September 9. But San Diego has its own special brand of magic all year. Because of the city's fortunate location, two strong cultural streams blend here.

When you come to San Diego, you visit two worlds in one. First there is the beautiful California city, with fine restaurants, parks, a world-famous Shakespeare Festival at the Old Globe Theatre and a zoo which boasts a population of more than 3700 birds, mammals and reptiles. Beaches and fishing are excellent.

Mexico is a bonus when you visit San Diego. Here you can experience all the thrills of a visit to a foreign country, yet never really be out of touch with the United States.

Plan your trip to San Diego now. Write for free literature. San Diego Convention and Tourist Bureau, Dept. G-8, 924 Second Avenue, San Diego 1, California.

SAN DIEGO

Where California and Mexico meet

"OH-OH! DOG DAYS AGAIN!"

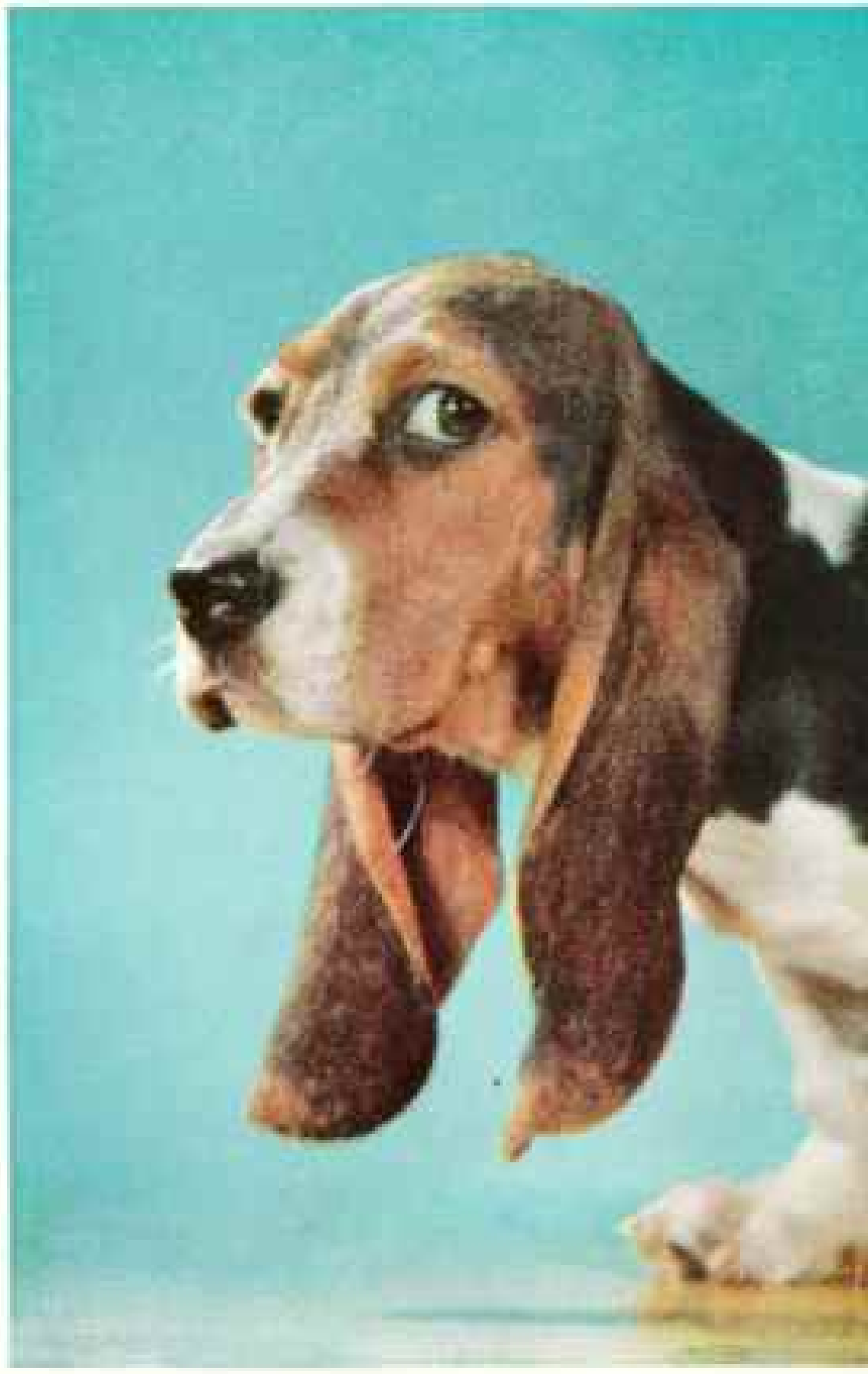
"And what is the National Geographic writing about? Dogs that *work*, that's what!"

No wonder the basset hound looks reproachful.

Actually, when hunting season comes, this long-faced fellow enjoys his "work"—following the scent of game while his ears, in Shakespeare's words, "sweep away the morning dew" (see "Dogs Work for Man," in this issue).

With 341 other choice photographs and paintings, this appealing portrait will appear in the National Geographic Society's 432-page *Book of Dogs*, to be published in October.

This big, handsome volume is the latest product of The Society's growing Book Service. Under its energetic chief Merle Severy, this division is constantly producing new books as a special service to members. So enthusiastic has been their reception that the first two in the Story of Man and Natural Science Libraries have soared into the best-seller stratosphere, *Indians of the Americas* having reached 170,000 copies and *The World in Your Garden* 100,000. These books are obtainable from The Society, and one of the advantages of membership is the opportunity to purchase them at special pre-publication prices.



RECOMMENDATION FOR . . . AND INQUIRY ABOUT *Membership*

CHECK ONE

Members of The Society roam the world through the pages of their official journal, the NATIONAL GEOGRAPHIC MAGAZINE. Annual dues of **$6.50** include subscription to the Magazine, and bring frequent 10-color map supplements. Members' enthusiastic nomination of friends for membership explains The Society's phenomenal growth.

Nonmembers interested in joining The Society—but who do not know a member—should inquire (right).

Members and others may make gifts or bequests of money, securities, or other property to The Society for "the increase and diffusion of geographic knowledge." Such gifts are deductible for tax purposes.

Please print form & mail to

THE SECRETARY
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON 6, D. C.

☐ **I NOMINATE** for Society Membership the person named below. (Use separate sheet for additional nominations.)

☐ **(GIFT MEMBERSHIP)** I nominate and enclose $_____ for dues of the person named below. Send gift card ☐

☐ **I DESIRE INFORMATION** concerning membership and the NATIONAL GEOGRAPHIC MAGAZINE. (Fill in below.)

DUES for calendar year: $6.50 rate applies in United States, U.S. Possessions, and Canada. Countries in the Postal Union of the Americas and Spain, $7. Elsewhere, $8. (Determined by postage differentials.) Life membership, $150 U.S. funds. Make remittances payable to and send direct to The National Geographic Society. 8-58

MEMBER'S NAME: _____

STREET

CITY ZONE STATE

CANDIDATE'S NAME: _____

STREET

CITY ZONE STATE

PAN AMERICAN STARTS FIRST JET

The No. 1 airline across the Atlantic welcomes you to a magic world of travel! Fares as low as $453.60 round trip to London, $489.60 to Paris . . . daily from New York.

Pan American carries more people across the Atlantic than any other two airlines combined

LONDON
6½ HOURS

PARIS 7 hrs.

No increase in minimum fares

The first Jet Clippers that you will ride in are Boeing 707s, the most thoroughly flight-tested airliners ever to enter commercial service.

SERVICE TO EUROPE THIS FALL!

Pan Am's Jet Clippers* are the first transatlantic jet airliners. They are *pure* jets, a major advance over turbo-props. Four massive jet engines give you beautifully quiet, vibration-free comfort at 600 mph. Jet Clippers will offer the finest, fastest transatlantic service including new *economy* class at no increase in fares.

Coming: Jet Clipper service to Latin America, across the Pacific and 'round the world. For fall reservations, call your Travel Agent or one of the 53 offices of Pan Am in the U.S. and Canada. For a free, colorful, fact-filled Jet brochure, write: Pan American, Dept. 707, Box 1790, New York 17, N. Y. In Canada, P. O. Box 811, Toronto.

*Trade-Mark, Reg. U.S. Pat. Off.

PAN AMERICAN

WORLD'S MOST EXPERIENCED AIRLINE

There is no more distinctive way to travel

This new Double Eagle, rich and deep in beauty, offers genuine distinction to the beautiful car it will carry. It is *the finest tire men can make or money can buy.*

Beneath the road-gripping tread is incredible strength . . . strength that provides far more safety.

This you can credit to Goodyear's exclusive 3-T process which triple-tempers the Double Eagle's Nylon Cord under precisely controlled Tension, Temperature and Time.

A revolutionary *pre-shaping* technique prepares this custom-crafted tire for increased mileage.

To this you can add the comfort that comes with soothing quietness—the security you sense from increased traction and non-skid protection—the satisfaction of better all-round high-speed performance.

Marked by the *blue circle of safety*, this superlative tire can be equipped with Goodyear's new Captive-Air Steel-Cord Safety Shield . . . an "inner spare" . . . for new freedom from worry over blowouts, punctures, or roadside tire changes.

Add distinction to your car with this remarkable new Double Eagle. You can see it at your Goodyear dealer's now. Goodyear, Akron 16, Ohio.

New 3-T Nylon Cord *Double Eagle*

GOODYEAR

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND!

ENJOY YOUR VACATION IN Ontario

Canada's Variety Vacationland

See the glorious cavalcade of fall colour Sept. 27-Oct. 5 . . . thrill to the racing at glamorous New Woodbine until Nov. 15 . . . the spectacular Canadian National Exhibition, August 20-Sept. 6. See the Royal Agricultural Winter Fair, Nov. 14-22.

Denise McDonald, Ontario Travel Hostess,
Room 327, Parliament Buildings, Toronto 2, Ontario.

NAME.....

STREET.....

CITY.....STATE.....

WELCOME . . . EVERYWHERE HE GOES

There's a reason. A fine binocular puts the active man **face to face** with the things he does for fun—travel . . . spectator sports . . . the whole outdoors.

Chances are he'd prefer a Bushnell. He knows that they deliver a brighter, crystal-clear picture . . . an exciting front row view that's reserved just for him.

Bushnell offers 33 lifetime models, $9.95 to $135, with handsome leather case included—each backed by a 20-year guarantee and trial exchange privileges.

See Bushnell Binoculars at better sport shops, camera and department stores everywhere.

Send for free gift guide "How To Select Binoculars"

Bushnell

V 68 Bushnell Bldg., Pasadena, Calif.

In Canada, write: 5766 Fraser Street, Vancouver, B.C.

Enjoy a New World of Carefree Living . . .

IN A

NEW MOON

Here . . . in this spacious, completely furnished twin bedroom home, with beautiful, tiled bathroom and fully equipped kitchen . . . you'll find all the room and easy-to-care-for comfort you want for relaxed, economical living.

Preferred by More Families, in More States, than any other Mobile Home

Write today for a free, illustrated folder.

NEW MOON HOMES, INC.

Alma A, Michigan Rapid City, S. Dakota

817

Read how effortless dictation becomes... with the automatic dictating machine

Here is how you operate the new Dictaphone TIME-MASTER: you start by snapping in its remarkable Dictabelt record. This record can *not* be erased by accident—it's the simplest, most economical dictation record on the market.

. . . now pick up mike. That turns machine on. Start talking. No wait for warm-up—thanks to transistors. And all your dictation controls are touchbuttons right under your thumb on the mike handle. Result: you save time—and that's money.

Easy so far? It gets even easier. The Dictabelt record does its recording *visibly*. You always know where you are. Mistakes are marked under exact groove here on this slip. Many more features. Call your local Dictaphone office for the full story.

ALL NEW DICTAPHONE TIME-MASTER

MORE THAN A DICTATING MACHINE—A MONEYSAVING INVESTMENT

CHOW TIME!

New dog food discovery makes dogs eager eaters. It's new Purina Dog Chow . . . everything dogs need, including real meat meal. Serve dry or moist.

Purina Dog Chow

ONE ROLL OF MOVIE FILM or KODACOLOR developed and printed FREE!

Special Offer to New Customers Only —Through One of the World's Largest Eastman-Kodak Licensed Color Laboratories. Your Choice of One of the Following Free — After Your First Order At Our Regular Low Price!

KODACOLOR DEVELOPED & PRINTED 8, 12 or 16 exp. roll (Jumbo Size)

KODACHROME PROCESSED (8mm, 16mm movie film)

35mm KODACHROME PROCESSED & MOUNTED

Simply send us your first order for developing and processing one or more rolls at our regular low price. To demonstrate our high quality, super color reproduction we'll rush back finished film to you and include a FREE PROCESSING CERTIFICATE . . . which you can use to have one roll of color film *processed without charge!* Or, you can apply your *Free Processing Certificate* as part or full payment toward any future order. We include special free mailer for your convenience, plus complete price list. Send cash, check or money order with your first roll. Satisfaction guaranteed. Send film with coupon now — or write for free mailer and helpful information. If you have no film for processing now — save this ad. Offer good for 90 days.

Fifth Ave. Color Lab Prices

KODACOLOR (Jumbo Size)	KODACHROME MOVIE FILM	35mm KODACHROME
8 exp. roll complete 2.75	8 mm. Roll ...1.25	Processed and Mounted
12 exp. roll complete 3.75	8 mm. Mag. ...1.99	20 Exp. 1.15
16 exp. roll complete 4.75	16 mm. Roll ...1.65	36 Exp. 2.00
	16 mm. Mag. ...1.25	
	16 mm. Roll (100 ft.) 3.25	

Fifth Avenue Color Lab, Inc.
550 Fifth Ave., New York 36, N. Y.

FIFTH AVENUE COLOR LAB, INC.
Dept. 4808, 550 Fifth Ave.
New York 36, N. Y

Enclosed please find..... (describe film)

and my full payment in the amount of $..... as per above price list. I must be completely delighted or I am entitled to full refund. With my order send me a FREE PROCESSING CERTIFICATE which I may use to have one roll of color film processed absolutely free, or apply as payment toward any future order.

Name.....

Address.....

City..... Zone.... State.....

☐ Send Only Free Mailer

More FUN in Leisure Hours

with a BALscope Family Telescope

Week-end and vacation trips take on added thrills as distant views are brought up close. Photography is more fun when capturing far-off subjects with your BALscope as a telephoto lens. Enjoy the fascination of amateur astronomy . . . increase your shooting accuracy at the range . . . make new discoveries when birding.

60mm BALscope with choice of 15×, 20×, 30× or 60× eyepiece, only $6.18 per month, $115.00 cash price.

FREE BOOK • WRITE for your copy of 48-page booklet, "The Telescope" (G-36). Bausch & Lomb Optical Company, 26232 Lomb Park, Rochester 2, N. Y.

BAUSCH & LOMB

Free! AIRMAIL COLLECTION

Get this spectacular collection of all-different, genuine **Airmails** from strange, far-away countries in Asia, Africa, Europe, the exotic Orient! World's largest airmail, scarce $33 stamp, old Zeppelin, many, many others. A truly remarkable collection containing stamps **worth up to 30c each** at catalog prices! **EXTRA:** Bargain Catalog **PLUS** other exciting offers. Send 10c for mailing costs. *Act Now!*

JAMESTOWN STAMP CO. Dept. F8&NG, JAMESTOWN, N. Y.

DON'T CLIMB STAIRS

RELAX . . . RIDE A

SEDGWICK "STAIR-CHAIR"

Put an end to climbing stairs. Ride safely, effortlessly from floor to floor on a Sedgwick Stair-Chair® Quickly, easily installed, electrically operated. Costs $1400 or less (installed N.Y.C.) Nationwide service

Sedgwick
MACHINE WORKS

259 West 14th Street, New York 11

Other Sedgwick Products

Residence Elevators • Dumb Waiters
Sidewalk Elevators • Freight Waiters

Established 1893

FREE! FOR THIS AD IN POSTER FORM, WRITE T.C. DEPT. BOX 3415 CB1 RINCON ANNEX SAN FRANCISCO 20.

CANADA

VIA BANK OF AMERICA

TRAVELERS CHEQUES

...money only you can spend

TRAVEL QUIZ
(FOR AUGUST)

The dormouse is a native of:

☐ *Europe* ☐ *Asia* ☐ *Africa*

Alice-in-Wonderland's drowsy dormouse is found in England, continental Europe, Asia and Africa —*all* of them! Somehow he avoided the Americas. Not so with The First National Bank of Chicago Travelers Checks—they're known and accepted everywhere!

"The Lord's Prayer Rock" is in:

☐ *Vermont* ☐ *Utah* ☐ *Texas*

Back in 1891, "The Lord's Prayer Rock" was inscribed near Bristol, Vermont to admonish profane teamsters urging their horses up the steep grade. Since horse and buggy days, The First National Bank of Chicago Travelers Checks have provided financial safety for travelers. Only you can cash them, there's full refund if lost or stolen.

An öre is a coin from:

☐ *Austria* ☐ *Morocco* ☐ *Norway*

Exchange your First National Bank of Chicago Travelers Checks for öre in Norway. Each denomination of these checks ($10, $20, $50, $100) is a different color to prevent cashing confusion. Ask for them at your bank!

The First National Bank of Chicago

Travelers Checks

For All Business and Vacation Travel

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

ASTRONOMY IS FUN!

Explore Mysteries Of Universe With Big Professional-Type DYNASCOPE

At surprisingly low cost you can own a genuine reflector telescope far superior to those used by Galileo and Sir Isaac Newton for their fascinating discoveries. Hand-crafted 4" parabolic mirror and precision eyepieces bring objects 167 times closer, provide startling views of planets, nebulae, clusters and other celestial phenomena.

Official Choice of Leading Colleges and Astronomers

This popular Dynascope is made for serious astronomical work yet is so easy to use that you will "track" planets and stars your first night. Shipped fully assembled with complete instructions for only

$49.95 F.O.B. Hartford. Shipping weight 14 lbs. Send check or money order today under our No-Risk Guarantee.

Includes ALL these quality features—no extras to buy!

- 45" Bakelite tube
- 3 Achromatic eyepieces—65X, 130X, 167X
- Rack and pinion focusing
- Cross-hair 4-power Achromatic finderscope
- Equatorial Mount with free-moving polar axis
- Sturdy portable tripod
- Triple-tested 4" parabolic mirror

Guaranteed Unconditionally! We guarantee this 4" Dynascope will out-perform other telescopes costing $75 or more. You must be fully satisfied or money cheerfully refunded.

Larger models to 10" also available. Write for complete information.

CRITERION MFG. CO., Dept. NLC-3, 331 Church St., Hartford 1, Conn.

HOME *Stair-Glide* ELEVATOR Models from $939

Satisfaction After 7 Days Use or Money Refunded 100%

Easily installed in less than 2 hours without a mark on your Home or Apartment. No special wiring—plugs in like radio. 10 cents monthly operating cost. Also useful as Dumbwaiter for transporting food trays, etc.

NO WAITING...SAME DAY SHIPMENT!

Automatic Safety Devices. Stairway left free for all normal Family use. Choice of beautiful upholstery colors. Leave carpets in place—No lubricating, no maintenance—Spotlessly clean. STAIR-GLIDE Portable Design and Safety Features covered by patents 2619195—2619196—2719607.

Write for FREE Catalog and name of Dealer nearest you

STAIR-GLIDE

AMERICAN STAIR-GLIDE CORPORATION
6026 Troost Ave., Kansas City 10, Mo.

Storm warnings...and HIGH BLOOD PRESSURE

WHEN a sailor encounters rough seas, he will, if possible, seek refuge in the nearest sheltered cove . . . and stay there until the storm has spent its fury.

Those who have high blood pressure, or as doctors say, hypertension, should also steer away from emotional "storms" or upsetting situations. In fact, doctors advise their hypertensive patients to spend as much time as possible in surroundings that help ease daily tensions and strains.

This is important because sustained tension tightens up the body's smallest blood vessels and the heart must exert a stronger force or pressure to pump blood throughout the body.

High blood pressure, according to recent estimates, affects about five million Americans . . . and is a major cause of heart trouble in middle age and later years.

Fortunately, treatment for it has steadily improved. Several new drugs, for instance, are bringing relief to many thousands of patients today.

These drugs, however, do not cure the condition. They must be used under close medical supervision, as the doctor has to study each individual case . . . and decide which drug or combination of drugs can be used safely and effectively.

Control of high blood pressure depends, to a considerable extent, upon what patients do about their health. Most patients who are careful about weight control, diet, relaxation, rest—and who see their doctors for periodic medical check-ups to guard against possible complications—can live long, comfortable and useful lives.

The best way to help avoid heart disease brought on by the strain of high blood pressure is to detect and treat hypertension when it first appears, often in the late 30's or early 40's.

So, everyone should have regular health examinations—especially those who are overweight and those who have a family history of hypertension.

Remember that everyone's blood pressure goes up and down in response to situations which we meet daily. Don't worry if yours is temporarily high, especially during times of stress. Only when blood pressure frequently goes above normal, or stays there, is there cause for concern.

The Douglas DC-8 in flight, newest bearer of the most respected name in aviation.

Look up to the DC-8 . . . world's newest jetliner!

Into the skies—from the Northern Lights to the Southern Cross—flies the Douglas DC-8. And with this flight, travel by air reaches a new high level of performance and comfort.

In the still, blue stratosphere, the miles tick away. The earth's masses of land and water, awesome as they are, yield to the murmuring power of the DC-8 jet engines. Cradled in peace and luxury, you can reach the world's farthest corners in less time than it takes the sun to go full circle.

But speed alone is not what distinguishes Douglas from all others. The DC-8—like each of its world-famous predecessors—takes to the skies a family tradition of experience, dependability and comfort. It is this—*and more*—which makes passengers and pilots look up to Douglas . . . reveals, in part, why more people and more airlines fly Douglas than all other airplanes combined.

Your own personal introduction to the jet age is not far off. You will experience it soon in the fabulous . . .

DOUGLAS DC-8 JETLINER

Built by the most respected name in aviation

These famous airlines already have purchased the DC-8: ALITALIA-Linee Aeree Italiane • DELTA AIR LINES • EASTERN AIR LINES • JAPAN AIR LINES • KLM ROYAL DUTCH AIR LINES • NATIONAL AIRLINES • OLYMPIC AIRWAYS • PANAGRA • PANAIR DO BRASIL • PAN AMERICAN WORLD AIRWAYS • SCANDINAVIAN AIRLINES SYSTEM • SWISSAIR • TRANS-CANADA AIR LINES • TRANS CARIBBEAN AIRWAYS • TRANSPORTS AERIENS INTERCONTINENTAUX • UNION AEROMARITIME DE TRANSPORT • UNITED AIR LINES

VOL. CXIV, No. 2 WASHINGTON AUGUST, 1958

THE NATIONAL GEOGRAPHIC MAGAZINE

Canada's westernmost Province builds dams, roads, and factories but saves her grizzlies, trout, salmon, and scenery

British Columbia

LIFE BEGINS AT 100

By DAVID S. BOYER, National Geographic Foreign Editorial Staff

With Photographs by the Author

"BRITISH COLUMBIA is a barren, cold mountain country that is not worth keeping.

"It would never have been inhabited at all (unless by trappers of the Hudson's Bay Company) had the gold fever not taken a party of mining adventurers there! And ever since the fever died down the place has been going from bad to worse. . . ."

That was what the *London Truth* had to say about Canada's wildest Province in 1881.

In a few decades, however, truth can change. I found British Columbia a booming Province, going from good to better.

Broad areas of B. C. are still cold and forbidding—untracked, untraveled, unexplored except by aerial survey (map, page 156). Inhospitable stretches of it are locked away in snow and ice, in thick forest, in wild mountain terrain. Yet, to a river of new British Columbians flooding into its valleys and trickling back into its mountains, it is a place of quiet away from a crowded world, a land of big stars in a big sky, of fishing and hunting, of room to live—a place of majesty.

Across their vast land (bigger by far than Texas) fewer than two million inhabitants annually welcome more than that many vacationing tourists. British Columbians, in their wilderness, follow a way of life that snares visitors by the heartstrings. Their two big cities have a charm unique on the continent.

Into Vancouver, second only to Montreal among Canadian ports, pour ships from around the world. Airplanes fly to it over the Arctic from Europe and over the Pacific from the Far East. Trains and cars roll in from eastern Canada and the United States.

It is a pity one sees Vancouver first by ship or plane or train or car. I wish, instead, that I could smuggle you blindfolded into the city and give you a particular first view of it.

Parachuting into a Valley of Gems

Here, out of the sea, rise the Coast Mountains, snow mantled and magnificent. Two ski lifts climb from the city's edge. We take the Grouse Mountain chair lift together. On the way up I tell you about the sunset through the Lions Gate—hauntingly like sunset through San Francisco's Golden Gate.

We reach the top. It is dark. Off comes your blindfold, and back we go for the grand entry into Vancouver.

From an altitude of 3,600 feet we float nearly two miles down the mountain in silent darkness. It is like parachuting into a valley of jewels. If there are more breath-taking nocturnal cities or ways to see them, I have yet to find them (next page).

Vancouver After Dark Unrolls a Jeweled Carpet Beneath Riders on a Chair Lift

Flourishing sea trade and spectacular scenery earn Vancouver, main port and largest city of the Province of British Columbia, the title "Canada's San Fran-

All Kodachromes by David S. Boyer, National Geographic Staff © N. G. S.

cisco." Visitors enjoy an incomparable vista from 3,974-foot Grouse Mountain, whose double chair lift serves summer sightseers and winter skiers. This view looks south across Burrard Inlet to a city cross-hatched by floodlit avenues. Blazing skyscraper of the British Columbia Electric Company rises at right.

The Lions Gate Bridge strings a nighttime necklace of topaz across Burrard Inlet, Vancouver's harbor. Beneath crawl the glowworm lights of a ferryboat bound for Vancouver Island and B. C.'s capital, Victoria, a city no visitor ever forgets.

To and fro move the running lights of freighters under way to Panama, passenger liners from the Orient, excursion boats to Alaska, tugboats, fishing boats, and pleasure craft of vacationing thousands back from exploring the bays and inlets of B. C.'s coastline.

Across the dark pool of the harbor twinkles the city of Vancouver—a convention of neon fireflies. Skyscrapers cast shimmering reflections along the water's edge.

Beyond, squared off by flickering street lights, burn Vancouver's major satellites—the cities of Burnaby and New Westminster on the Fraser River. Dotting the distance are the gleaming farm towns of the Fraser delta.

This summer Vancouver welcomes a fleet of visiting warships to its harbor as part of British Columbia's centennial celebration. The Commonwealth's Princess Margaret was invited to review them in the Royal Roads off Victoria on July 15.

Yet here only 100 years ago, when British Columbia became a British colony, Vancouver's site held only dense, fern-matted forest.

Every Road a Radius

Vancouver is to British Columbia what Paris is to France—the focus of a spider web. To the far corners of B. C. spread roads, railways, airlines, and steamship lines. From Vancouver's office buildings they lead to sources of wealth in distant reaches of the Province. Into Vancouver roll the products of the developing wilderness.

Photographer Dick Colby and Park Surveyor Chess Lyons of the Provincial Government offered to introduce me to B. C.'s "Interior." And British Columbians move quickly. Before I could even finish exploring Vancouver, we were off visiting farms and towns on both banks of the Fraser.

This great river, I came to know, is the central fact of British Columbia. In a dozen ways it is the lifeline of the Province.

Seventy miles from Vancouver, emerging from a mountain gorge, it spills out across its alluvial plain, building B. C.'s richest deposit of fertile soil. The Fraser delta fills supermarkets with fresh milk and eggs, vegetables and small fruits.

We drove through pastureland where dairy herds try to equal the milk consumption of the growing population. Fraser Valley chickens were busy with their annual program of laying 30 million dozen eggs.

Less than two percent of British Columbia's 366,255 square miles actually produces crops, and only four percent is considered arable. Yet so fertile is the Fraser River Valley that more than $50,000,000 worth of produce comes annually from its soil—half of B. C.'s farm wealth.

Campers Crowd New Park Sites

We first met wilderness where the village of Hope guards the entrance to the Cascade Range. Forty miles beyond we found Manning Provincial Park alive with campers, many of them en route to the Okanagan Valley.

Dick Colby told me that Chess Lyons himself had selected and reserved for the public not a few picnic and campsites. These manicured vacation spots are flung across the Province, many of them in B. C.'s 119 provincial parks.

During 1957, Chess said, his government had set aside recreational areas at a rate of one every other day.

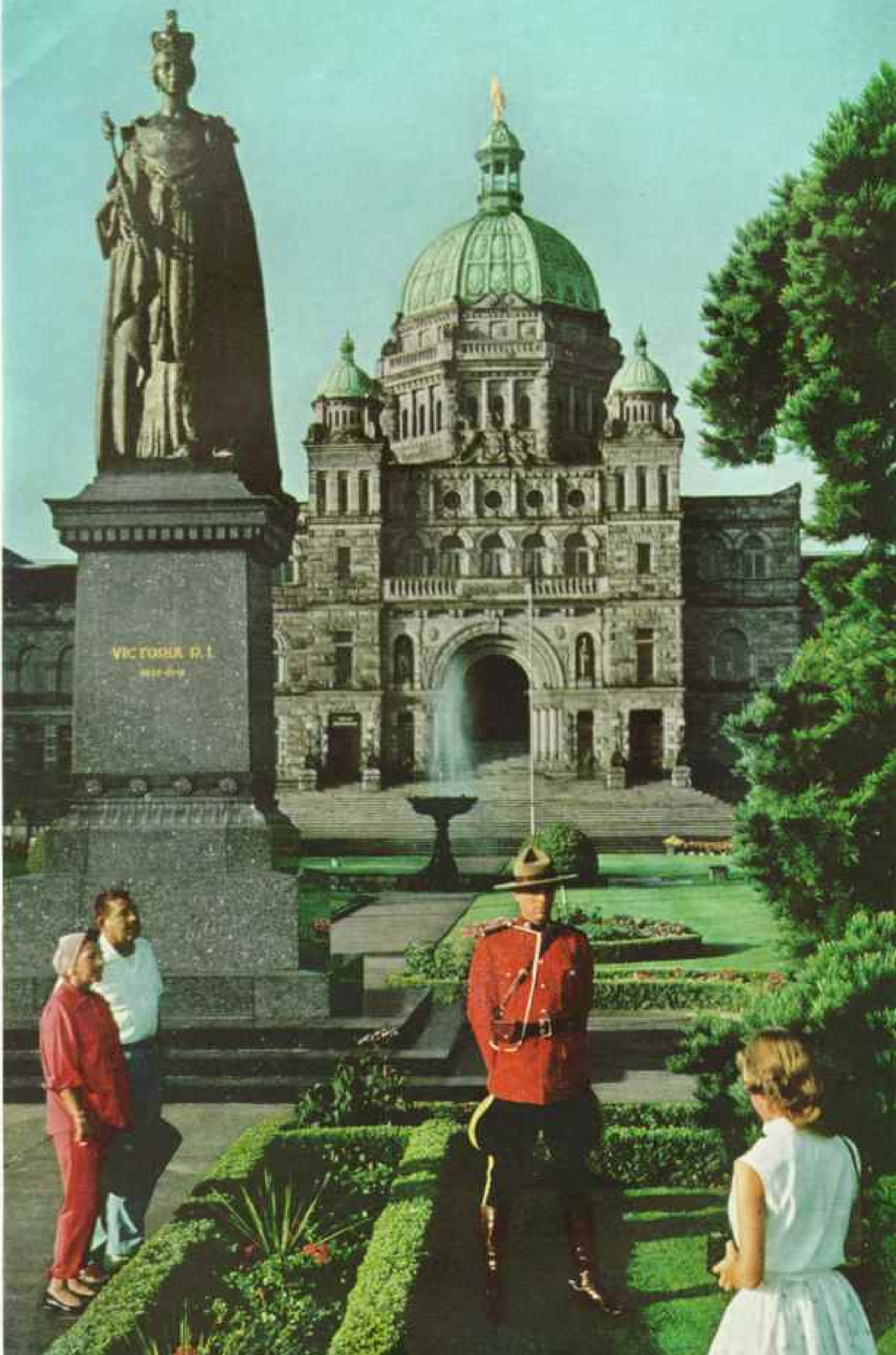
"Much of it comes from Crown lands. But sometimes we have not been quick enough, and we must buy land already fallen into private hands.

"The State of California," Chess went on, "has had to pay landowners as much as $562 a foot for sea front, just to give citizens a look at the Pacific. We want to reserve land in British Columbia for recreation before it is turned to mining, logging, industry, private homes, or sites for power dams. We're trying to think of the millions more people who will live here 100 years from now. They'll need recreation room ten times as badly as we do today."

By then we were driving into Penticton,

From Victoria's Parliament, a Bronze Queen Surveys Her Namesake City

This year British Columbia celebrates the centennial of its founding. Queen Victoria, naming the new Crown Colony, remarked that "the citizens of the United States call their country also Columbia, at least in poetry." A Hudson's Bay Company trading post, now the city of Victoria, was made the capital. In 1871 the colony became a Canadian Province.



There, as if to point up his words, camping grounds of the famed fruit-growing Okanagan Valley were inundated with tourists.

Ogopogo, the Displaced Sea Serpent

Chess knew the Okanagan as a palmist knows the lines on his own hand. He had even written a book about it, called *Milestones in Ogopogo Land*. Ogopogo is a displaced sea serpent of the Loch Ness breed. He lives in Okanagan Lake. It is not at all difficult to find people who will vouch for his presence there from personal experience.

Originally, Chess told me, the Indians called the serpent *N'ha-a-itk*. But one night in 1924, in the city of Vernon, an old London music hall hit was sung:

His mother was an earwig;
His father was a whale;
A little bit of head
And hardly any tail—
And Ogopogo was his name.

Ogopogo has been his name ever since.

The city of Kelowna, which disputes Vernon's right to Ogopogo as exclusive publicity property, has immortalized him with a statue. But Ogopogo, who shows four distinct humps above water when he rides the waves, is long enough to go around.

Boats, swimmers, and divers from all British Columbia—and some from eastern Canada and the U. S. as well—were competing for blue ribbons at the annual Kelowna Regatta (page 173). Only occasionally did the sun break through dripping clouds. Most miserable of all were the Kelownans, who complained that summer sunshine had never before failed them.

Cold and rain—even hail—had delayed and damaged the valley's peach crop. A shadow of gloom lay over the peach festival and parade in Penticton. But Dick and I found at least one sunny day and a cherry orchard under harvest (page 158).

British Columbia's cattle country unrolled as we drove northward toward a ranch so big

(*Continued on page 159*)

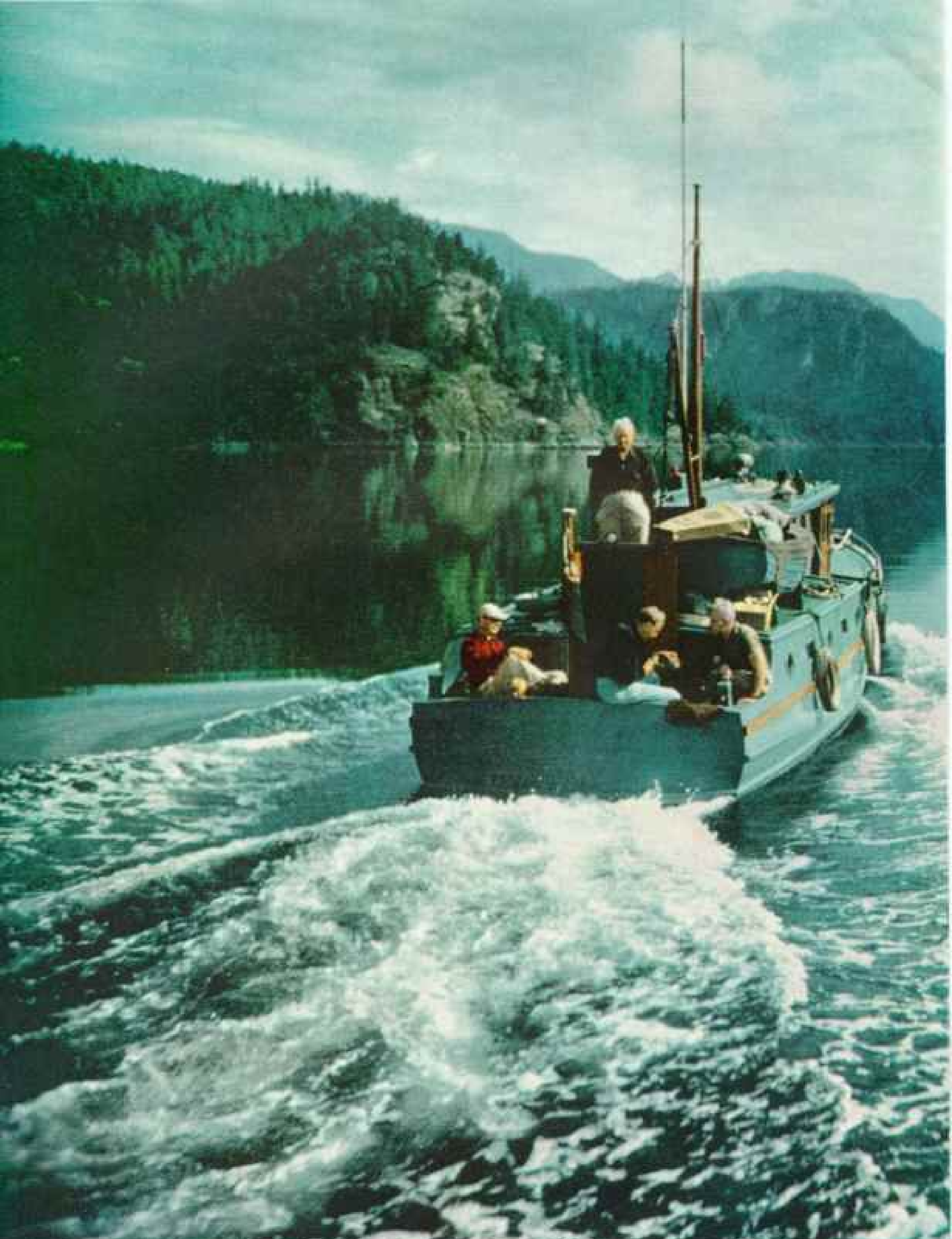
Coves and Inlets, Arms of the Pacific, Bring the World to Vancouver's Door

Shipmasters prize the deep channels and sheltered harbor of the port of Vancouver, distinct from Vancouver Island (map, page 156). Ocean liners, coastal steamers, and tugs compete for berths. Ferries to Victoria, 72 miles away by water, add to the traffic.

This view looks across the inner harbor to wooded Stanley Park and Lions Gate Bridge, which takes its name from twin peaks (upper right) resembling crouching lions.

Log rafts fill basinlike False Creek. Tower of the Marine Building (center) overlooks Coal Harbour.

Val Hennell



Cabin Cruiser Churns a Glassy Channel of the Inside Passage to Alaska

British Columbia's gnarled coast holds a labyrinth of bays, islands, and mountain-rimmed fiords. Each year thousands of United States and Canadian pleas-

© National Geographic Society

ure craft, facing tides that rise and fall as much as 25 feet, cruise the spectacular Inside Passage, a coastal waterway sheltered by offshore islands. This British Columbia fish-and-game patrol boat cracks the mirror of Waddington Channel cutting straight between the timbered slopes of the Redonda Islands.

ALASKA

Mt. Pattullo 8955

Prince of Wales Island

Stewart

Portland Canal

Alice Arm

Ketchikan

Metlakatla

Kincolith

Dixon Entrance

Inside Passage

Prince Rupert

Masset

Graham Island

Hecate Strait

Queen Charlotte Islands

Queen Charlotte

Banks Island

Skeena River

Kitimat

Pacific

Hazelton

New Hazelton

Moricetown

Smithers

Terrace

Bulkley River

Babine Lake

Topley

Burns Lake

Takla Lake

Takla Landing

Omineca River

Manson Creek

Finlay Forks

Fort St. James

Canadian National Railways

Wistaria

Vanderhoof

Ootsa Lake

Kemano

Princess Royal Island

Tweedsmuir Provincial Park

Ocean Falls

Bella Coola

Bella Bella

Namu

Monarch Mt. 11174

Rivers Inlet

9200

Silverthrone Mt.

Charlotte Lake

Mt. Waddington 13260

Chilko Lake

Queen Charlotte Sound

STATUTE MILES

©N.G.S.

Port Hardy

Port Alice

For years Ripple Rock took a heavy toll of Inside Passage shipping. In April, 1958, engineers blasted it out of the channel.

Kelsey Bay

Campbell River

Zeballos

Redonda Islands

Waddington Channel

Strathcona Provincial Park

Powell River

Courtenay

Cumberland

Port Alberni

Strait

Tofino

Nanaimo

Chemainus

Barkley Sound

Strait of Juan de Fuca

Sooke

Cape Flattery

Lapush

Capilano River

Grouse Mountain 3974

Chair Lift

Bowen Island

Horseshoe Bay

Capilano Canyon Park

Mount Seymour Provincial Park

Capilano Bridge

Queen Charlotte Channel

West Vancouver

Lions Gate Bridge

North Vancouver

First Narrows

Deep Cove

Burrard Inlet

Stanley Park

Nanaimo ferry

Coal Harbour

False Creek

Exhibition Park

B.C. Electric Co.

Burrard St.

Port Moody

Point Grey

City Hall

University of British Columbia

VANCOUVER

Canadian Pacific Railways

Burnaby

New Westminster

Fraser River

Sea Island

Vancouver International Airport

Lulu Island

Annacis Island

Trans-Canada Highway

STATUTE MILES

Alaska Highway
Fort St. John
Peace River
Gas fields
Mt. Burden
Taylor
Gas fields
Hudson Hope
Dawson Creek
Under construction
East Pine
Natural gas pipeline
Tupper
Pine Pass
ROCKY MOUNTAIN TRENCH
9400'
ROCKY MOUNTAINS
Prince George
Caribou Mountains
McBride
Edmonton 180 miles
Mt. Robson
12972
BRITISH COLUMBIA
Wells
Barkerville
Quesnel
6142 Cariboo Mt.
Jasper
Hamber Provincial Park
Jasper National Park
ALBERTA
Wells Gray Provincial Park
Quesnel Lake
Cariboo Road
Horsefly River
Mt. Bossburg
Big Bend of the Columbia
Columbia Mt.
12294
Mt. Forbes
12972
Banff National Park
Williams Lake
Alexis Creek
Lac la Hache
108 Mile House
Fraser River
Yoho National Park
Lake Louise
Mt. Eisenhower
Bonaparte Lake
Hammer Lake
Mount Revelstoke National Park
Golden
Glacier National Park
Banff
Kootenay National Park
Calgary
Pacific Great Eastern Railway
Clinton
Natural gas pipeline
Revelstoke
Columbia River
Turner Valley
Road under construction
Radium Hot Springs
Ashcroft
Bugaboo Group
Invermere
Windermere Lake
Lillooet River
Lillooet
Cariboo Road
Kamloops
Trans-Canada Highway
Armstrong
Upper Arrow Lake
Vernon
Selkirk Mountains
Purcell Mountains
Tornado Mt.
Lytton
Douglas Lake Cattle Co. Ranch
Okanagan Lake
Kaslo
Kokanee Glacier Prov. Park
Kootenay River
Blairmore
Garibaldi Provincial Park
Merritt
Kelowna
Lower Arrow Lake
Kimberley
Garibaldi Lake
Fraser Canyon
Hells Gate
Penticton
Nelson
Kootenay Lake
Fernie
Yale
Princeton
Castlegar
Cranbrook
Hope
Vancouver
Manning Provincial Park
Oliver
Rossland
Trail
Creston
Strait of Georgia
Steveston
Chilliwack
Cascade Range
IDAHO
MONTANA
Huntingdon
WASHINGTON
Okanagan River
Bellingham
Deep Cove
Victoria
Okanogan
Mt. Vernon
Juan de Fuca
Glacier Peak
10436
Port Angeles
Everett
Columbia River
Olympic National Park
Puget Sound
Seattle
Spokane
U.S.S.R.
North Pole
Alaska
To Tokyo
To Honolulu
San Francisco
Pacific Ocean
British Columbia
Mapped Area
Vancouver
CANADA
To Minneapolis
Quebec
Ottawa
Montreal
U.S.A.
To Mexico City
Texas
Mexico

Sea and Mountains Hem British Columbia

Canada's westernmost Province bestrides land and sea routes between Alaska and the United States. Map omits its thinly settled, barely explored northern region. Globe compares British Columbia and Texas.

© National Geographic Society

Pickers attack a cherry orchard in the rich Okanagan Valley, fruit basket of British Columbia. One girl uses the Girette, a long-necked, self-propelled platform with all controls beside the rider.

that almost any description of it sounds like exaggeration—the Douglas Lake Ranch.

Road blasting held us up. By curious coincidence, waiting in the truck ahead of us was Michael Ferguson, cowboy foreman of the Douglas Lake Cattle Company, Ltd.

Mike looked just the way you'd expect a cowhand on a big western ranch to look—bow-legged, seemingly about nine feet tall, maybe 20 inches around the waist, even fewer in the hips, shoulders broad as an ax handle. His unshaven Dick Tracy jaw jutted from a weather-beaten face of stone that softened sometimes into a most engaging grin.

"Pretty Big" Ranch—430,000 Acres

Mike was a slow talker. He always thought before speaking. It took me a long time to get a little information.

"How big is Douglas Lake Ranch?" I asked.

"Well . . . pretty big." Mike rubbed the gray stubble of his beard. "I've been here a long time and I haven't seen it all yet."

"How long have you worked on the ranch?"

Mike considered. "Well . . . pretty long."

I tried the original question in a new way.

"How far across would you say the ranch is?"

"Oh . . ." Mike interrupted himself to reflect. "Quite a ways."

"Well, in terms of miles . . . ?"

"Quite a few, I guess. I've ridden two, three days on horseback without getting to the other side."

Next morning we rode out ourselves to have a look. But we knew we wouldn't reach the other side. Manager Brian Chance had told us the ranch operated 430,000 acres and was the biggest in Canada.

At 4 a. m., just before sunrise, we started off with Mike. We rode toward the darkness in the west. Behind us the sun rose. Then ahead, where black night still clung, a single spot of red materialized on the horizon.

"That's strange," I said. "How do you account for that, Mike?"

"It is strange," Mike admitted.

There was a minute of silence as we watched this displaced fiery ball, some sort of reflection, perhaps, from the sunrise behind us.

"We have pretty short nights up here in the north," Mike finally said. "Maybe it's left over from the sunset!"

When the sun was fully up, we photographed cowboys rounding up Herefords for a drive to new range (next page).

"The professional cowboy is disappearing," Mike told us as we headed back toward ranch headquarters. "Ranchers can't pay them enough to compete with other jobs. They ride with us for a while, then they go off logging or road building. I can't find cowboys any more who want to break bucking horses."

"Do you break them yourself, then?" Dick asked.

"Nope. These days we train 'em with love. I'll show you."

In a corral he introduced us to Al Cowan, horsebreaker. "Just watch," he said.

Al hobbled a sorrel filly with strips of burlap and canvas. He kissed her a few times on the nose and about the eyes and slipped a bridle over her head.

Then followed one of the most tender scenes I ever expect to watch.

Half a dozen times the blanket went over her back. Then came the saddle, a dozen times or more. He cinched and recinched it. Every move was punctuated with soft words, kissing and nuzzling, brushing, patting, rubbing, talking, stroking.

Finally, Al mounted into the saddle. The colt stood like a statue (page 163).

"After two weeks of this," he said, "she'll be in love with you. She'll never try to throw you. I get a lot of satisfaction out of turning out gentle horses that keep their minds on the job of chasing cows."

Dentist Takes to the Woods

In Kamloops I broke a tooth on a bone in a beefsteak, and we halted for repairs. The dentist, as dentists always do, filled my mouth with gadgets and began asking questions.

It turned out he was a photographer, too. But only as a supplement to his main hobbies—fishing and hunting.

Dr. Boyd Seigel came from Ontario six years ago, strictly a city type. Since then he's gone fishing or hunting every weekend, every vacation. He told me he has bagged four grizzly bears and numbers of moose, elk, caribou, and deer, plus hundreds of Kamloops trout.

"When in Kamloops," I said to Chess, "do as the dentists do." So off we went in a bush plane loaded with cameras, tripods, and fishing rods.

Below us lay a land of mountain lakes, an expanse of spruce and jack pine that seemed even colder and bluer for an occasional warm yellow-green patch of aspen.

We skimmed the surface of Bonaparte Lake

Roundup: Cowboys Drive a Herd from a Lakeside Range

British Columbia, almost half again as big as Texas, devotes vast undeveloped tracts to grazing. Ranches run large, a few covering hundreds of square miles. These riders converge on Hereford cattle on the 430,000-acre Douglas Lake Ranch, largest in Canada.

and saw it streaked bright yellow with jack-pine pollen, as if a child had been mixing water colors. Our pontoons settled onto the lake and there, in a cove, was habitation—the fishing camp of Bus and Kay Ellis (page 167).

Bus was delighted to learn we fished with flies. People who trolled with "hardware" he called "meat-getters."

"Try Hammer Lake," he said. "Have the pilot drop you off there. I'll come up by jeep and bring something for supper. We won't be back here till midnight."

Four-pound Trout Feels Like Forty

Hammer Lake didn't look big enough to drop an egg into, much less land a plane. But Canadian bush pilots can pancake into spots that barely pass for puddles. We skittered onto the lake like the loons that live there.

I was riding copilot. Fifty yards ahead a trout, a yard long and shaking like a wet dog, came soaring out of the water and headed straight for heaven. When he plopped back into the lake, rings spread as if we'd thrown a camera case overboard.

This was one of British Columbia's famous fighting Kamloops trout. Dick and Chess and I almost fell in, nervously trying to get equipment ashore, rods assembled, and white-winged sedge flies tied onto our tapered leaders.

Almost before the bush plane had disappeared over the hills, a Kamloops trout took my fly, and Hammer Lake erupted into a spasm of silver explosions. The fight lasted 20 minutes, but I'll remember it 20 years! Bus later held my catch up by the gills and estimated him at four pounds. In the water I had put him at 40.

Most of them got away, of course. That is one smug reason fly fishermen don't talk much to "meat-getters." Still it was almost pitch black on the lake before any of us would give up. Even Bus Ellis, who has fished since he was big enough to hold a rod, was still bellowing, "There's another one!" and sending 60 feet of line snaking across the dark water to lay another sedge fly in a ring made by a feeding Kamloops.

Alder Smoke Adds Tang to Trout

It took an hour to bounce back three miles in the jeep over the muddy, potholed forest trail to camp and bed. There I lay awake with aching muscles and thought, if this is British Columbia, what have I been doing all these years around the rest of the world?

What surprised me was Kay's not cooking our Kamloops for breakfast. To be sure, she did serve us canned pears, ham and eggs, oatmeal, toast, hotcakes, and coffee. But where were the trout?

I found out later. I went to investigate possible trouble behind the camp. What looked at first to be a burning privy turned out to be Bus's smokehouse. There were our trout neatly split and laid on shelves of wire mesh. From a pan on the ground rose the pungent smoke of alder wood; it would take 24 hours to permeate the thick, red Kamloops meat. The aroma of alder smoke, salted trout, and warm pine resin oozing from smokehouse timbers is something manufacturers of face lotion should capture and advertise for men!

"Where did these little ones come from?" I asked Bus as he came up, indicating a dozen trout only 10 to 12 inches long.

"They're from Tingley Lake, near Hammer," he said. "We send the kids over there to fish. They can catch a limit in an hour.

"One of our problems in a lot of B. C. lakes, you know, is to get enough fishermen into them to keep the trout from overrunning the lake. There are so many fish in Tingley now that they won't grow longer than 12 inches. Not enough food. In Hammer, where there aren't so many, they run to 8 or 10 pounds."

Wild West Starts on Cariboo Road

Hammer and Bonaparte Lakes lie in the Cariboo country. We switched from jeep to sedan to ride the asphalted Cariboo Road.

When you say Cariboo Road in British Columbia, it's like saying Wild West in the United States. Here was the romance of old B. C. Here began the legends of the mining adventurers, the gold fever written about by the *London Truth*.

Here, a century ago, miners came in a daze of gold dust, and squandered it as cash in swinging-door saloons where one dance with a hurdy-gurdy girl cost ten dollars.

In the boom town of Barkerville an exultant miner named Red Jack McMartin, with $44,000 in gold in his poke, celebrated his strike in one historic fling. In its course he smashed all the glasses in a saloon, tromped with hobnailed boots on costly bottles of French champagne, flung a handful of gold nuggets into a $3,000 mirror, and wound up in the street without money enough to stake himself to flour and bacon.

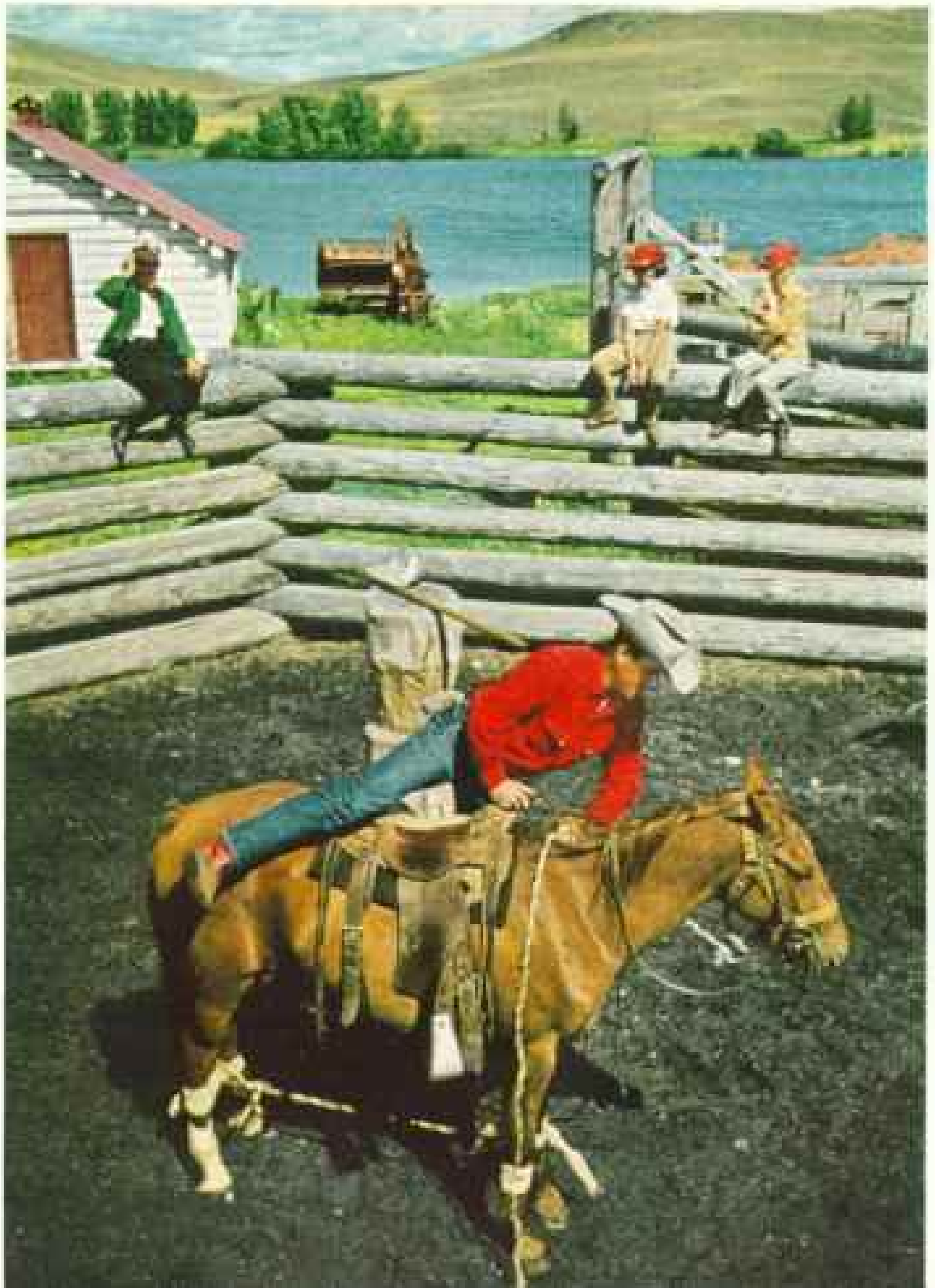
(Continued on page 171)

A Kiss for Teacher: Pupil Greets Her Trainer

Horses still dominate ranch life in British Columbia. Al Cowan, chief trainer for the Douglas Lake Cattle Company, Ltd., breaks 10 new mounts a month, substituting patience and kindness for the traditional harsh schooling.

Trainees gradually learn the feel of bit and bridle, circling for hours with saddle empty and reins pulled sharply to the side. Throughout the course, Cowan talks constantly to his charges, brushing, rubbing, and patting.

His graduates are ready for the range. "You can guide 'em with one finger the first time you ride 'em," Cowan says. Here he accepts a nuzzle from an appreciative filly.



Halfway mounting a hobbled student, Cowan brushes the filly's rump to teach her not to shy when accidentally kicked. Ax-shaped noisemaker on the post, a tin can filled with rocks, accustoms horses to strange sounds.

Kodachromes by David S. Boyer, National Geographic Staff © N.G.S.

Rider Braves Dynamite on the Hoof at Williams Lake Stampede

So boisterous is the annual three-day rodeo that neither cowboys nor law officers get much sleep. Contestants rope calves, ride bareback, race chuck wagons,

Ansochrome (opposite) and Kodachrome by David S. Boyer, National Geographic Staff © N.G.S.

Shuswap Indians share a joke in the pub of the Clinton, oldest hotel in the Province until its destruction by fire in May of this year. Ox yoke on the wall and fringed, beaded jacket call to mind the days of the 19th-century gold rush, when these old-timers hauled miners' supplies up the Cariboo Road through Clinton, 75 miles south of Williams Lake.

Stampede queens Bridgett Johnson, a Shuswap, and cowgirl Joanne Dunaway watch a rodeo event at Williams Lake. British Columbia's 33,000 Indians represent more than 100 tribes or bands and 24 tongues.

and milk wild cows. Bell and surcingle goad this rider's bawling, wild-eyed Hereford opponent.


CF-BMM

An angler's dream. 25 Kamloops, or rainbow trout, are displayed fresh and smoked before a bush plane on Bonaparte Lake.

Airborne Izaak Waltons Camp by Glacier-fed Garibaldi Lake

As a fisherman's paradise, few regions surpass British Columbia. The Province offers some 25,000 lakes. In many, fish are so numerous that they are stunted for want of food. Lack of roads preserves vast wilderness areas accessible only by hiking, horseback, or flying.

These campers pitch their tent within sight of snowy Gentian Peak (left).

Paper bouquets and corsages replace live flowers at Prince George, a Fraser River lumber town in the heart of British Columbia. Here long, cold winters make even a hothouse florist business impracticable. This store fills wedding and funeral orders for paper blooms from as far away as Yukon Territory.

Like Huge Periscopes, Gas Scrubbers Rise at Taylor

Natural gas fields in northern Alberta and British Columbia provide a vast new source of power for the Pacific Northwest.

This plant, operated by Pacific Petroleums Ltd., at Taylor, cleans, or scrubs, raw gas, removing acid gases and heavier hydrocarbons that can be upgraded into gasoline and other products.

Lead refinery of the Consolidated Mining and Smelting Company at Trail is one of the world's largest. A worker checks electrical current that passes through an acid bath between lead sheets, depositing pure lead by electrolysis.

Today Barkerville is a ghost town that few tourists ever find. In 1862 it was the biggest western city north of San Francisco. The miners came 400 miles up the Fraser River Valley on stern-wheel steamers, on foot, on horseback, on freight wagons pulled by mule teams or oxen, and later in stagecoaches.

They panned for gold along the streams. They sank shafts to bedrock and came up with gold by the handful. They rigged sluice boxes and washed thousands of tons of gravel, making themselves wealthy and turning the bottoms of the creek beds into ugly scars.

Dick Colby and I—Chess Lyons had gone off with an Indian guide to canoe into some unsurveyed lakeland—found a pub that hadn't closed its doors since gold-rush days. It was in the oldest hotel in British Columbia, at Clinton in the Cariboo. There we found two aged Indians who once drove ox teams over the old Cariboo Wagon Road (page 165).

Ghost Town Makes a Comeback

The Cariboo Road left the Fraser River Valley for Barkerville at Quesnel. Once Quesnel, too, was a ghost town; now it has 4,500 people and a wealth of modern homes mushrooming in a forest of pine and aspen. Houses no longer go unpainted on this frontier. They splash the forest with incongruous pastel colors and embossed plywoods from Quesnel's new plywood plant.

At Williams Lake we photographed the rip-roaringest rodeo in western Canada (page 164). This town of 1,800 boasts the title "Cattle Capital of B. C.," and once a year proves it with a slam-bang Stampede, put on in true frontier style by the Cariboo country's own working cowboys.

Sawmills in the Cariboo proclaimed settlements from afar. In daytime, out of the green distance, would rise a plume of blue smoke, as if a locomotive were puffing away on a siding. At night a red glow loomed on the skyline. A shower of sparks, escaping from a domed wire screen over a sawdust burner, threatened, it seemed, to burn the village to the ground while its people slept.

Most places are named for the milestones of the historic old roadhouses that stud the Cariboo Road. Once we stopped to photograph a lake scene, then pulled up at a nearby log hotel called 105 Mile House to inquire the name of the lake.

"I'll give you one guess," I said to Dick as I climbed back in the car.

"Don't tell me," he replied. "It's 105 Mile Lake!"

Trail Becomes Trans-Canada Highway

Bulldozers were laboring on the Trans-Canada Highway as we plunged into the Fraser Canyon. Soon this transcontinental road system will stretch 5,000 miles, from St. John's, Newfoundland, on the Atlantic to Vancouver and Victoria on the Pacific.

Only the men drilling the rock, exploding the dynamite, urging on the growling bulldozers, dragging down mountainsides, filling ravines, riveting steel, and pouring concrete across rivers have any real appreciation of what this means.

The Fraser River gorge is one of the Trans-Canada's most spectacular challenges.

Explorer and fur trader Simon Fraser of the early North West Company canoed down this river in 1808. Then he met the fearsome rapids tumbling into Hells Gate. They forced him ashore. Following Indian footpaths worn into the near-vertical cliffs, Fraser and his men risked their lives on precarious swinging ladders made of poles and vines.

Below Hells Gate, at Yale, began the old Cariboo Road. Gold miners could come this far in steamboats. The rapids halted them. From here to Barkerville they walked or rode such animals or wagons as they could find.

Even before gold was discovered in Barkerville, Yale was a boisterous town. For four years gold seekers had panned the gravel bars from Hope to Yale. This stretch of river, indeed, had much to do with the advent of British Columbia as a political fact in 1858.

In tents, shacks, lean-tos, and log cabins, thousands of gold miners lived and quarreled. Though it was British territory, many of them were United States citizens.

One hundred miles away, on Vancouver Island, already a colony of the British Crown, Governor James Douglas sat frowning. He

Boots Fly and Log Spins in a Birling Match: The Loser Goes for a Swim

Forestry, British Columbia's leading industry, produces expert birlers, loggers who wage a balancing duel with calked boots on a peeled log. Each year regional contenders vie for the championship at the International Log Rolling Contest. Here at Sooke, on Vancouver Island, winner Ardiel Wickheim (blue shirt) dunks Chuck Harris in the semifinals.

feared the miners might be used as an excuse to violate the hard-fought treaty that had recently set the U. S.-Canada boundary just south of the Fraser at the 49th parallel.

His urgent dispatches to London winning approval, Douglas crossed to the mainland and pronounced establishment of the colony of British Columbia and of British justice on the river of gold.

In a way, therefore, it is a grizzled old prospector, squatting with a copper pan on a sand bar of the Fraser, who is responsible for British Columbia. And that, no doubt, is why gold miner "Century Sam" was chosen as the symbol for 1958 centennial celebrations throughout the Province.

"You still see the odd character with a pan on the river," Dick Colby told me. British Columbians forever refer to the odd this and the odd that.

"Do they still find gold?" I asked.

"Oh, they pick up the odd bit of color. Maybe two or three dollars' worth in a day's work. I suppose the odd nugget turns up too."

To celebrate 100 years of mining, B. C.'s Centennial Committee this year ran a stagecoach over the Cariboo Road to Barkerville. And, in salute to Simon Fraser, who canoed down the golden river of British Columbia, 18 adventurers in three Indian canoes this spring repeated his historic river journey.

Stairway for Fish Averts Disaster

A new salmon fishway clinging to a Fraser cliff near Yale was under construction. Now it was high out of the water, but in floodtime it may save one of British Columbia's great cash crops fighting its way upriver to die.

The Fraser is one of the great salmon hatcheries of the world. Few readers of this article have not eaten sockeyes spawned in the gravel beds of Fraser River tributaries.

To reach the precise spot where they hatched from eggs four years before, some salmon swim 760 miles upstream. Before 1913 millions passed the boiling rapids of Hells Gate. Then disaster fell on the Fraser.

The Canadian Northern Railway, now part of the Canadian National, blasted a cliff into the channel at Hells Gate. Salmon in relentless hordes exhausted their lives against the rockslide and the terrible current. The number on one run alone, to the Horsefly River, plummeted from 4,000,000 to a pitiful 3,000.

I stood at Hells Gate and thought of old John Pease Babcock, British Columbia fishery administrator. In 1913 he had stood there, in tears, watching the race of Fraser salmon batter itself almost to extinction on the rocks.

Through the patient diplomacy of Babcock and others, Canada and the United States agreed by treaty to restrict the annual catch among the survivors. And at Hells Gate they built a magnificent fishway to help the salmon in their upstream struggle.

Science Probes Salmon's Private Life

A network of Canadian and international organizations today pursues a far-flung research program aimed at conserving and increasing salmon and other commercial fish.

I talked at length with Dr. A. W. H. Needler, Director of the Nanaimo Biological Station of the Fisheries Research Board of Canada. The board has 130 investigators throughout the Province trying to learn as much about salmon as doctors and psychologists know about humans.

"We still do not fully understand the great secret of how the salmon finds its way back to its birthplace after three years at sea," Dr. Needler told me. "But we are learning how to help it get there.

"We are finding ways to protect the small fry that live for a year in our lakes, and how to improve their chances of survival as they migrate to the sea.

"Also, we hope successfully to transplant eggs to rivers where salmon runs are small or nonexistent, making them fully productive."

Two problems remain for the future.

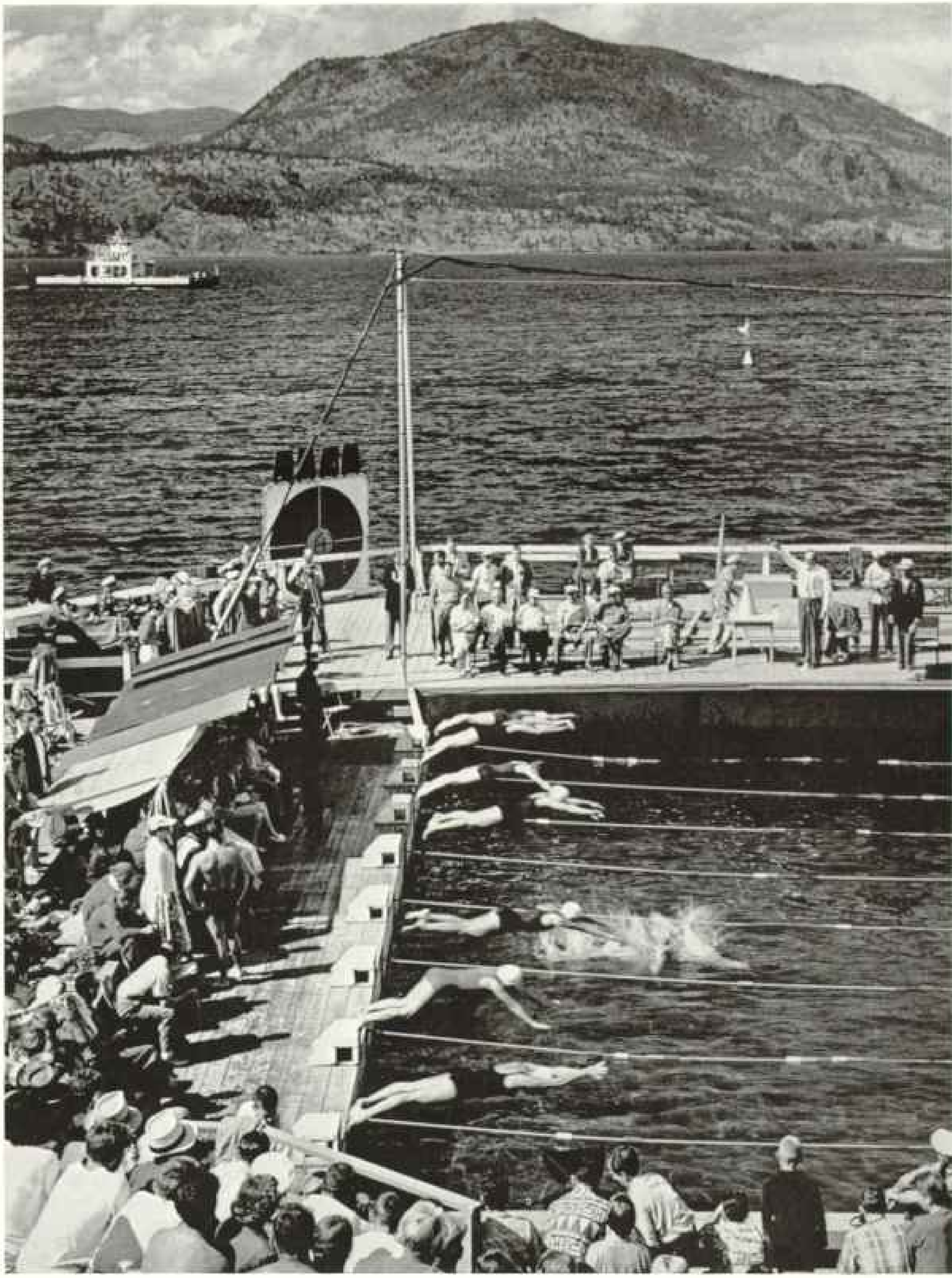
First is the pollution of rivers by sewage and industrial waste. At Vancouver the Fraser flows through B. C.'s most highly concentrated urban and industrial area. Constant vigilance and chemical analyses are required to keep these waters safe for migrating fish.

Second is the building of dams to generate electricity. As British Columbia grows, more and more of its rivers are being harnessed to light homes and turn the machines of industry.

But fish, as well as power, are so valuable that intense effort is made to keep damage to migrating salmon as small as possible.

British Columbia knows it has inherited prodigious natural resources. Yet it is still learning how incredibly rich is its vast piece of real estate. It has just begun to realize the almost inexhaustible potential if its land, water power, forests, minerals, recreational areas, fish and wildlife are properly used and conserved.

"For 10 years we have had reports on our resources from students, professors, leaders of industry and government," I was told by Dr.



At the Crack of a Gun, Swimmers in Kelowna Regatta Arch for the Pool

Each summer thousands of visitors gather beside Okanagan Lake for swimming, diving, water skiing, and sailing competitions. A car ferry bound for Kelowna passes the stands.

David B. Turner, Secretary of the British Columbia Natural Resources Conference.

"We meet annually in Victoria. We publish and distribute the views of these men who are looking to the future. If the best talents of our citizens are devoted to the policy and philosophy of developing our natural resources in keeping with the principles of conservation, British Columbia can become great."

Pipeline Carries Gas over Mountains

Back in Vancouver Dr. Turner introduced me to businessmen who are flooding the Province with a great new resource—natural gas. I was off again, this time by plane to the northeastern boundary of the B. C. map, and the gas fields of the Peace River.

The airway to Fort St. John roughly parallels the route of the Westcoast Transmission Company Ltd. pipeline. For 650 mountain-strewn miles, this thirty-inch steel tube carries 300,000,000 cubic feet of gas daily—enough to supply all B. C. and sell large surpluses to the U. S. (opposite).

Eventually the pipeline will carry enough gas to produce as much horsepower as Bonneville and Grand Coulee Dams combined. With allied wells and refineries, the pipeline taps the gas of an Oregon-sized basin in northern B. C. and neighboring Alberta.

Over the Rocky Mountain Trench we flew. Aerial surveyors for Swedish industrialist Axel Wenner-Gren are spending five million dollars to investigate resources of this lonely region of B. C. If the Wenner-Gren Foundation is sufficiently encouraged by its survey, it may spend a billion dollars to turn a wilderness of forest into a railroad-linked 400-mile chain of lumbering, mining, smelting, and power-producing towns.

District Superintendent Frank A. Ronaghan of Pacific Petroleums Ltd. transferred me from plane to car on a rainy night in Fort St. John. Frank's short-wave car radio flashed him an S O S. In minutes we were sloshing ankle deep in mud toward a sick gas well. The drill pipe was broken 928 feet down, and grimy "roughnecks" were fishing for the broken section.

Rain means nothing to Frank's drilling crews. "When it gets cold up here," he said, "they wear three suits of underwear, the dirtiest one on top."

"How cold is cold?" I wondered.

"Well, I've seen it 45 below zero the odd time or two. That's cold enough to freeze your tires flat on the bottom overnight. For a few minutes in the morning, it's like riding a freight car with broken wheels!"

Frank's gas wells funnel into a scrubbing plant operated by Pacific Petroleums at Taylor. Assistant Plant Superintendent Harold N. (Bud) Olson gave me a tour through this mammoth operation that accepts sour gas from the wells and pours sweet natural gas into the pipeline (page 168).

Refineries Turn Waste to Wealth

Bud was from sunny Texas. But his ready grin proved that neither rain nor cold discouraged him on northern B. C.

"The refinery over there," he gestured, "takes liquid hydrocarbon from the scrubbing process, turns out gasoline, kerosene, diesel fuel, propane, and butane. And this plant," he swung around, "is the Jefferson Lake Sulphur Company's operation. From another component of the raw gas they'll make 300 tons of sulphur per day."

He turned again, looking up the Peace River. "That dash of orange is the new bridge of the Pacific Great Eastern. Soon the line will be through from Vancouver, and the sulphur can go by rail."

I rode the gravel Alaska Highway back south to its beginning, among grainfields and wheat elevators at Dawson Creek. Gravel spurted from beneath the wheels of passing cars; Pacific Petroleums' new sedan, with only 6,200 miles on the speedometer, had 13 rock holes in the windshield.

"Yes, we get the odd rock through the windshield," the driver admitted. "But this one's in good shape. You can still see through it."

Canadian Pacific Airlines makes one stop returning from Fort St. John to Vancouver. At Prince George, prospering lumber town and focal point of a big-game hunters' paradise, I stopped off to see Walter Gill, veteran game inspector. For a full day I listened to stories

Snow and Cold at Pine Pass Fail to Stop a Pipeline Crew

A 650-mile line, opened last year, carries gas from the Peace River fields to Huntingdon on the United States border. Crews slashed through mountain wilds and wintry forests to lay the big pipe. These machines scour, paint, and wrap sections prior to burial.

William Belcik

Logs at a Sawmill Paint Chemainus Bay Rose, Gray, and Salmon Pink: Sawdust

Ektachrome by Photographic Survey Corporation Limited © National Geographic Society

Barges and Rafts of Cedar, Fir, Spruce, and Hemlock Line Up Like Dominoes

of moose hunting, grizzly stalking, wolf poisoning, trout hatching, cougar killing, and myriad other things a B. C. game warden considers commonplace.

Now it was back to Vancouver on one radial airline route and out on another to Trail.

Not long ago one writer described Trail as a "smoky little smelter town, huddled deep in the gnarled recesses of B. C.'s Kootenay mountains." Today it is neither so little nor so smoky, nor its mountains so gnarled and barren.

"One of our big sidelines now is growing prize roses and tulips." Safety Inspector Ronald Ramsden of the Consolidated Mining and Smelting Company of Canada Ltd. has good reason to boast of this hobby.

"Until the early 1930's, roses wouldn't grow here. Little would. Vegetation for miles was dead from sulphur dioxide pouring from our smokestacks. Today we scrub the smoke with ammonia, and extract 1,200 tons of sulphuric acid per day. We use that to make commercial fertilizer. What we release into the air is partly ammonium sulphate. It does more good than harm to plant life."

Precious Metals from "Slime"

Old-timer Mickey Brennen showed me the smelter, where the process of electrolytic lead refining was pioneered in 1902. Lead production now is 400 tons daily (page 169).

"Anode slime" from the process is treated to recover gold, silver, bismuth, and antimony.

Mickey leaned casually on a stack of silver ingots worth $800,000. "Silver is just a by-product with us," he said. "We sell much of our high-purity production to Eastman Kodak Company. The silver grains in the black-and-white film in your camera could easily have come from this very room."

Consolidated powers its refinery with its own hydroelectric plants in the Kootenay River Valley north of Trail. I drove this scenic route toward the company's main mine at Kimberley.

In Cranbrook a game department fish biologist, Frank P. Maher, told me of his running battle with mining companies to limit pollution of mountain streams.

He had pictures of the havoc that mining and smelting wastes can work when carelessly released. He had shown these photographs to civic and conservation groups, and their indignation had put an end to pollution in 21 streams in his district.

"I still have two to clean up," he said. "But, you know, the mining men themselves sometimes turn out to be the best conservationists of all. They have children, and they want their sons to have places to fish when they grow up, too."

This work of Frank's, I realized, is the groundwork for reports at Dr. Turner's Natural Resources Conference. Frank's success means better fishing and recreation in the Kootenay region. The Resources Conference means that others will hear of it and take steps to halt pollution in other areas of B. C.

Mine Extends 195 Miles

At Kimberley they put a hard hat on my head and handed me a miner's lantern. For two hours I slogged through the underground maze of the Sullivan Mine, world's largest producer of lead, zinc, and silver. Nearly a thousand men mine 11,000 tons of ore per day from this honeycombed mountainside.

I came out feeling I had seen a lot of mine. Then my guide showed me a model of the workings and traced our route. We had walked four miles, but had missed 191 miles of the labyrinth!

The beautiful Kootenays were first opened up by explorer and fur trader David Thompson of the North West Company. Thompson explored the Kootenay and Columbia Rivers before Simon Fraser started down the river that now bears his name.

Fraser thought it the Columbia, as had explorer Alexander Mackenzie before him.* These three North West Company pioneers, in fact, gave the best of their lives to locating and mapping the legendary Columbia. Only its mouth was known, and their aim was to follow the river and claim it as Canada's southern border. Only Thompson ever saw it.

Descending the Rockies, he stumbled on the river in 1807. Unfortunately, because it ran north here instead of southwest toward the Pacific, Thompson could not believe it was the Columbia. He set up a trading post in Windermere Valley and postponed following the river.

"Our only consolation is in imagining it was the beauty of our valley that kept Thompson exploring here for years—and thereby presented the lower Columbia to the United States," I was told by an ardent partisan of

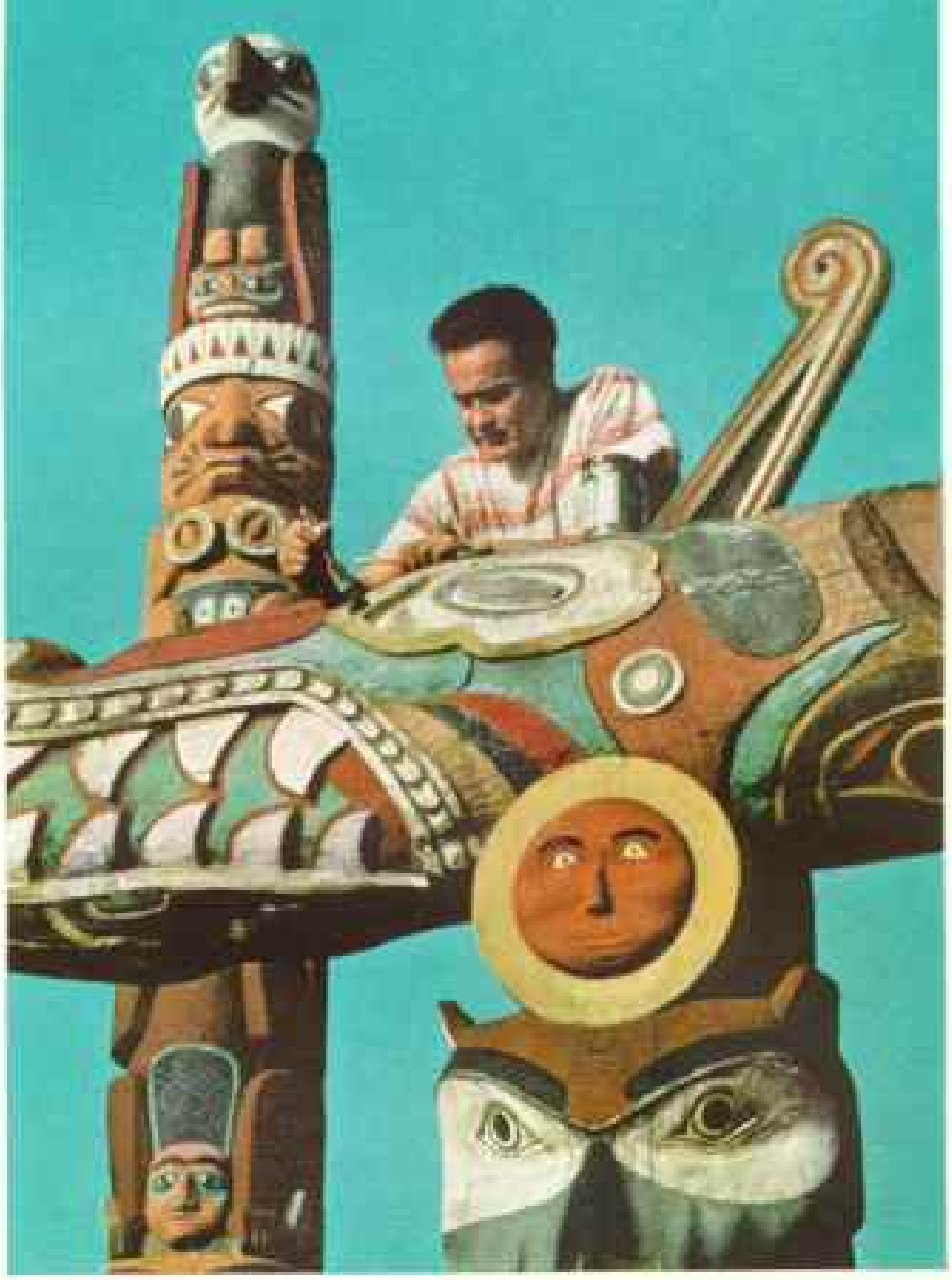
*See "Across Canada in Mackenzie's Track," by Ralph Gray, National Geographic Magazine, August, 1955.

Totem Spirits Glare and Grimace Through a Spring Coat of Paint

David Martin, a Kwakiutl Indian, restores a totem in Victoria's Thunderbird Park, the world's finest display of the grotesque carvings. Horizontal bar depicts Sisiutl, a legendary snake armed with fangs and horns. An impish moon and owl-like raven appear below.

The upright pole, a rare Haida Indian carving, caricatures an eagle (top), an Indian doctor, and a human face between a beaver's hind paws. Images, heraldic rather than religious, symbolize favored animals, clan traditions, or events in the owner's life.

Kwakiutl Indians recently completed a 100-foot pole as a British Columbia centennial gift to Queen Elizabeth.



Amateur gardener inspects a manicured flower bed at Victoria, whose homes are famed for floral art and landscaping. Warm air from North Pacific ocean currents gives the city moderate temperatures and a long growing season.

Kodachromes by David S. Boyer, National Geographic Staff © N.G.S.

both David Thompson and his valley. She was Winnifred Weir, editor of the *Lake Windermere Valley Echo*.

Thompson finally explored northward on the Columbia. I followed him around the river's lonesome Big Bend.

The Columbia and Kootenay Rivers are joined at the Columbia headwaters by a ditch, built as a canal but long abandoned. When they meet again, they have circled a wild region of mountain and glacier unequaled in beauty west of Switzerland. This landlocked island is curiously like Vancouver Island in shape and size.

Rivers of Logs Flow to Vancouver

Vancouver itself, and near-by New Westminster, play leading roles in British Columbia's lumber industry. Sawmills, pulp mills, and plywood plants embroider the cities' shorelines. In places the water is a solid phalanx of log booms, waiting to be barked, ground, chipped, or sawed (page 176).

One of the stirring sights of Vancouver is to stand amid Stanley Park's thousand acres of towering Douglas fir trees and watch tugboats straining at their cables as they toil past Lions Gate Bridge (page 152). Behind them come "hog-fuel" scows, carrying golden mounds of sawdust. Fifteen hours later these tows will reach the Powell River Company's newsprint factory, one of the largest in the world. I reached it by plane in 60 minutes.

Hog fuel was unloading as I arrived. This material gains its name from the machines—aptly called "hogs"—that grind it. Into these choppers sawmills shovel all their "garbage" of bark and wood scraps; the hogs chew it up and spew it out as fuel.

At Powell River the hog fuel heats cooking vats—digesters, my guide called them. In a deadly witches' brew of sulphurous acid and calcium bisulphite, they reduce wood chips to a porridgelike slush. Combined with untreated wood pulp ground by emery stone, the mixture flows onto an endless moving wire screen through which the water drains, leaving a thin sheet of pulp. The wet sheet passes through suction presses and around steam-heated driers that take out more water, then through a stack of heavy steel rollers that give it a final smooth finish. Cut and spindled on great rolls, the newsprint is ready for newspaper presses.

Powell River's nine newsprint machines can make more paper than all Sweden, disgorging 1,400 tons of it in an eight-hour day.

Immense forests feed these papermakers. British Columbia's greatest wealth is in timber. England could be swallowed three times in the Province's timbered area. Wood products earn 43 cents of every dollar that comes from primary and secondary industry.

When I flew to the forested Queen Charlotte Islands, I met a man who typified for me the modern B. C. logger.

Viv Williams *was* the Williams Logging Co. Ltd. He was cutting timber on contract for Crown Zellerbach of Canada Ltd. One reason for his perpetual grin was a mammoth-tired machine that pulls logs from the woods and rolls across fallen trees as a baby buggy rolls over toys in a playroom.

"It's the only LeTourneau Electric Arch in the Charlottes," Williams beamed. "It cost $50,000, and I pay $2,200 more every time I need a new tire. But I love it like a baby."

An amphibian aircraft flies to Prince Rupert, and here I toured the wood-pulp mill of Columbia Cellulose Company, Ltd. This pulp is destined to become acetate yarn and find its way across the world as carpets, draperies, or taffeta evening gowns.

Through a streaming window in the wood room, I watched a violent jet of water, at 1,200 pounds per square inch, rip the bark from giant logs. Farther along the line a set of vicious-looking knives chewed the logs into small chips.

"Oh, those poor trees!" one feminine visitor cried, staring transfixed down the muzzle of this murderous chute. "Those poor trees!"

Colossus in Fish and Aluminum

Smoked Alaskan black cod was on the Prince Rupert breakfast menu. My host, Police Magistrate E. T. Applewhaite, former member of the Canadian Parliament, winked: "Across the sound, in Alaska, they call it smoked *Canadian* black cod," he said.

More than 6,000 people, among them Indians from surrounding reservations, find work in Prince Rupert at the height of the salmon and halibut fishing seasons. An official of the International Pacific Halibut Commission, which regulates fishing seasons and areas, told me more than 15,000,000 pounds of halibut are landed annually at Prince Rupert.

It had been two years since I first saw Kitimat.* Even before I arrived this time, I knew things had changed. The aluminum

* See "Kitimat—Canada's Aluminum Titan," by David S. Boyer, National Geographic Magazine, September, 1956.

Ray Atkeson

Like a Circus High Wire, Capilano Bridge Sways 210 Feet Above Water

Few roller coasters offer more thrills than the thin ribbon of steel in Capilano Canyon Park near Vancouver. Many visitors take one look and choose the long way around. Seen from the bank of serpentine Capilano River, sightseers look like ants on a blade of grass.

Dungeness crabs provide a feast for two summer residents of Deep Cove, Vancouver Island. The crustaceans, monstrous by Atlantic standards, inhabit Pacific coast waters from Mexico to Unalaska Island.

Fish Trap Near Sooke Yields a Glittering Harvest

British Columbia fishermen account for nearly half of Canada's commercial catch. Salmon, the leading money earner, brings the Province an average of $45,000,000 a year.

Here on the west coast of Vancouver Island, men in slickers scoop salmon—spring, chum, coho, pink, and sockeye—as well as an occasional cod (lower right) from a huge net-and-piling weir. Species trapped out of season are netted back unharmed.

The camera catches a vanishing scene; British Columbia's fish traps have largely been replaced by purse seines and gill nets.

Stacked like cordwood, frozen salmon await canning in a cold storage locker at Steveston. Cleaned and headed, the fish keep indefinitely at 10° below zero.

Kodachromes by David S. Boyer and (below) J. Baylor Roberts, National Geographic Staff © N.G.S.

colossus of British Columbia was no longer a Wild West town.

Behind me on the train chattered a 16-year-old English schoolgirl, coming to join her immigrant father in Canada. Her soft accent and expressions seemed completely incongruous with the rough male atmosphere I remembered from Kitimat construction days.

So did Kitimat's tea parties, its plush new restaurant, and the swank Hudson's Bay Company department store. They would have been more in keeping with Burrard Street in Vancouver. Kitimat had acquired a strange new refinement.

But great fires were still blazing in the forest behind the model town, and bulldozers pushed piles of burned stumps out of the way for construction of new neighborhoods.

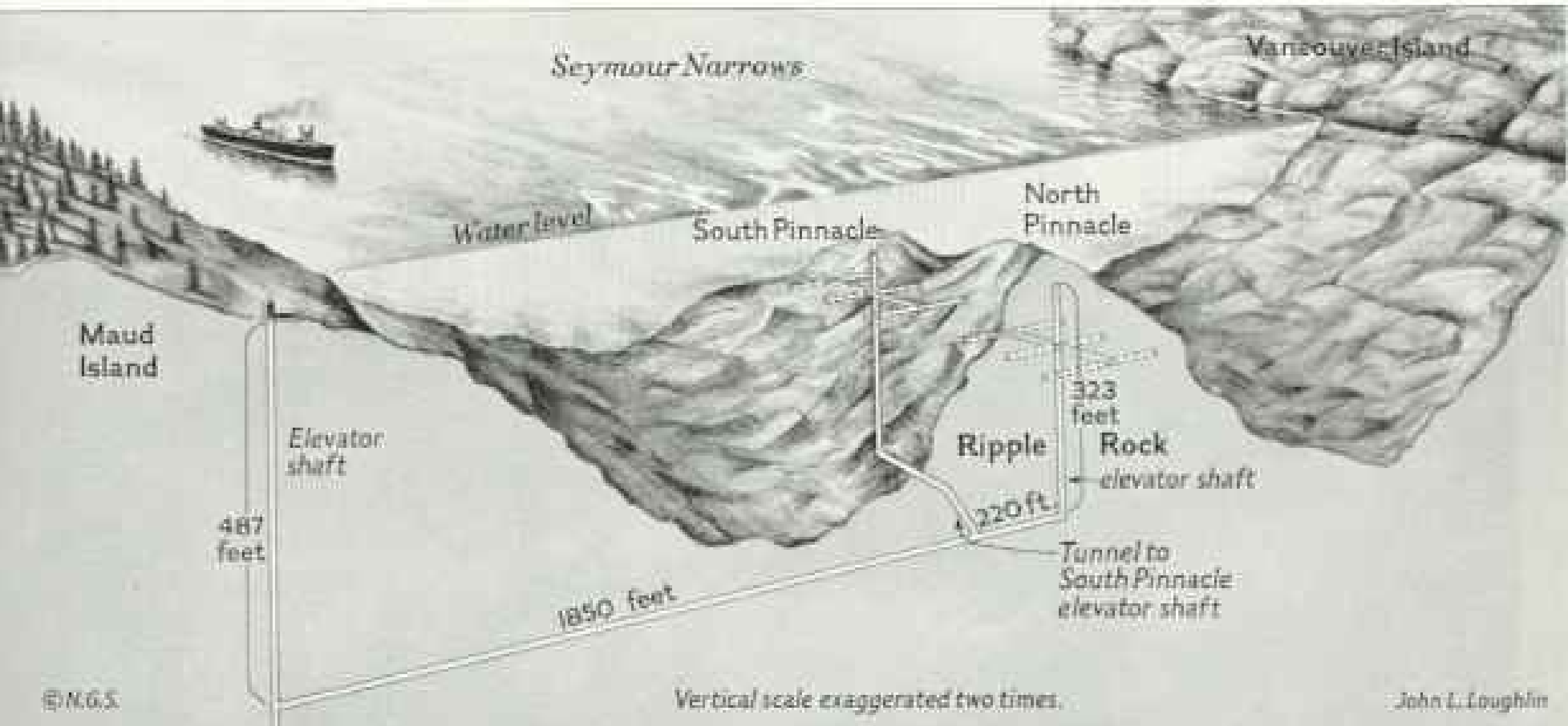
The Aluminum Company of Canada had slowed expansion of its mile-long smelter. ALCAN's plans for British Columbia, however, now included more than producing raw aluminum.

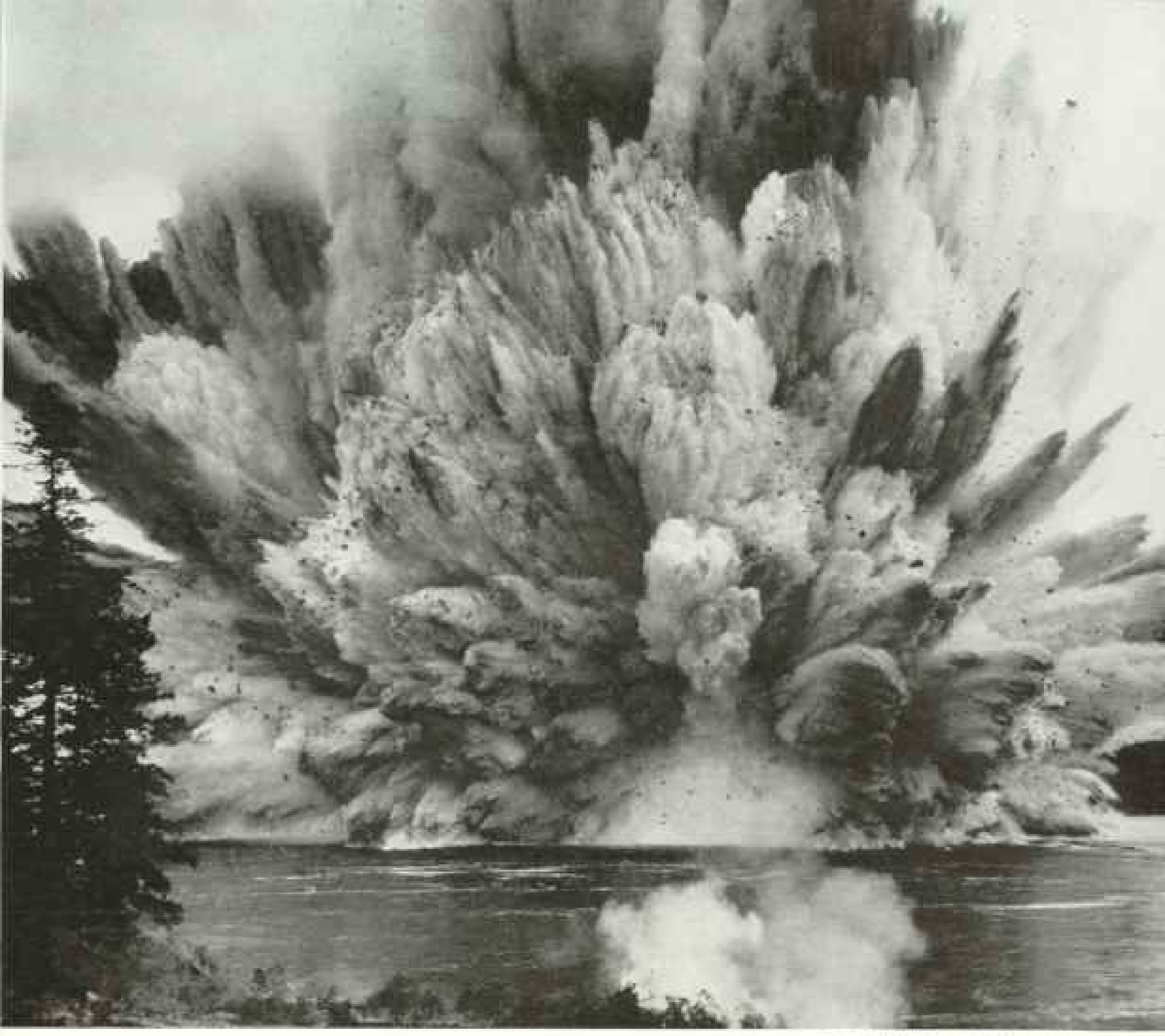
"We now have a plant on Lulu Island at Vancouver, making aluminum wire, rod, and other semifinished products directly from raw ingots," Robert Muir, an old ALCAN friend, told me.

Mammoth Blast Set Off Under Water Blots Out a Killer of Ships

The twin peaks of Ripple Rock, rising within 9 feet of the surface of Seymour Narrows (map, page 156), wrecked more than 100 vessels sailing the Inside Passage. Last April America's largest nonatomic explosion hurled 370,000 tons of rock 800 feet into the air and reduced the peaks to rubble. A second and a half apart, the two pictures were taken 2,400 feet away, looking toward Vancouver Island.

Diagram shows how miners sank shaft from Maud Island, then burrowed under the channel to plant explosives.





K. J. du Pont for Newsweek & Company

Lulu Island and near-by Annacis Island are both promising sites for secondary industry. Annacis, I could tell from the air as I landed back in Vancouver, was partially reclaimed from the Fraser River.

On the way from the airport to the ferry for Vancouver Island, I detoured through the campus of the University of British Columbia.

B. C.'s university is known throughout Canada. The school's magnificent setting on Point Grey provides room for expansion. Expanding it is, and expand it must. Of 369 buildings, fewer than one-tenth are permanent. Even rapid new construction, however, may never catch up with student population. Today there are 9,000 students; 15,000 are expected by 1965.

Half a dozen students were riding the ferry to Vancouver Island, a place for lazy weekends. I found it sprinkled with campsites, beach playgrounds, and vacation retreats.

Recreation becomes involved even in the island's basic development. Dr. Turner of the Natural Resources Conference showed me a generating station at the foot of a lake dammed by the B. C. Power Commission on the Campbell River in the island's frontier-like northland.

"It cost as much to clear timber from this new lakeline as it did to build the generating station," Dr. Turner told me. "But now the entire lake can be used for fishing, swimming, and boating."

Ripple Rock Blasts into Rubble

Near the village of Campbell River, mining engineers were tunneling under a narrow, turbulent channel of the Inside Passage. They were preparing for the biggest single nonnuclear explosion ever set off by man on this continent.

Last April the twin underwater peaks of Ripple Rock, a navigation menace that took more than 100 ships and 114 lives in the past century, were blasted into rubble by enough high explosive to fill 140 railroad boxcars.

Kodachromes by David S. Boyer, National Geographic Staff © N.G.S.

Rubber-shod horses draw rubber-tired Tallyho, one of Victoria's open-air sightseeing coaches. The wagon team pauses for water beside one of the city's many flower-decked lampposts. Turreted Empress Hotel overlooks the inner harbor.

Bagpipes skirl a welcome to excursionists. Victoria's Bruce Hutchison, describing his city, wrote: "Canadians and Americans, even the English, poured in here and, having average intelligence, refused to go home again."

Where only 9 feet of water once swirled at low tide, now more than 60 feet flows quietly.

Once I thought—and fondly hoped—that good Americans go to Paris when they die. Now I favor Vancouver Island. One thing is certain. Lots of them go there before they die. And those who do, live longer.

Retired Americans, Canadians, and Englishmen putter about in every village and suburb. Each has his own garden, his own fishing boat, his own accent, his own manner of life.

Victoria and Vancouver Island seem to know something that the rest of booming B. C. never has time to realize—that the activity and industry and labor of man are for one thing alone, man himself.

A Way of Life Worth Living

Victorians believe that life is worth taking the time to live, and people worth taking the time to talk to. For talking, they show a strong preference for sprawling on lawn chairs at a garden party, slouching in motorboats as they troll salt-water bays and inlets for salmon, perching contemplatively on logs at the beach while children drop crabs into kettles boiling over driftwood fires (page 182).

Victoria isn't so much a city as it is a way of life.

To be sure, here sits the Provincial Parliament. Here, too, are logging companies, fishing fleets, plywood plants, paint factories. These industries are necessary for life. But in Victoria it is living that counts.

What matters is not so much how many salmon were taken this year by seines or gill nets. What really matters is how many were caught in the bay by a father and son this morning before breakfast.

To Victoria, bathed by warm air from North Pacific currents, the equable climate is important. If the weather turned cold, its profitable cut-flower industry would be nipped in the bud. No planeloads of Victoria daffodils would wing their way for Easter to the frosty winter streets of Edmonton, Montreal, and Quebec.

But what is equally important is that the daffodils bloom in one's own garden. Here are trees and lawns and gardens in the heart of a city (page 179). Along the streets, swinging from the lampposts to beguile the tourists, are Victoria's famous flower baskets.

I was not surprised, one day, to hear a disembarking traveler exclaim, "Why, this is the loveliest place I've ever been!"

And she wasn't even there yet!

Unfortunately, too, she was probably only going to stay for five hours. Just before lunch each summer day a steamboat discharges a flood of visitors from Seattle, welcomed stiringly ashore by a kilted Scottish bagpiper. Then, just before dinner, the gangplank groans as they are gathered back aboard with their armloads of purchases.

They barely have had time to dash out to famed Butchart Gardens, jump into a horse-drawn Tallyho for a guided tour of the city sights (opposite), then scurry into a half-timbered English shop to snatch up some Wedgwood china, some Scottish tweed, or some genuine old-country antiques. This is to prove they've really been to Victoria.

Green Fingers and Five-o'clock Tea

Visitors are not the only ones who think Victoria is charming. A famous Canadian writer, Bruce Hutchison, described it thus:

"Avoiding exaggeration, I will say only that [Victoria] is the loveliest place in America—a tweedy, daffodilish, green-fingered sort of place, a golfish, fly-fishing, 5 o'clock teapot place, a thoroughly crazy place, more interested in aphis than America, in caterpillars than civilization, in salmon than socialism."

To be a Victorian, one needs to be a little un-Victorian. The Victorians I met were. A laughing pair of them took me salmon fishing in Oak Bay, a few minutes drive from the Parliament Buildings (page 151).

We didn't talk civilization or socialism. We talked salmon. We talked fishing and hunting. We talked British Columbia. We talked about it as a place of quiet away from a crowded world, a land with room to live.

The *London Truth* had said British Columbia was a "barren, cold mountain country that is not worth keeping."

I was glad nobody had accepted that idea as the unchangeable truth.

Cloud, Snow, and Glowering Peaks Hem Climbers in the Bugaboos

Next two pages: Members of the American Alpine Club pause in an assault on the Bugaboo Group, part of the Purcell Mountains in the far southeastern corner of the Province. Sheer-walled Bugaboo Spire rises 10,350 feet at right. British Columbia's many unclimbed peaks challenge mountaineers from countries as distant as Switzerland.

Kodachrome by Barry C. Bishop © National Geographic Society

Intelligent and eager, man's oldest friend learns new ways to catch thieves, find the lost, and master other tricky tasks

Dogs Work for Man

By EDWARD J. LINEHAN, National Geographic Magazine Staff

Paintings by Edwin Megargee and R. E. Lougheed

AN EERIE DRAMA unfolds in the night hours inside one of New York's largest department stores.

Faint lights bathe empty aisles and laden counters. The din of shopping crowds has surrendered to stillness, punctured only by distant traffic clangor.

Enter, as if from nowhere, a spectral black creature. Swiftly it pads down the central aisle, explores each corridor, weaves past shrouded showcases and clothing racks. Mannequins, frozen in lifelike pose, stare as the big dog trots by—seeking, always seeking.

The trim Doberman pinscher stops abruptly, swings its narrow nose like a settling compass needle. Ears twitch erect; muscles tense. A growl rumbles from its throat.

Behind a counter . . . *there!*

A few bounds and the dog confronts a cowering figure in dark raincoat and pulled-down cap: a thief who hid at closing time, to loot the store and walk out boldly with the morning crowds.

Dog Takes Thief into Custody

Crisp, ringing barks fetch the animal's handler at a run from a distant doorway. He orders the intruder to lean, facing a wall, hands high. He points and gives the dog a low, urgent command:

"*Watch him!*"

For long minutes Red Star, pride of Macy's 10-dog guard force, holds his post a yard from the prowler's heels, a study in canine vigilance. He seems chillingly eager for his captive to make a gesture toward escape.

"Okay, Red," the handler says finally. "Heel!" The dog trots obediently to his side and wags at his reward for a job well done, an affectionate pat on the head.

This purposeful drama, in which another handler portrays the thief, is played and replayed at Macy's as part of a constant training program to keep its dogs alert, efficient, and interested in their lifetime task.

To learn how a department store watchdog is taught his job, I visited Macy's and Francis X. Fay, its Director of Security.

Fay, a brisk, gray-haired former Air Force Intelligence officer who once headed the FBI's New York office, told me that about six years ago the store was plagued by nighttime thefts, one alone accounting for $12,000 in furs. Having seen military sentry dogs trained during World War II, he persuaded Macy's officials to try canine patrolmen.

"We couldn't be happier over the results," he said.

Sudden Stop to Burglary

In the 10 months before the dogs arrived, guards apprehended 12 intruders after store hours; nobody knows how many escaped undetected. In October, 1952, four dogs began patrolling the store's two million square feet of floor space and its hundreds of potential hiding places.

"To our knowledge," said Fay, "we haven't lost a penny in merchandise to burglars since."

We stepped out onto the wind-swept roof 20 floors above the street, possibly the loftiest dog kennel in the United States. A fierce clamor broke loose from wire-fenced runs.

"They don't see many strangers," Fay apologized. "We discourage them from 'fraternizing' with anyone but their four handlers and me. Some night it might save a dog from a prowler with a knife or poison."

Each 20-foot pen enclosed an insulated doghouse and a sleek black-and-tan Doberman. The dogs writhed with delight at seeing Fay, and fixed me with cool brown-eyed stares.

All were magnificent specimens. Five, in fact, had been sired by Ch. Rancho Dobe's Storm, twice winner of the Westminster Kennel Club's Best in Show award.*

* See "Westminster, World Series of Doglom," by John W. Cross, Jr., National Geographic Magazine, January, 1954.

Aristocrats or not, their names showed the down-to-earth touch of the advertising man: Red Star (a Macy's trademark); Mom ("Macy's Own Merchandise"); Suzy (a brand of perfume), and on through trade names of bicycles, linens, groceries, and golf balls.

Obstacle Course Sharpens Reflexes

At the last pen, handler Steve Muller was taking six-year-old Cash out to work off pent-up canine energy and sharpen discipline.

After a bit of play, he gave a few basic obedience commands: "Come," "Heel," "Sit," "Down," "Stay." Cash responded like an automaton. Next he dispatched the dog around a rectangular obstacle course. Cash bounded through and over the rooftop hoops and barriers with the precision of a steeplechase horse.

"Each of these dogs is like a loaded pistol," Fay said. "To make sure it won't go off accidentally, we rehearse and rehearse, repeat and repeat."

So absolute is the dogs' obedience that they won't eat food placed before them until granted permission. When ordered, they stop

Patrol Dogs Ignore Store Mannequins in a Search for Living Intruders

Doberman pinschers strain at the leash as they prowl the night aisles of Macy's in New York. They alert guards to anything unusual, from hidden thieves to smoke or fire.

M. Woodbridge Williams, National Geographic Staff

German Shepherds Run Obedience Tests with the Precision of an Oiled Machine

This handsome, powerful animal evolved in the late 1800's from a mixture of German sheepherding and cattle-driving varieties. As use of dogs on the pastures declined, the new breed was trained in police service; by 1910 some 450 German constabularies employed canine assistants. Enlisted

Painting by Edwin Megargee © National Geographic Society

for military duty during two world wars, the **German Shepherd** saved countless lives on both sides, scenting out wounded, carrying messages and medical supplies, alerting patrols against ambush, and protecting coastlines against saboteurs. Known today as a "dog of all trades," the German shepherd aids police of many nations. It guards families and businesses against intruders and guides thousands of blind persons. Poised and intelligent, it gives its friendship for life. Here dogs in training retrieve a dumbbell, endure the "long sit," and leap a barrier.

eating instantly. Such discipline has meant survival for the dogs themselves.

"See that wall?" Fay pointed to a low parapet bordering the roof. "Any one of the dogs could clear twice that height in one jump." To forestall such accidents, each in turn is held at the edge for a long look at the awesome canyon below, and commanded: "No!" None has forgotten the lesson.

The mere presence of keen-nosed dogs at Macy's has discouraged nocturnal shoplifters, who might chance human watchmen. Only twice have genuine prowlers been flushed since the dogs came to the store.

Last year a watchman turned a corner and bumped squarely into a prowler, who spun and fled. The guard called for the dogs, and several Dobermans trailed the intruder to an open window. They kept the burglar perched on a 12th-floor ledge until dawn, when he was easily captured.

Sentries Prowl on Silent Paws

Some nights Macy's canine detectives are staked out on three-foot leashes throughout the main store or one of five suburban branches. If they are posted within earshot of each other and one barks, others relay the alarm like a chain of sentries. Otherwise a tiny radio transmits the warning to the guard-room.

Customarily, however, a handler in rubber-soled shoes takes a dog from floor to floor, unleashes it, and orders, "Find him!" Its claws filed to avoid telltale clicking, the dog silently searches every counter, office, and stock-room cranny. After two hours a fresh Doberman takes over.

"On duty they're constantly keyed up, working every second of the time," Fay explained. "A couple of hours is enough to ask of them."

Though trained to detect only strangers, fire, or smoke, Macy's dogs instinctively warn of open windows, blowing shades, leaky radiators, running water—anything departing from the normal sights and sounds of the store.

Investigating an office one night, Cash bristled and growled. His handler found nothing. But the dog was insistent. Checking again, the guard lifted the cover of a costly accounting machine. It was silently running and very hot.

Sergeant Muller, finished with Cash, was now sparring with Red Star.

"Watch him," said Fay admiringly. "That dog runs on steel springs!"

Time after time the big Doberman rushed his handler with mock ferocity, twisting at the last instant to deal him a glancing blow on the shoulder.

"He loves to play this game," Muller grinned. "That is, until he thinks I'm winning. Then he'll sit back and eye me, as if to say: 'I can take you if I really want to!'"

Red Star proved his point later. In another mock encounter a "prowler" and the dog faced each other across a broad aisle. Red shot quick, inquiring glances toward Sergeant Muller, awaiting the climactic command.

"*Get him!*" Muller hissed suddenly.

Red Star sprang like lightning for the second handler's heavily padded forearm; without protection, bones might have broken. Grimly the 85-pound dog hung on, even though hoisted entirely off the floor and whirled in a circle. He relaxed his steel grip only to seek a tighter one.

My spine tingled at the dog's deadly determination.

"Okay, heel!" Muller called. Red released his hold and trotted submissively to his master.

"These dogs are trained to attack only if a prisoner tries to escape," Muller said, "or on the command 'G-E-T H-I-M.'"

Fortunately he spelled the words; Red Star was watching intently. I wondered what would happen if the dog could spell.

Dogs Bred to Their Work

I asked why Macy's chose the Doberman pinscher, a breed developed in the late 1800's by a German dogcatcher, Louis Dobermann.

"We tried German shepherds," Fay replied. "On summer nights in the closed-up store the heavy-coated dogs felt the heat. But Dobermans are ideal for us. They're stable, intelligent, and alert. And they show job satisfaction—they love to work."

"Who trained the first dogs for Macy's?" I asked.

"John and Bill Behan," Fay answered, jotting down a name and address. "You should pay their 'Canine College' a visit."

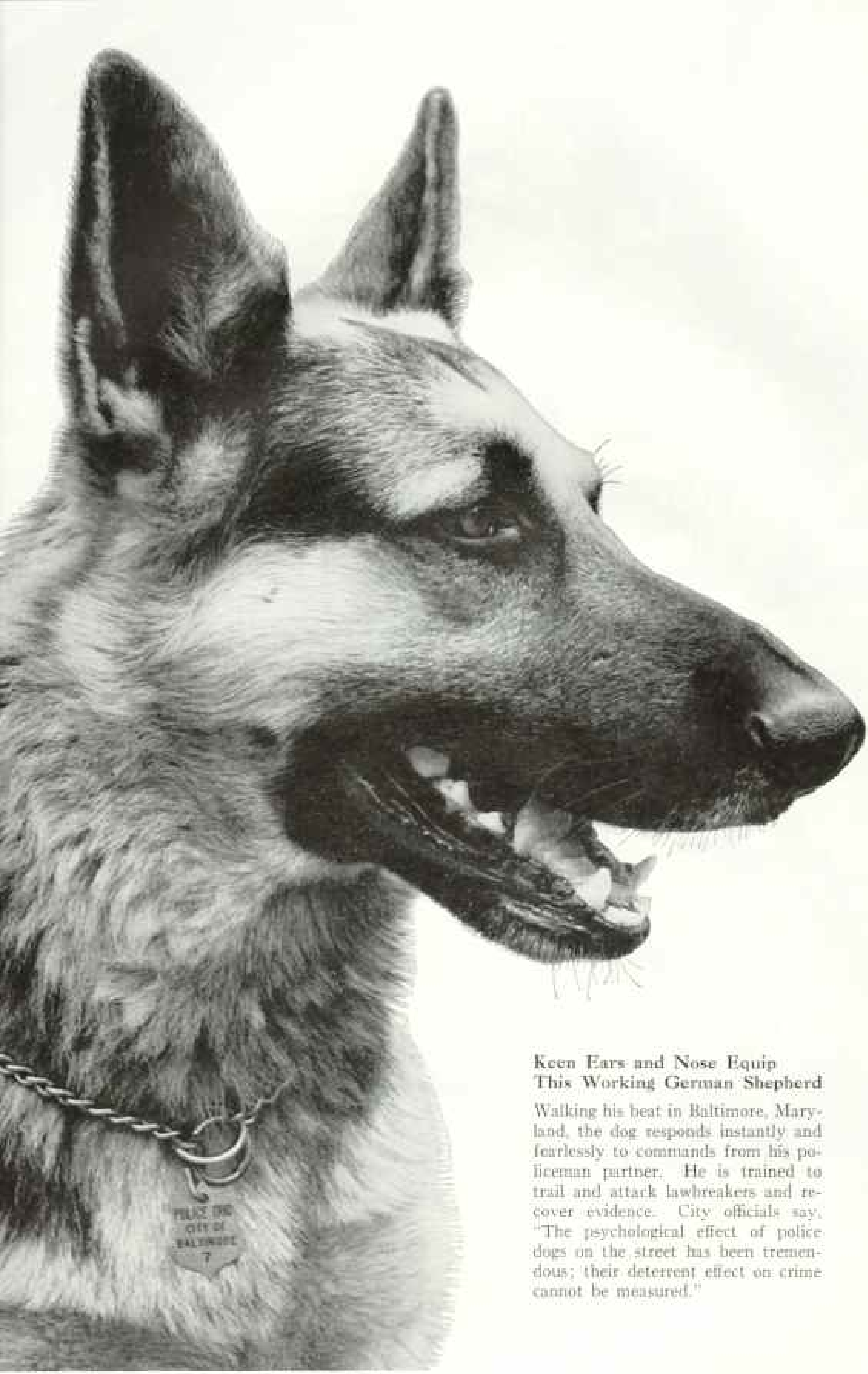
A day later I pulled up to a neat 14-acre farmstead amid rolling hills near West Redding, Connecticut.

Here a trim house, barn, kennel, and stable comprise the Behan "campus" (next page). Its four-footed graduates are worth up to

Painting by B. E. Lightfoot © National Geographic Society

A Powerful Athlete, the Doberman Pinscher Leaps to Attack a "Gunman"

Though this dog was once so fierce it took courage to own one, aggressiveness is now bred down, and **Doberman Pinschers** make affectionate family pets, gentle guides for the blind, and frequent show winners. Here at Connecticut's Canine College, near West Redding, instructor John Behan trains a guard. The dog's jaws could break an unpadded arm. Behan's severest punishment for disobedience: a dignity-wounding slap across the muzzle.



Keen Ears and Nose Equip This Working German Shepherd

Walking his beat in Baltimore, Maryland, the dog responds instantly and fearlessly to commands from his policeman partner. He is trained to trail and attack lawbreakers and recover evidence. City officials say: "The psychological effect of police dogs on the street has been tremendous; their deterrent effect on crime cannot be measured."

David Baker, Washington Star

James F. Kelly, Baltimore News-Post

Baltimore Police Dog Climbs a Ladder in Pursuit of Burglars

Late one evening last summer, three would-be robbers entered a jewelry store by a back window.

Tripping the burglar alarm, they fled. A cruising police patrol heard the alarm and searched the store. When they found nothing amiss, they called for 3-D, one of the 26 German shepherds on the city's police force. An open second-floor window next door invited investigation. Up a ladder went Officer Charles Esler with 3-D right after him. The dog nosed through the second and third floors to the roof and there flushed the three cowering burglars.

$1,000 each. They ply their trade at Boston's Jordan Marsh department store, in the schools of Great Neck, Long Island, and elsewhere throughout the Northeast.

John Behan, an ex-Coast Guard specialist who trained sentry and scout dogs during World War II, gave me a rapid-fire history lesson. Dogs have served man, he pointed out, ever since primitive hunters thousands of years ago grew dimly aware that these wild creatures possessed more virtues than might appear on the end of a roasting spit.

The dog first acted as a sort of warning device, simply by slinking away when danger threatened, Behan continued. Eventually the animal became a working partner in the ceaseless search for food.

"We still use these natural instincts and abilities," Behan said. "We merely develop them a little more finely."

The Behans base their training on three "A's"—"Affection, Approval, and Authority."

At eight or nine months of age a potential guard dog is ready for simple obedience training, lasting several months. In more advanced stages the trainers take advantage of a common canine characteristic.

"A dog is instinctively wary, even a little afraid of anything it doesn't understand. We put it in a familiar setting, then suddenly introduce an intruder or something else unexpected. The dog reacts by barking—and we reward it with praise."

Teacher with a Light Touch

I watched Bill Behan work a handsome young German shepherd in an early stage of its vocational training.

"To teach a dog anything, you first have to let him make a mistake," said Bill. "I'll show you."

He ordered the frisky dog to heel and led him on a slack leash up and down the cork-floored stable.

Carelessly the dog chose the wrong side of a post. Bill jerked lightly on the leash,

Children Play Under the Watchful Eye of a Faithful Collie Guardian

Bred in the Scottish Highlands, these dogs were often called "coalie" or "coaly," perhaps for black-faced sheep they herded or for their own black color. They developed endurance and dexterity shepherding skittish charges along craggy Highland paths; an abundant double coat pro-

Painting by Edwin Megargee © National Geographic Society

tected them against cutting winds. Collies rose to fame after Queen Victoria expressed admiration for them. Thereafter, efforts to beautify the breed resulted in a long-muzzled, beruffed dog in a variety of colors, including the tawny shades common in America. Today the highly intelligent **Rough-coated Collie** serves chiefly as an affectionate companion, such as Lassie of TV fame. England's Northumberland County produced the **Smooth-coated Collie** (right, background) as a cattle drover. The smaller Border collie, or working sheep dog, is now considered a separate breed.

thumping the dog's head against the post. Unhurt but surprised, the shepherd backed up and came around to his master's side.

"He's made a mistake. He's been corrected. And he's learned something. Now watch."

He led the dog past several more posts, leaving scant room. Each time the animal squeezed past the obstacle on the proper side, and got an approving word.

Trainer Counts on Dog's Dignity

The worst punishment the Behans inflict on a student is a light slap across the muzzle.

"It doesn't hurt him," said John, "but it touches his dignity. A dog takes pride in what he can do without being corrected."

I remarked that Bill seemed fair but not lavish with praise when the dog did his job.

"He needs praise, of course. It's the only reward he gets. But we feel if he gets too much, he's buying it cheaply."

"How do you choose a pup for a career in guard work?" I asked.

"We take him out, walk him around a bit, watch how he reacts to things. Does he flinch when a car passes? Does he make friends easily? Maybe too easily? Is he curious and alert to the world around him?

"We narrow it down to the pup with drive and spirit, yet with a nice disposition."

Some time ago a multimillionaire asked Behan for three of the biggest, most savage dogs obtainable to patrol his estate at night against possible kidnapers.

"Try just one, first," Behan counseled. "And take a well-trained dog, not a vicious one."

His advice was justified some months later. A watchman on the estate left a kennel gate open: the powerful 100-pound shepherd roamed loose somewhere on the grounds. An apprehensive search found the dog gently playing on the lawn with the children.

A bully doesn't make the best policeman, John Behan believes, and neither does the "mean" dog.

Much of Canine College's curriculum deals with the so-called "problem" dogs—barkers, biters, excessively shy dogs, chicken killers, and the like.

Spoiled Pet Learns Manners

Often the trainers find problem owners are to blame. One woman brought her horribly pampered pet for a course in good manners and urged that he be treated gently, confiding, "He's the reincarnation of Buddha."

A pair of collies arrived at Canine College in separate automobiles, so deadly was their enmity. "It was easy to see that they fought simply to get attention," Behan said. "For a few weeks we corrected them whenever they snapped at each other, and they went home the best of friends, in the same car."

Another student, a boxer, was so shy he

A Ring of Border Collies Closes In

These dogs, bred from Scottish stock, demonstrate herding techniques at the Ohio Agricultural Experiment Station near Wooster. Obeying their master's signal, five crouch at guard as a sixth inches forward. Much of the collie's value lies in its ability to bunch the flock.

"Move!" Barks This Bossy Sheepherder

The Border collie leaps aboard to break up a woolly traffic jam. Specially trained for work in close quarters, this dog uses a bridge of backs instead of running around the flock. Experienced sheep respect a dog but have no fear of him; they rarely need to be nipped.

National Geographic Photographer J. Baylor Roberts

crashed into doors while running away from people. The Behans patiently taught him that humans needn't be feared. Later the owner wrote an enthusiastic letter of thanks—the dog had actually growled at a stranger.

But John Behan is proudest of the "Case of the Opera Fan and Her Crippled Pet."

Several years ago a New York woman brought them her small mongrel, he said. An encounter with an automobile had left it unable to walk. She was loath to leave the helpless animal alone, yet she was a dedicated operagoer and sorely missed Verdi and Wagner. What could she do?

Behan mulled the matter over and set to work. In a few weeks he had the bright little creature trained to lie perfectly still, no matter its position.

The dog's delighted owner seldom missed an opera thereafter—with her pet contentedly draped around her neck as a living fur scarf!

Dogs Join Baltimore Police Force

Behan, with his experience in the military use of dogs for scout, sentry, and messenger work, believes any police department would find them ideal additions to the force.

In Baltimore, Maryland, officers nightly patrol the dim streets and dark alleyways of that city's trouble spots, each with an alert, leashed German shepherd (page 196).

"When I hunt a prowler in a dark building," one of these patrolmen told me, "I'd rather have Kejn, here, than my gun." The powerful police dog at his feet thumped the floor with his tail.

During my visit I met Maj. L. Wilson Davis, former commander of Marine Corps war dog units in the Pacific. He told me of the outstanding crime-deterrent record of Baltimore's K-9 Corps (pages 196-7).

"Some nights we'd need extra officers to control crime on one particularly bad post," Major Davis told me. "Now one man and his dog do the job more effectively."

The K-9 Corps, with 26 dogs, accounted for more than 400 arrests in its first year of operation. Dog-supported officers captured eight burglars in one weekend.

Shepherd Nabs His Man

In a typical case, a patrolman and his dog saw two men beating and robbing a third on the sidewalk. The officer sent his dog after one of the fleeing suspects and then pursued the other himself, but lost him. Returning 15 minutes later, he found that the dog had got his man and was holding him at bay in a doorway.

Then the shepherd efficiently wrapped up the case by sniffing out and recovering the victim's wallet, thrown away by the robber during the chase.

Every dog in the K-9 Corps is a donated pedigreed male. Each handler is a volunteer, training his own four-legged partner.

"An officer must want to work with a dog, or the animal will reflect his attitude," said Major Davis.

In a course averaging 12 weeks, the police dog learns basic obedience and how to guard a prisoner. He learns to pursue a fleeing suspect, and to attack fearlessly on command, even in the face of gunfire. Advanced training teaches him to follow a criminal's trail, and even to scent out evidence.

Off duty, the dogs live in their masters' homes, not only to save costly kenneling, but to foster a strong bond between man and dog.

I made a night prowl-car patrol with Sgt. Irvin Marders and his dog Victor. As calls squawked from the radio, Victor paced the

Boxer Pups Frolic in the Face of Grown-up Dignity and Self-assurance

This German breed, a descendant of the Molossian dog of ancient Greece, was developed for attacking bear and wild boar after hounds brought the beasts to bay. Courage and stamina made the black-masked **Boxer** a favorite in old-time bullbaiting and dogfighting arenas. Today it ranks among the Nation's four most popular breeds. One boxer champion with 121 Best in Show awards was acclaimed the "winningest" contestant in American dog-show record books.

Through Raging Surf, a Newfoundland Tows the Lifeline of a Sinking Ship

"...Beauty without vanity, strength without insolence, courage without ferocity, and all the virtues of man without his vices," wrote Lord Byron of his beloved **Newfoundland.**

A powerful swimmer, the Newfoundland rose to fame with lifesaving exploits, as in this painting of a 1919 disaster. Through seas too rough for lifeboats, the dog brought a rope to rescuers, who rigged a breeches buoy and saved 92 passengers. Black-and-white Landseer variety bears the name of the 19th-century artist whose paintings helped popularize the breed.

Paintings (left and next two pages) by R. R. Knudsen © National Geographic Society

National Geographic Photographer J. Baylor Roberts

Seeing Eye dog leads his blind master through city hazards. In this final test for trainees at the Seeing Eye, Inc., man and German shepherd walk as a confident team amid the traffic and obstacles of the streets of Morristown, New Jersey.

car's seatless rear, alert to every movement in every alley. His muzzle probed the back of my neck with disquieting interest. Finally he swiped at my ear with his huge tongue.

"You've been accepted," Marders grinned.

Shortly I saw Victor in a different mood, responding to an alarm in an east Baltimore garment factory. But there was no burglar this time—the alarm had been tripped by a window left ajar. So Victor didn't get a chance to repeat his achievement of a few nights before, when he had found and captured two thieves in a furniture store.

Nevertheless, as the big dog ranged eagerly but silently ahead of us through darkened rows of sewing machines, I felt secure, recalling with fuller appreciation what the sergeant had told me:

"These dogs do a real job for us. Yet all they want is meals, good care, and affection. It's the cheapest protection in the world."

In Morristown, New Jersey, I saw canine service of another sort, on its most inspiring plane.

I sat in a car watching two blind students and their Seeing Eye dogs traverse a tree-shaded suburban street. At each curbstone the dogs stopped and awaited the command, "Forward."

As one dog stepped into the street, I inquired how it would cope with a careless driver.

My companion, a Seeing Eye official, replied by shifting into gear and careening around the corner, squarely into the pair's path!

We squealed to a halt; my fleeting vision of a ghastly accident never materialized. Instead, the dog calmly checked its sightless master within arm's length of the car and led him around it.

At the Seeing Eye, Inc., near Morristown, nearly 2,500 blind persons since 1929 have learned to rely on patient, gentle dogs to guide them through the hazardous corridors of a life in darkness.

The dogs learn first. Many are raised from puppyhood by youthful 4-H Club members throughout the State, to familiarize them with other animals, people, and automobiles. At 14 months of age they return to the Seeing Eye to train for a life's work that will last, on the average, more than eight years.

Puppies Turn to Serious Task

I watched Seeing Eye trainers (who serve a four-year apprenticeship themselves) gain the confidence of student dogs by playing and walking with them, drilling them in fundamental obedience.

In harness, each dog learns to move left, right, and forward on command; to stop automatically at each curb; and to lead its master at a brisk 3½-mile-an-hour gait.

It learns to avoid pedestrians and to bypass obstructions on busy city streets—even to gauge accurately the height of the man it leads. The trainer deliberately collides with obstacles to teach his pupil that dog-sized clearance is not enough.

Throughout its three-month education a Seeing Eye dog meets the distractions of loud

(Continued on page 215)

Painting by Edwin Megargee © National Geographic Society

A Toad Bemuses Whiskered Schnauzers; a Rat They Would Tear to Pieces

Schnauzers count among their ancestors the pinscher, poodle, and spitz, and possibly strains of Airedale, Irish and Kerry blue terriers, and hound. Robust, sinewy, and much like terriers in appearance, the schnauzer was known in medieval times as a sheep dog. Today the breed exhibits vermin-killing skill at ratting trials in Germany. Here the **Giant** (foreground) and **Standard** varieties meet; the popular Miniature is not classified as a working breed.

Apollos of Dogdom, Great Danes Guard the Gates of an Estate

Ancient Egyptians, Greeks, and Romans kept statuesque animals of Danelike characteristics, whose bloodlines are now unknown. The modern **Great Dane,** emerging from a mixture of mastiff and wolfhound, was originally developed to run down and fight the murderously tusked wild boar.

Painting by Edwin Megargee © National Geographic Society

Such feats required supreme courage, strength of jaw, stamina, and agility. German nobles used the largest of their Danes as personal bodyguards. The harlequin (left) served as a favored English coach dog. "No equipage can have arrived at its acme of grandeur," reported an 18th-century observer, "until a couple of harlequin Danes precede the pomp." Working as watchdogs, Danes intimidate intruders by size alone. They are naturally mild in disposition; breeding has eliminated the bad temper that once characterized them. Coats can be fawn (right), blue, black, or brindle.

Two Dogs Long, Half a Dog High, Dachshunds Invade a Badger Hole

Though comic in appearance, the **Dachshund** has long served Europeans as a serious hunter of badgers, rabbits, and foxes. Its German name tells its use: *Dachs*, badger; *Hund*, dog. Combining qualities of hound and terrier, dachshunds work

with courage and tenacity. Short, strong forelegs dig swiftly; a sausage body permits underground burrowing; supple skin allows free action in cramped quarters; and powerful jaws grip game tightly. The dog's build precludes speed, however; its walk is often a waddle. While dachshunds participate in field trials, most American owners value them as pets. Here gather varieties in three coats: **Wire-haired** (left, foreground), **Long-haired** (upper, right), and **Smooth.**

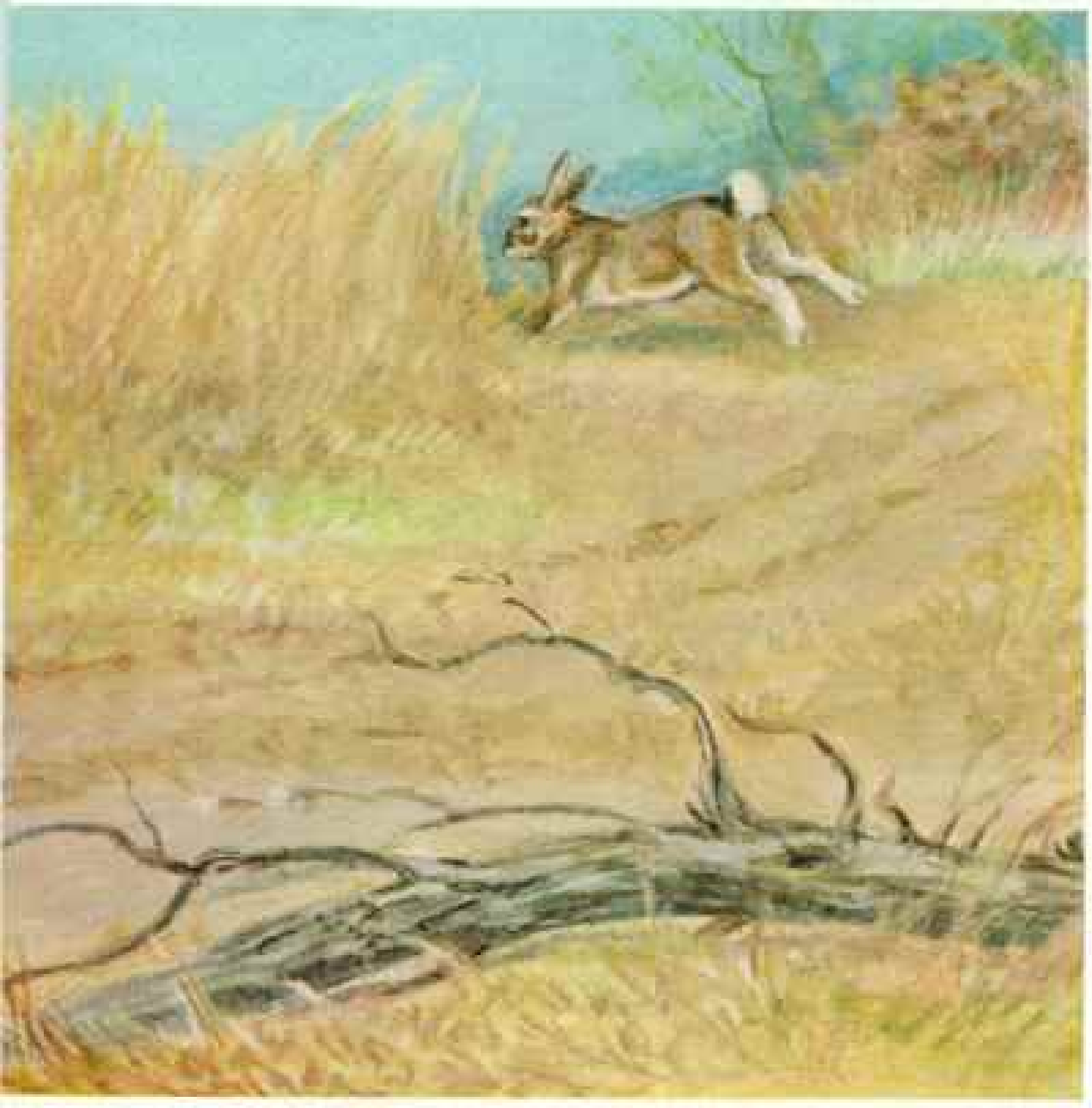
Painting by Edwin Megargee © National Geographic Society

A Basset Takes the Scent, Then Gives Tongue

"... Their heads are hung with ears that sweep away the morning dew; crook-knee'd, and dew-lapp'd like Thessalian bulls; slow in pursuit, but match'd in mouth like bells. ..." Thus, in *A Midsummer Night's Dream*, Shakespeare creates a picture that perfectly fits the **Basset Hound.**

As mournful looking as the beagle is merry, the basset hunts at a slower, more sedate pace than its livelier distant relative. Except for the pure bloodhound, the basset yields to no breed in ability to follow the scent. One specialty is trailing and flushing pheasant.

A breed of ancient lineage probably originating in France, the basset has only recently become well known in the United States. Its new-found popularity may be due in part to the fame achieved by Cleo, the dour-faced TV star who borrows a human voice for her acid comments about people.



Beagles in Full Song Press After a Cottontail

Expert in hunting by scent, the pint-sized **Beagle** may be the oldest breed native to Britain. Queen Elizabeth I took pride in her "singing" beagles; in her day nearly every country gentleman kept a pack for tracking hares.

Today this hound is the most popular purebred dog in the United States, adapting equally well to field, home, and show bench.

Each year the 70-year-old National Beagle Club holds field trials where hounds are rated for eagerness, drive, keenness of scent, and obedience to signals and commands.

Running in pack, with ears flopping, tails swinging, and melodious voices raised in chorus, beagles appear the happiest of breeds.

Paintings by Edwin Megargee © National Geographic Society

noises, the challenge of a cat chase, the nuisance (and allure) of doggy strangers—and learns to ignore them all.

Not until it has safely led a blindfolded trainer through the busy streets of Morristown is the animal judged ready for training with its blind new master (page 206).

"The transition from trainer to new master is the most difficult part for the dog," Seeing Eye's chief trainer, G. William Debetaz, told me. "Some dogs actually lose weight during this period."

I asked what kind of dog makes the best Seeing Eye guide.

"Big enough to pull a man out of danger; small enough to fit under a train or bus seat; healthy enough to work in all weather," he replied. "It mustn't be a fighter, and must have a strong sense of responsibility."

Many Dogs Guide the Blind

Debetaz and his staff have successfully trained dogs of 28 breeds, including boxers, Labrador and golden retrievers, Norwegian elkhounds, and Weimaraners. But the amazingly versatile German shepherd (page 192), with its long heritage of guardianship, accounts for sixty out of every hundred Seeing Eye guides.

"Sometimes," Debetaz reflected, "I think it is the man who belongs to the dog. In a good relationship there's no limit to what the dog will do to safeguard its master.

"We encourage the dog to use its head. It'll often have to make decisions—what we call 'intelligent disobedience.' That means it will refuse to lead its master into danger."

A dramatic example occurred several years ago while a German shepherd led its sightless mistress through a Connecticut city. Unknown to the woman, an excited crowd had gathered near a theater entrance where two bandits and police had fought a pitched battle.

The dog balked at leading its mistress through the milling throng where she might be jostled and injured. Despite her commands of "Forward," it detoured four blocks, skirting a cloud of stinging tear gas, to bring her safely back on her route.

"My Dog Made Me Over"

Those who come to the Seeing Eye for a dog must learn, too. Often a person without sight arrives with stooped and tentative shuffle. But in the month that follows, he or she comes to "see" through a dog.

A blind man learns to read the sensitive signals of his dog's harness. He learns to praise his dog as it leads him safely from curb to curb. He learns to care for and to love the companion that will seldom again leave his side until death. And when he leaves the school, he goes erect and confident, with the quick stride of one newly liberated and unafraid.

Gaining a new pair of eyes through a dog guide has enabled thousands of salesmen, lawyers, ministers, musicians, and typists to pursue their professions or learn new ones. And new mobility and freedom await the blind man or woman with a dog.

As one graduate expressed it: "When I came to the Seeing Eye, I had little interest in life. . . . Now my dog has done what I never believed could be done—she has made me over mentally."

George Werntz, Jr., Seeing Eye's executive vice president, told me: "Only 5 percent of the 330,000 blind persons in the United States can or want to use a dog guide. Age and physical condition bar many. For those who qualify, there are nearly a dozen schools like the Seeing Eye."

Some provide their services free of charge, such as Guide Dogs for the Blind, of San Rafael, California; Second Sight, at Smithtown, Long Island; and Pilot Dogs, of Columbus, Ohio.

Silk-coated Aristocrat, an Afghan Hound Pauses During a Gazelle Hunt

Known to ancient Egypt as the "monkey-faced hound," the **Afghan** developed a long, fine coat to endure the severe winters and broiling summers of Afghanistan. High-set, powerful hindquarters make it a champion hurdler. A bold and courageous breed, it works in the East as hunter and herder. The West prizes its beauty, dignity, and grace.

"Barkless" Basenjis Wear Bells for Driving Antelope in the Southern Sudan

Although normally quiet, the highly intelligent **Basenji** can emit a kind of murmur or chortle. Like a cat it keeps its short, odorless coat immaculate. The ancient but little-known breed appears terrierlike, but a habit of leaping high to see over elephant grass testifies to a strain of coursing hound. Here an Azande hunter sends his dogs to round up game.

Paintings by Edwin Megargee © National Geographic Society

Seeing Eye's fee of $150 for the first dog, board, and training falls far short of actual costs. The blind applicant pays the fee himself, in small installments over years if necessary. Nobody else may pay for him. "The idea is to make him assume some responsibility himself," Werntz explained, "to spur him on to make his own financial way in a seeing world."

Rare is the letter from a graduate to the Seeing Eye that does not include an eloquent tribute to a four-footed guide. One sightless writer summed it up, "Blindness has at last come out of the tin-cup stage."

Dogs Aid the World's Herdsmen

Since man first domesticated livestock, he has recognized the worth of a dog to guard and move his flocks and herds. This task has molded a variety of herding dogs.

The rough-coated komondor protects—and even resembles—the semiwild sheep of Hungary's wind-swept plains. Half a world away the agile kelpie shuttles flocks across Australia's outback.

For centuries the stumpy Welsh corgi, favorite of Britain's Royal Family, has nipped at laggard cattle's heels. So have Germany's Rottweiler, a remnant of Roman invasion; France's Briard; and the Low Countries' Bouvier des Flandres. Even the Russian Laika breeds tended reindeer herds long before a mongrel by that name won fame as the first space dog.

But the most worked shepherd's dog in English-speaking countries is a canny little Scot known as the working, or Border, collie.*

I was reminded recently of an English physician, Johannes Caius, who in 1570 wrote the earliest treatise on the dogs of Britain. Of the shepherd's working partner he said:

"This dogge either at the hearing of his masters voyce, or at the wagging and whistling in his fist . . . bringeth the wandring weathers and straying sheepe, into the selfe same place where his masters will and wishe . . . wherby the shepherd reapeth this benefite, namely, that with litle labour and no toyle or moving of his feete he may rule and guide his flocke, according to his owne desire, either to have them go forward, or to stand still, or to drawe backward, or to turne this way or to take that way."

Doctor Caius's dog may well have resembled today's Border collie, traceable to the Scottish-English frontier more than three centuries ago. And aside from whistling through his teeth rather than his fist, Carl Bradford

An Obedience Class Meets in a Theater—

of Wooster, Ohio, might well illustrate the old writer's remarks.

This specialist in sheep research at the Ohio Agricultural Experiment Station has happily joined his work with his avocation—breeding and training Border collies.

I watched, amazed, as Bradford worked the black-and-white pride of his kennels, Roy, with a flock of ewe lambs.

Bradford first scattered the sheep out of sight behind a low rise. Then, with a snap

* See "Sheep Dog Trials in Llangollen," by Sara Bloch, National Geographic Magazine, April, 1940.

Lois Gallant, Gillette

Some Students Pay Close Attention; Others Make Friends; at Least One Falls Asleep

of his fingers, he dispatched Roy on the "outrun"—a wide sweep around the flank—to bring them back.

The dog sped low across the meadow. With two whistles, one low, the other high, Bradford corrected his course a bit to the left. Roy vanished over the rise.

Collie Gives Sheep the "Eye"

"Now he's on his own," Bradford said. "A good herding dog must be obedient, of course. But he must have initiative too, for he often works out of sight of his master, like this."

A minute later a sea of dust-stained wool flowed like heavy sirup over the brim of the hill. Patiently, never approaching too closely except to head off an errant sheep, Roy darted in an arc behind. When the flock edged toward a fence, Bradford split the air with two low-pitched whistles. Roy shot instantly to his right, heading off a difficult situation.

By stops and starts the sheep approached like a company of awkward recruits. At each halt Roy crept closer with a crouching, almost hypnotic movement to start them again.

"That's what we call 'eye,'" Bradford explained. "All good herding dogs have it to some degree. It's the ability to creep up with

Photo, Muskegon

"No You Don't—Come Back!" A Great Dane Tugs His Mistress to Safety

trancelike attention on the flock and force it to move without stampeding."

It was indeed an astonishing display, as a 40-pound dog silently pushed balky sheep hundreds of times his own weight at his master's wish (page 201).

Bradford or one of his sons annually combs the English and Scottish countryside for working Border collies to augment their kennels.

Although these dogs are consistently black and white and run 30 to 50 pounds in weight, color and size are of secondary importance. None can be registered in the North American Sheep Dog Society without certified working parentage. This breed's fanciers believe with the Highlands shepherd that "pretty is as pretty does."

Training develops the Border collie's long-inbred herding instinct. As with all working breeds, basic obedience comes first—except for the command, "Heel." The last place a shepherd wants his dog is at his side. Fifteen minutes a day for six or seven months trains the dog for most herding work.

Swine are the hardest of all stock to move, Bradford told me, requiring a forceful dog. A cattle dog needs the courage to return for a second nip at the heel of a kicking heifer. Sheep usually prove the most tractable. Herding poultry, particularly turkeys, the dog can work closest of all, using slighter movements to control the flock.

Carl Bradford, Jr., and his brother Jerry demonstrated for me the difficult feat of working three dogs simultaneously. The subjects were four reluctant ducks that flapped and skittered in ragged circles to escape the canine fence around them. Oddly, a few fowl are harder to work than a large flock.

With whistles and different commands for each dog, Carl skillfully directed his charges as they herded the quacking quartet back and forth between wooden barriers.

Even an unpracticed eye could discern differences in style. Fly, veteran of sportsmen's shows and State fairs, pursued her duties with artistic flair. Nan tended her business with grave concern. Towser let the others tire themselves on the flanks as he ploddingly shut off escape to the rear.

Bradford furnishes trained dogs to livestock farmers throughout the United States. He has sent dogs to herd sheep on mining-company land high in the Peruvian Andes, and he has received inquiries from as far away as China.

Ancient Welsh law said a good herding dog was worth a prime ox. In recent years one Border collie sold for $1,500. Whatever the cost, it is fully repaid in faithfulness to flock and master.

A memorial stone was erected at an English roadside years ago to pay tribute to Tip, a female Border collie. Her master, an 85-year-old shepherd, took her along on his last winter's walk on the lonely moors, where he died. Not for 15 weeks was either seen again, until searchers discovered the feeble, emaciated dog, 12 years old herself, still standing vigil over her master's body.

Dogs Broke Trail for Indian and Explorer

The herding dog's faithful service for centuries is matched by other working dogs. Watchdogs like our modern mastiff guarded Assyrian palace as well as medieval manor. Hunters like the graceful greyhound and swift saluki coursed game for the early Egyptians 6,000 years ago (page 228). Romans and Greeks, Celts and Gauls clad courageous battle dogs in spiked collars and armor; in more recent conflict they have served as sentries, messengers, scouts, and for detecting mines. The clown's clever Tumbler of Elizabethan times furnished man with gentle entertainment, as does today's collie (page 198) as a television star.

The versatile dog hauled crude Indian travois across North America's plains, and still pulls vendors' carts through cobbled Belgian streets. The Portuguese water dog retrieved tackle for the fishing fleets. There is the barkless basenji, beating game in central Africa (page 214), and the fur-ruffed keeshond, guardian of Dutch canal barges.

The massive Newfoundland (page 204) and the St. Bernard are heroes of rescues at sea and in snowy mountain pass.* Even the

* See "The Great St. Bernard Hospice Today," by George Pickow, NATIONAL GEOGRAPHIC MAGAZINE, January, 1957.

Old English Sheepdog gets a rare look around as helping hands lift its hairy veil. Ears and nose make up for the visual handicap.

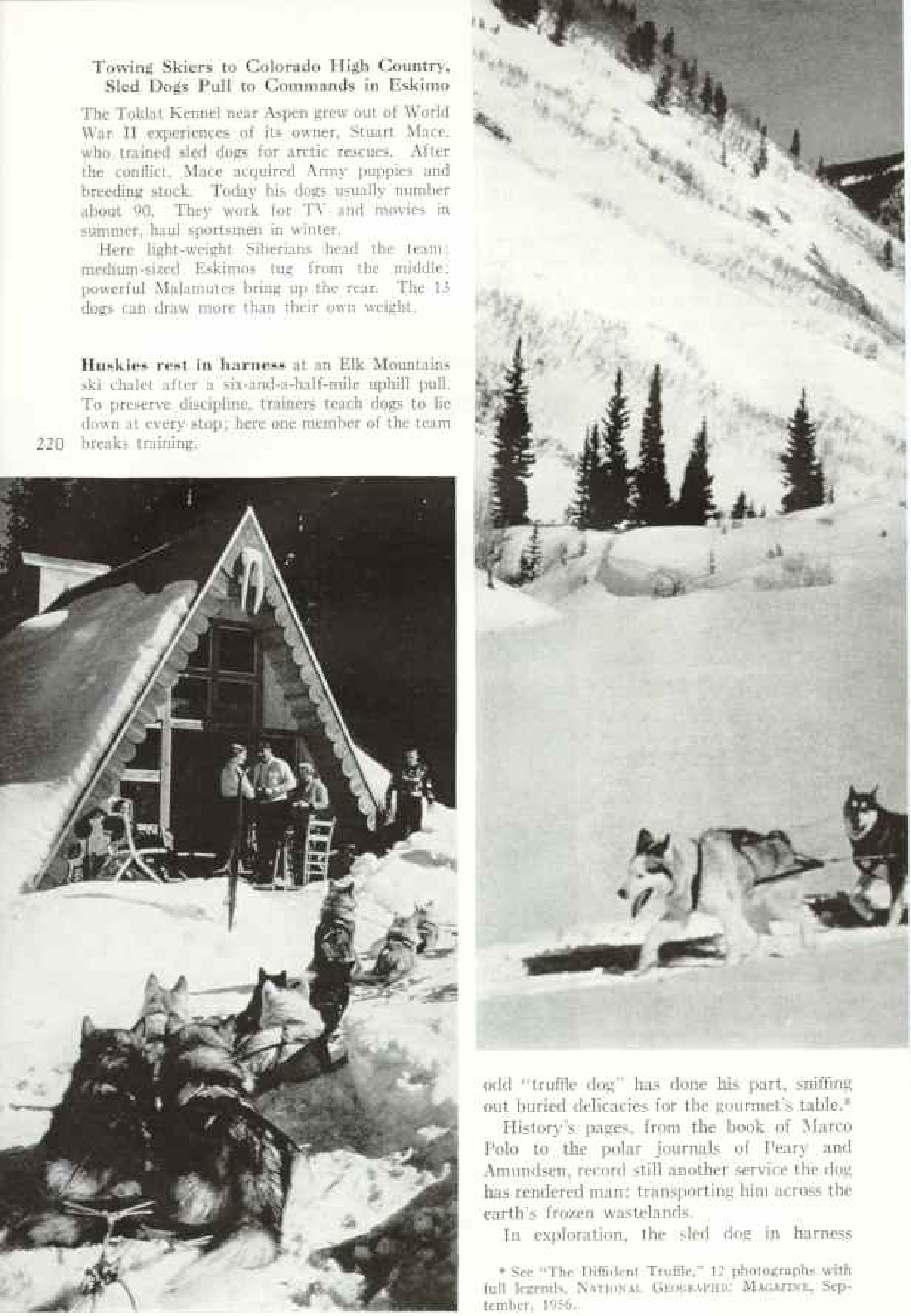
Francis Rigaud, Washington Star

Towing Skiers to Colorado High Country, Sled Dogs Pull to Commands in Eskimo

The Toklat Kennel near Aspen grew out of World War II experiences of its owner, Stuart Mace, who trained sled dogs for arctic rescues. After the conflict, Mace acquired Army puppies and breeding stock. Today his dogs usually number about 90. They work for TV and movies in summer, haul sportsmen in winter.

Here light-weight Siberians head the team; medium-sized Eskimos tug from the middle; powerful Malamutes bring up the rear. The 13 dogs can draw more than their own weight.

Huskies rest in harness at an Elk Mountains ski chalet after a six-and-a-half-mile uphill pull. To preserve discipline, trainers teach dogs to lie down at every stop; here one member of the team breaks training.



old "truffle dog" has done his part, sniffing out buried delicacies for the gourmet's table.*

History's pages, from the book of Marco Polo to the polar journals of Peary and Amundsen, record still another service the dog has rendered man: transporting him across the earth's frozen wastelands.

In exploration, the sled dog in harness

* See "The Diffident Truffle," 12 photographs with full legends, NATIONAL GEOGRAPHIC MAGAZINE, September, 1956.

National Geographic Photographer Kathleen Revis

opened countless thousands of ice-locked miles never seen before. In war, dog teams hauled ammunition in blizzard-swept France and rescued downed fliers from the Greenland Icecap. In peace, they have carried Alaskan mails, supplied trappers and prospectors.

Aside from feats in polar exploration, dog teams have made astonishing journeys. One driver left Nome, Alaska, with dogs and a wheeled sled in 1905, and arrived 8,000 miles away in Washington, D. C., in 1907.

The best-known sled-dog headquarters in the United States is Chinook Kennels of Wonalancet, New Hampshire. Here, on winding forest trails of the White Mountains, hundreds of dogs have been trained for Antarctic expeditions and innumerable wartime search and rescue missions. Here, too, many inexperienced GI's learned dog-sled driving.

"It's easier to train the dogs than the drivers," the owner of Chinook Kennels told me with a smile. Mrs. Milton Seeley, known

to her friends as "Shorty," has bred, trained, and raced sled dogs for 30 years.

Training at Chinook Kennels is a matter of example. A puppy of about eight months is harnessed amid experienced dogs, and learns from them. On snowless ground the dogs pull wheeled "gigs"—old cars stripped down to the chassis.

"At first he's playing, not pulling," said Mrs. Seeley. "But it doesn't take him long to get the idea." Educated in easy stages, most puppies soon love to work.

Blue-eyed Huskies Brave Arctic Glare

One out of ten displays the speed, obedience, and initiative of a first-rate lead dog. Some work well at the "point" positions, directly behind the leader; others prefer the "wheel" posts nearest the sled. Secret of a good team is the driver's knowledge of each dog's temperament.

At Chinook Kennels are 80-pound Alaskan Malamutes, ideal for heavy freighting in rough terrain; big Eskimo dogs, favored in the eastern arctic areas of North America; and lighter Siberian huskies, speediest of all.

Each possesses the "snowshoe foot," with thick fur between the toes, and the heavy double coat and plumed tail that serve the arctic dog as a natural sleeping bag. Some strains of the husky are born blue eyed, which seems to immunize them against the sled dog's saddest malady, snow blindness.

I was struck by the dogs' energy. A chill north wind, portending snow, inspired them to a ceaseless trot around their runs. They leaped rhythmically on and off ice-glazed doghouse roofs, deliberately slanted to develop sure-footedness.

Today's lumbering tractor trains and airplanes haul most of the tonnage of polar expeditions. Yet sled dogs accompanied Operation Deep Freeze to Antarctica for rescue work in foul flying weather or in terrain otherwise impassable. One born on the white continent, Bravo, became the mascot of the first party ever to spend the six-month night at the South Pole.*

Husky, Malamute, Eskimo, and Samoyed (another Siberian breed) have turned to another vocation, the booming winter sport of dog-sled racing. More than a dozen clubs have sprung up in North America in the past several decades.

Mrs. Seeley believes racing preserves the working qualities of northern breeds. "These dogs are born to work," she said. "Even if you harness one merely to a load of firewood, you've given him an identity."

A few early writers, I recalled, described the sled dog as unpredictably savage, perhaps because of maltreatment or crosses with arctic wolves.

I was about to ask Mrs. Seeley's opinion, when a furry pad gently touched my knee. In a moment another joined it. Ch. Alyeska's Suggen of Chinook was requesting permission to come aboard.

With 50 pounds of Siberian husky on my lap, proffering a furry chest to be scratched, the question of a sled dog's "ferocity" never came up.

Friendly Bloodhounds Save Lives

Victim of a similarly unearned reputation is the doleful, pendant-eared bloodhound.

"Historic libel!" asserts one of its best known breeders and trainers, veterinary Dr. Leon F. Whitney, of Orange, Connecticut. "The bloodhound is the gentlest creature in dogdom."

Part of its reputation for ferocity springs from the very name "bloodhound," which actually signifies purebred ancestry, not a bloodthirsty nature. More misunderstanding stems from crossbred prison dogs trained to attack or tree their quarry. The rest, perhaps, is an echo of *Uncle Tom's Cabin*.

Although the bloodhound is not classed as a working dog by the American Kennel Club, few breeds can match its service record. These friendly hounds have tracked down fugitives from a mink farm and sniffed out gas leaks

(Continued on page 231)

*See, in the National Geographic Magazine, "Man's First Winter at the South Pole," April, 1958, and "We Are Living at the South Pole," July, 1957, both by Paul A. Siple.

After a Race Through the Woods, Coonhounds Tree Their Quarry

One of a large group of tracking dogs developed in the southern United States, the **Black and Tan Coonhound** recently joined the roster of purebreds. Working at night, it trails by scent alone. Chase ends with the "barking up"; many sportsmen spare the treed raccoon. A coonhound inspired the tribute in the late 19th century by United States Senator George Vest of Missouri: "The one absolutely unselfish friend that man can have . . . the one that never deserts him. . . ."

Painting by Edwin Megargee © National Geographic Society

Edwin Megargee

Pink-coated Hunters Follow a Pack of English Foxhounds

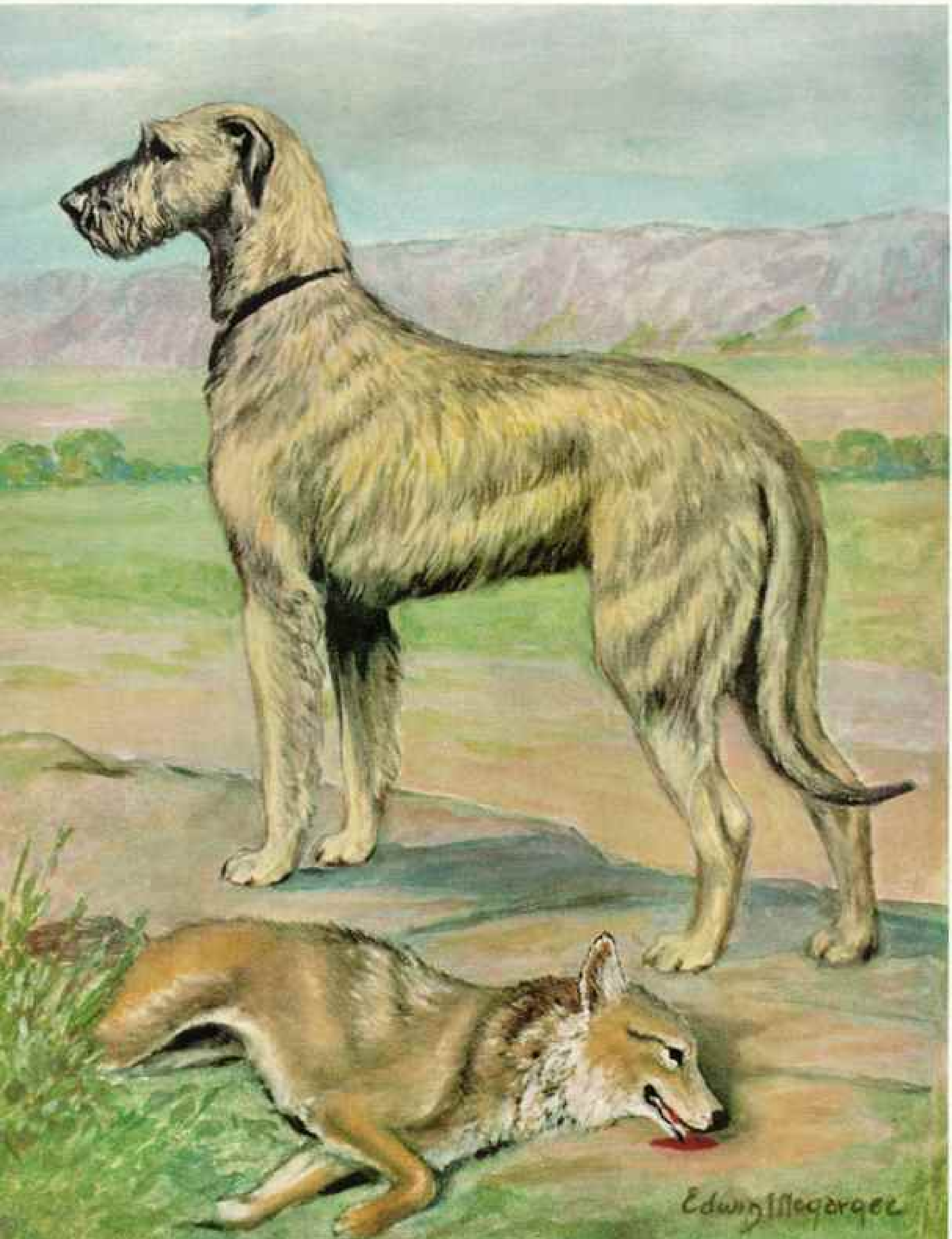
Many of England's deer parks disappeared during Cromwell's rule. As a result, Restoration sportsmen turned to fox hunting and developed the **English Foxhound** from old deer-hunting breeds. The modern hound—rarely seen except in packs kept by hunts or clubs—is a finely tuned instrument of speed, strength, and scenting power. A good foxhound on a hard day's hunt may travel 75 miles, sometimes at top speed and over rough country.

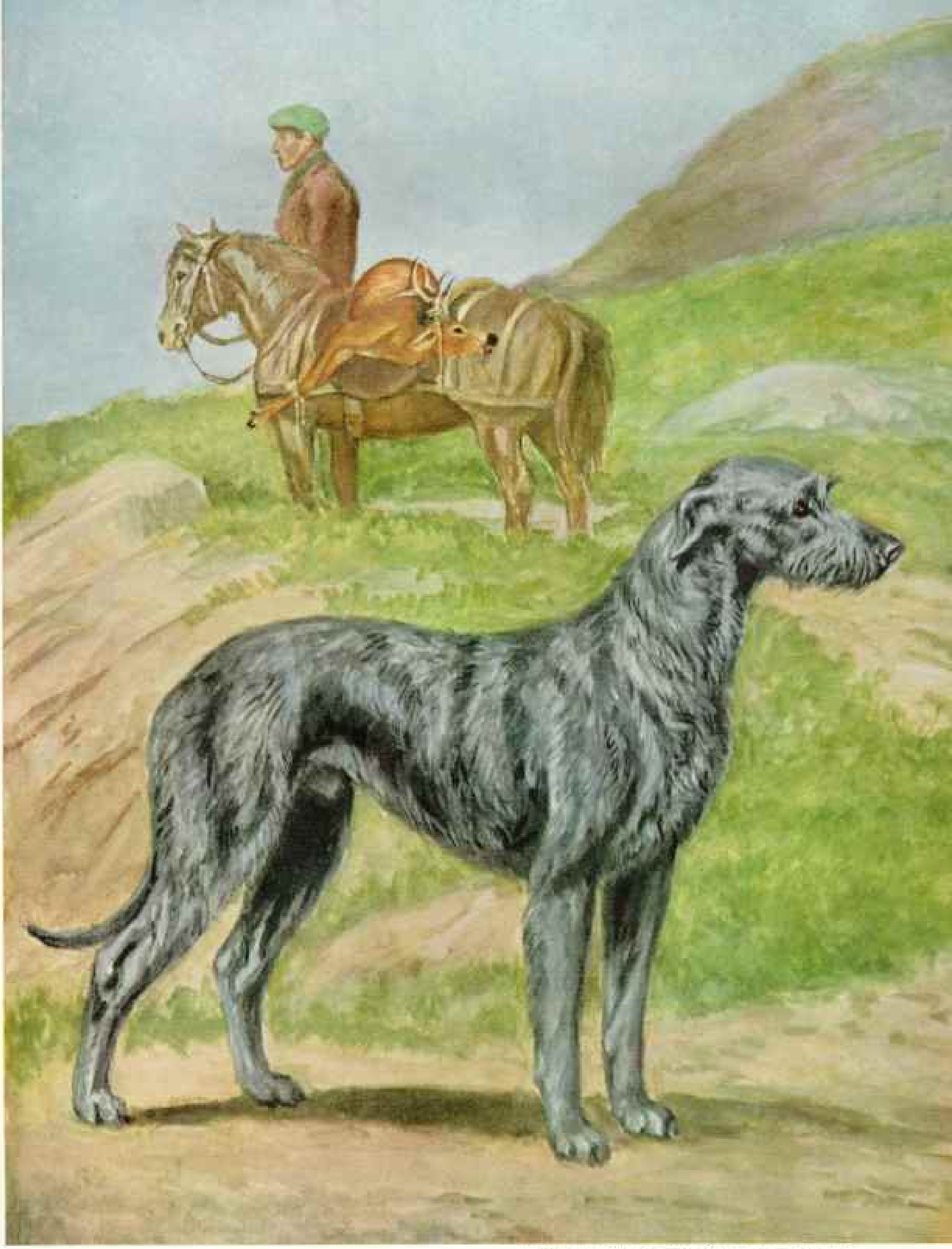
American Foxhounds Give Cry to Huntsmen at a Campfire

Some authorities believe De Soto brought the first tracking hounds to North America for hunting Indians. George Washington imported English foxhounds and later mixed them with French hounds given him by Lafayette. Today's **American Foxhound** differs only slightly from its British cousin. It stands a bit taller but weighs somewhat less.

Tallest of Dogs, an Irish Wolfhound Stands Victorious After Battle

Some 38 inches high at the shoulder, the **Irish Wolfhound** rivals a Shetland pony. "All Rome viewed them with wonder" when seven of the giants fought in the imperial circus A. D. 391. Companion of kings, the breed faced extinction after Irish wolves disappeared in the late 1700's. Wolfhounds today serve chiefly as amiable and remarkably courteous com-
 panions. A few still hunt in the western United States; this one has brought down a coyote.





Paintings by Edwin Megargee © National Geographic Society

A Fallen Roebuck Testifies to the Hunting Prowess of a Scottish Deerhound

A member of the greyhound family, standing leaner and lighter than its Irish relative, the **Scottish Deerhound** once starred in the splendid hunting pageants of medieval times. King and court would retire to the Highlands and watch dogs drive entire herds of deer. Such hounds—any one capable of bringing down a 250-pound buck—were so valued that three could ransom a knight. Later the breed declined; dog shows in the 1860's signaled a revival.

Coursing at 40 Miles an Hour.
Salukis Overtake a Bounding Gazelle

Possibly the oldest purebred in the world, the **Saluki** appears in Sumerian carvings 4,500 years old. Pharaohs of ancient Egypt kept the dog for coursing and companionship; its mummified body was often buried with its master. Although Mos-

Painting by R. E. Lougheed © National Geographic Society

lems believe that all dogs are unclean, they respected the saluki as a hunter that provided them meat. Considered a noble creature, it was the only dog to share the sheik's tent. The breed, isolated in the desert, remained pure; some Arabian pedigrees go back perhaps 1,000 years. Here in Saudi Arabia a gazelle leaps wildly over a saluki in a desperate attempt to evade its pursuers. The falcon works with the dogs by attacking the head of the panic-stricken quarry.

in underground pipelines. But their main job today, as it was 400 years ago when they trailed cattle thieves on the Scottish border, is to follow human scent (opposite).

This the bloodhound does with unparalleled zeal. Dr. Whitney tells of one that wandered out of its owner's yard, singled out a scent, and happily pursued it for 20 miles—to the door of a marathon runner training for a race.

Keen Nose for a Cold Trail

"Every bloodhound wants to follow a trail," says Dr. Whitney, who has furnished man-trackers for the police of many states. "But he must be trained to keep to the right one."

This requires runners to lay trails through woods, fields, streets, and buildings. Neighborhood children love the game. The trainer dangles a garment over the dog's nose to start him on the desired track. A morsel of meat awaits the loping hound at the end of the right trail, a slap on the nose at the end of any other.

After six weeks of such education, one Whitney-trained hound unerringly followed a trail laid in early morning through a public golf course, after hundreds of golfers had trod over it all day.

Experiments show that a dog can distinguish human perspiration diluted to one part in a million; many readily follow human scent. But no breed, bloodhound fanciers say, excels theirs on a cold trail.

Nick Carter, a Kentucky hound whose radarlike nose led to more than 600 arrests, once successfully tracked an arsonist who had fled 105 hours earlier.

Such a feat requires ideal conditions: damp ground, not much breeze, moderate temperature. In dry, blazing summer weather, body scent dissipates rapidly; on chilly nights, frost smothers it. A bloodhound courses a fresh trail with head up, catching the odor directly from the air. On a faint track the dog may rasp nose and lips raw against the earth.

One crisp day last fall Sgt. W. W. Horton of the New York State Police took one of his six dogs—and me—out for a practice run near Hawthorne, headquarters of famed Troop K.

A trail had already been laid. Smoky, a young, half-trained bloodhound, trembled excitedly as Horton transferred the leash from collar to harness, signaling that work was about to begin.

Unexpectedly, Sergeant Horton shoved the leash into my hand.

"You take him," he said. Then, to the dog, "Seek 'im out, boy!"

Smoky shook his head in a blur of ears and jowls and took off like a rocket. Half running, half dragged, I followed. Far behind, Horton shouted cheerily, "Don't hold back—you'll discourage him!"

I fervently wished something would. My lungs were afire, and my deskbound legs were turning to rubber.

Smoky lost the scent and swerved erratically into a thicket, snarling the leash. I sank gratefully to the ground as the sergeant hove into view.

"I'm not sure," I gasped, "But I think that was a dirty trick!"

The trooper's eyes twinkled: "I forgot to mention that this dog might be a little eager; he hasn't been worked for nearly a month."

Once extricated, Smoky picked up the trail again, soon finding his quarry and his reward, a morsel of leftover turkey. By then I well understood why a bloodhound handler, despite popular notion, seldom holds two dogs on a trail.

Hound Traces Scent Floating from Car

Though dogs from the Hawthorne Barracks have tracked many an escaped convict and wandering mental patient, most calls are to find lost hunters, elderly vacationers, and children.

Criminal cases are fewer than one might expect. "Most fugitives head for a car," Horton explained. Even this failed to help one suspect. The dog's incredibly sensitive nose followed the faint scent drifting from the open roadster for two and a half miles.

The shortest trail Horton ever followed with a bloodhound was 30 feet—from a missing baby's back yard, tragically, to a near-by stream. The longest took him through Adirondack wilds for two months in vain pursuit of a killer later captured in Nevada.

A Sad-eyed Sleuth, the Bloodhound Only Tracks, Never Attacks

After centuries of careful breeding in England, the hound came to be known as "blooded"; thus **Bloodhound.** It is a master at tracking the lost and the fugitive. In criminal investigation, some courts will accept as evidence a bloodhound's tracing of a human scent from the scene of a crime to a suspect. One canine detective brought about more than 600 arrests.

Golf De Luxe: Dog to Pull Clubs, Seat for Resting

The Labrador retriever, which in fact springs from Newfoundland, loves to swim through icy waters after wild fowl. And who, at times, wouldn't like a retriever on the golf course?

One of Horton's dogs, Smarty, found a missing boy in 20 minutes, after hundreds of searchers had tramped the area for a day and a half. Smarty, it should be added, was 12 years old and totally blind.

"Our greatest problem," Horton told me, "is that no one thinks of bloodhounds until all else has failed. Searchers leave hundreds of conflicting scents and then wonder why the dog is confused. Call for a bloodhound quickly, particularly where a missing child is concerned. It can mean life or death."

One mother did report her little boy's disappearance promptly, but otherwise proved too cooperative. Horton asked her to have an item or two of the youngster's clothing ready for his dog. He found awaiting him virtually every garment the boy owned—spotlessly and scentlessly laundered while he was en route. But an overlooked sock was located, as was, in a short time, the unharmed child.

In such ways does the dog serve man today:

The National Geographic Book of Dogs, a new color-illustrated volume in the Geographic Natural Science Library, will be published this fall. Further details will appear in the next issue of your Magazine.

tracking and trailing, herding and hauling, guiding and guarding.

After watching scores of them learning and performing their varied tasks, I cannot help agreeing with Doctor Caius:

"For if any be disposed to drawe the above named services into a table, what may more clearely, and with more vehemency of voyce giveth warning eyther of a wastefull beaste, or of a spoiling theefe than this? Who by his barcking (as good as a burning beacon) foreshoweth hassards at hand? . . . What servant to his master more loving? What companion more trustie? What watchman more vigilant? . . . What messinger more speedie? . . . Finally what packhorse more patient?"

What creature, indeed, but the wagging, willing, working dog.

A Young Boxer Learns Manners to Match Her Smart Appearance

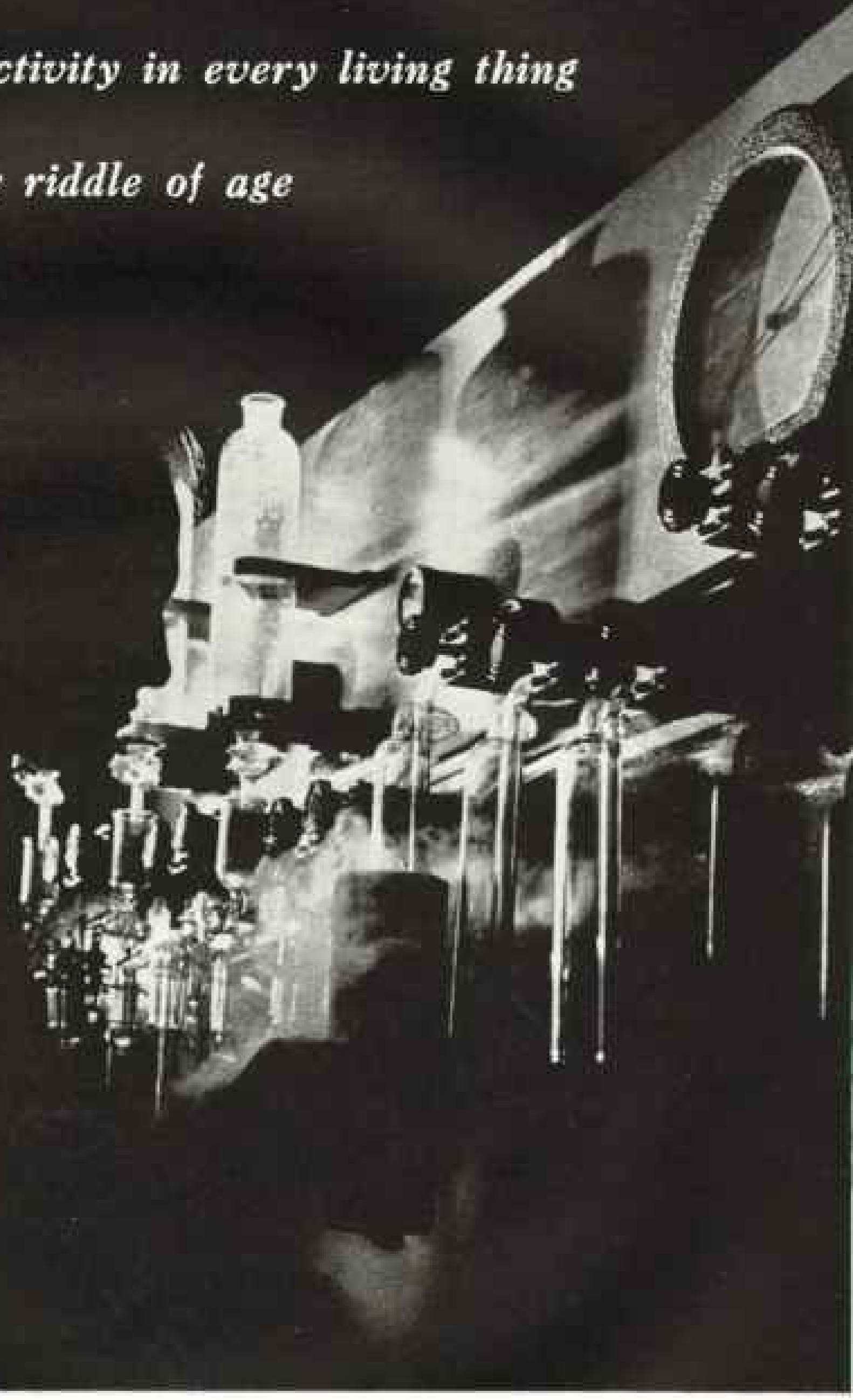
To teach canine etiquette, begin with a six-month-old pup whose confidence you have won. Employ a leash; suit commands to action; use hands for signals, not spankings.

Use your knee to cure a dog from jumping up on people. Press leash to floor with a foot to make the puppy "Lie Down." A dog learns to "Sit" when you pull back on the leash and push down hindquarters. In training pet to walk quietly at your side, command "Heel" and tug leash whenever the pupil lunges ahead or lags. Above all, be gentle but firm.

How Old Is It?

Telltale radioactivity in every living thing

is cracking the riddle of age



Like a witch's caldron in a firelit cave, a flask of liquid nitrogen boils and fumes in a radiocarbon laboratory. Here, as though by magic, man unlocks the secrets of the past. Inside this chain of flasks and tubes, a scrap of ancient charcoal has burned. Carbon dioxide gas, one of the combustion products, is now being frozen by liquid nitrogen at 310° F. below zero. Purified, it will pass into an electronic counter. There

Humble Oil & Refining Company

faint pulses of radioactivity from a substance known as carbon-14 will reveal the approximate age of the charcoal (page 245). Similar tests can date organic materials as old as 60,000 years.

By LYMAN J. BRIGGS, Sc.D., LL.D., Ph.D.

Director Emeritus, National Bureau of Standards and Life Trustee, National Geographic Society

and KENNETH F. WEAVER

National Geographic Magazine Staff

TICK . . . tick . . . tick . . . *tock!*

Watch in hand, we timed the slow clicking of the electronic counter. Soft ticks at irregular intervals of three or four seconds and a louder click every minute or so played an obbligato above the sounds of the laboratory.

In imagination's eye we pictured a mighty grandfather's clock, its pendulum swinging grandly, its leisurely ticktock echoing down the corridors of time.

In part this was imagination, but only in part, for the bank of instruments before us—in the radiocarbon laboratory of the U. S. Geological Survey in Washington, D. C.—did indeed contain a kind of clock, an atomic clock.

Carbon Tells the Time

This atomic timekeeper consisted of a tiny amount of radioactive carbon from a fragment of charcoal. Long ago it blazed in a cave fire that warmed a Stone Age family in northern Iraq. Through the centuries this carbon had been radioactively disintegrating, its atoms exploding one by one. Each year it had given off fewer explosions, just like a clock whose spring is running down.

Now, as we watched and listened, a counter recorded those explosions. With mounting excitement we watched as the scientist with us made a quick calculation.

"There it is," he said, pointing to his pad. The figures showed that the embers of that prehistoric campfire had burned out *more than 30,000 years ago*, when glacier ice covered northern Europe.

Here we had seen for the first time how radiocarbon can give a birth certificate to a very ancient object. The people who sat around that campfire 1,000 generations ago had no writing and no calendar and left no records; yet we can now begin to read their secrets in the charcoal of their hearths.

David S. Boyer, National Geographic Staff

Egyptians Restore the Enclosure of King Djoser's Pyramid at Saqqara

How do we know that radiocarbon dates are valid? In answer, scientists point to the method's success in dating objects of known age. Egyptian royal tombs prove especially useful because dynastic dates are fairly well established back to 3000 B. C. Wood from Djoser's tomb was the first object tested by Dr. Willard F. Libby, who pioneered the C-14 technique (page 239). This stone structure was the first Egyptian tomb built in the form of a pyramid.

Why is it that archeologists today—to use the words of anthropologist Carleton S. Coon—"collect flecks of charcoal as carefully as if the Queen of England had dropped her pearl necklace in a gutter"? Why indeed should anyone bother to spend time and money trying to find out how old a scrap of charcoal is?

In part, perhaps, because the riddle of age has always fascinated civilized man.

Think for a moment—what is your first question when you look at a mummy or a dinosaur skeleton in a museum, or find an arrowhead in a field? Inevitably you wonder, "How old is it?"

The scientist shares your curiosity and asks even more penetrating questions: How old is the universe? How old is the earth? When did man first appear? When did the glaciers last release their frozen grip and retreat silently into the Arctic?

Such problems occupy thousands of minds in universities and laboratories around the world. And remarkable new dating methods, of which radiocarbon is the most spectacular, are beginning to give intriguing answers.

During the late 1940's the now-famous Dead Sea Scrolls were found in a number of caves in Palestine. Were they fakes? Some people thought so.

Linen wrappings from some of the scrolls were subjected to carbon dating; they proved to be more than 1,900 years old. This test, made by highly reputable scientists, helped convince skeptics that the documents were authentic; among them were early copies of the Book of Isaiah (page 249). Since then the many scrolls found in the Dead Sea caves have proved of incalculable worth to Biblical scholarship.

Lotus seeds still capable of sprouting were found 20 feet below ground near Tokyo in 1948. Radiocarbon showed them to be more than 3,000 years old—much, much older than anyone had previously thought possible for living seeds (page 250).

Charcoal from a ritual pit at Stonehenge, the stately circle of ruined columns in Wiltshire, England, went into the radiocarbon counter in an attempt to solve the mystery of Stonehenge's origin. The carbon date corroborates estimates based on astronomy that the strange circle must have been laid out about 1,800 years before Caesar's legions invaded Britain in 55 B. C.

The explosion of Mount Mazama that helped create Crater Lake, Oregon, burned the surrounding trees and buried them under many feet of pumice. Some of the charred wood, put through a carbon counter, indicates that the cataclysm took place about 6,500 years ago—much more recently than some scientists had estimated.

And at another Oregon site, Fort Rock Cave near Newberry Crater, archeologists found nearly 100 sandals woven from sagebrush bark (page 239). They had been buried by volcanic pumice. Since radiocarbon shows the sandals to be more than 9,000 years old, Fort Rock Cave could claim to be the oldest shoe factory in the world.

Becquerel Discovers Radioactivity

Late in the 19th century a French physicist, Antoine Henri Becquerel, found that uranium salts would fog a photographic plate wrapped in black paper. Becquerel guessed, correctly, that the uranium was slowly breaking down into something else and throwing off "rays" that penetrated the paper.

Since then scientists have discovered a number of other radioactive materials, each with its own rate of disintegration, or radioactive decay. One is radiocarbon, discovered during the 1930's. This substance has an atomic weight of 14 instead of carbon's

With This Cedar Barque, Sesostris III Planned to Sail to the Nether World

Excavators found the 32-foot vessel buried in the sands outside the Pharaoh's pyramid at Dahshur, Egypt. Mourners carried it in his funeral procession about 1850 B. C. Carbon testing of a plank in the deck gave an age within 180 years of that date—a bull's-eye as carbon dates go. Here the vessel rests in the Chicago Natural History Museum.

Chicago Natural History Museum

normal 12. For this reason it is often called carbon-14.

The relative number of carbon-14 atoms, compared with normal carbon-12, is *extremely* small. In living wood, for example, only one out of a trillion (million million) carbon atoms is radioactive. Only through the use of modern electronic methods, by means of which the explosion of a single radioactive carbon-14 atom can be detected and counted, has radiocarbon dating been made possible.

Carbon-14 in Every Living Thing

The man who first found radiocarbon in nature and worked out a way to use it as a means of dating the past is Dr. Willard F. Libby, a nuclear chemist, now a member of the Atomic Energy Commission (opposite). His discovery is a brilliant example of scientific deduction.

Dr. Libby, then at the University of Chicago's Institute for Nuclear Studies, knew that cosmic rays bombard the upper atmosphere with billion-volt energy, producing great numbers of rapidly moving neutrons.* These, he believed, must collide with abundant nitrogen atoms in the atmosphere, transmuting some of them into radiocarbon. They literally change nitrogen to carbon by replacing one of the positively charged protons in the nucleus of the nitrogen-14 atom with an uncharged neutron of nearly the same mass.

He reasoned further that the radiocarbon joins with oxygen to form carbon dioxide, which diffuses throughout the atmosphere. Plants absorb this carbon dioxide by the process of photosynthesis. They in turn are eaten by animals and human beings, which thus acquire radiocarbon in all their tissues.

How much radiocarbon is there? Dr. Libby calculated that with only one radioactive atom to every trillion atoms of ordinary carbon, the total world supply would be an infinitesimal 79 tons.

Radiocarbon Search Ends in a Sewer

Having spun his theories, Dr. Libby set out to look for radiocarbon in nature. He delights in recalling that his search ended in the sewers of Baltimore.

"We assumed that the amount of carbon-14 would be so small that it would have to be concentrated before we could detect it," he says. "The only person we knew with equipment to do this was Dr. A. V. Grosse of the Houdry Process Corporation. He agreed to join our work and to make available his equipment, which could concentrate carbon from methane gas.

"We asked ourselves—where could we get methane that was still radioactive? There is plenty of methane from oil wells, of course, but we knew that any radiocarbon it once contained would long since have disappeared.

"Then we thought of sewer gas, which is produced by decomposing organic matter. Through the courtesy of the mayor of Baltimore, we got a quantity from the Baltimore sewage plant and tested it. In this sewer-gas methane we found our first natural radiocarbon, and we found it in about the amount we expected."

What happens to radiocarbon when a living organism dies? The answer to that one was easy for Libby. Death halts the intake of radiocarbon, but what is already in the tissues continues to break down, just like the uranium that fogged Becquerel's photographic plate.

As the physicist puts it, the carbon-14 atom is unhappy with its unstable condition. Soon or late, it throws out a negatively charged electron and becomes nitrogen again. This radioactive discharge, Dr. Libby knew, could be amplified and detected with an ultrasensitive Geiger counter.

Slow, Relentless Decay of Atoms

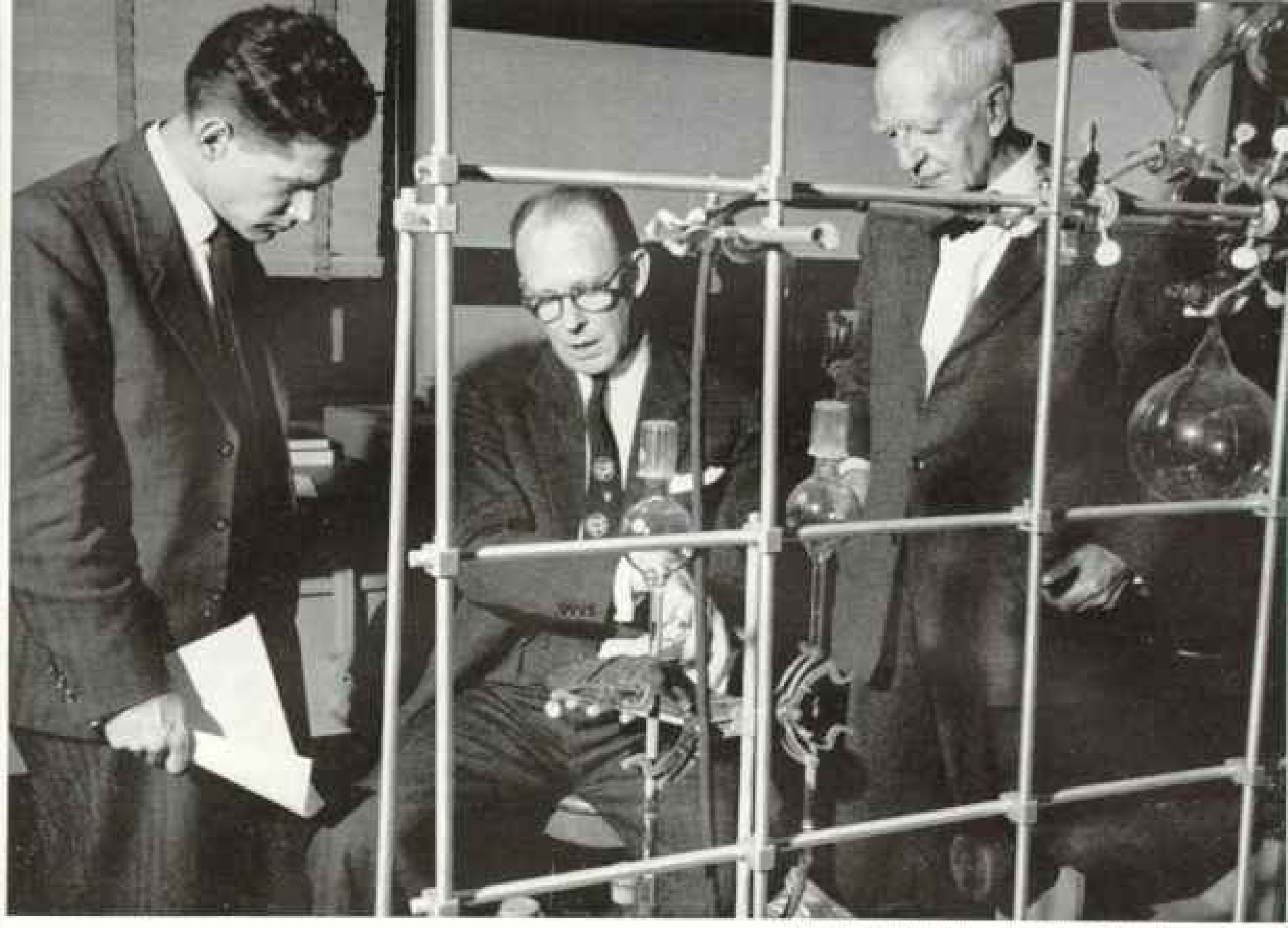
Radiocarbon has a "half life" of 5,568 years, plus or minus 30. In that period half the radiocarbon in any sample disappears. Half of what is left disintegrates in the next 5,568 years, leaving one-fourth of the original, and so on until all the radiocarbon is gone. Neither heat nor cold nor pressure nor any other circumstance can speed or slow the disintegration. By determining the amount of radioactivity left at any point, and by measuring that amount against a calibrated scale based on the radioactivity of modern carbon, the scientist can tell the age of the substance.

And so carbon dating was born.

Any organic material—wood, flesh, bone, antler, peat, dung, grain, or beeswax—will reveal its age so long as we can measure the faint pulses of unhappy carbon atoms.

To prove whether his idea would work, Dr. Libby sought the aid of distinguished archeologists, anthropologists, and geologists.

* See "Trailing Cosmic Rays in Canada's North," by Martin A. Pomerantz, NATIONAL GEOGRAPHIC MAGAZINE, January, 1953.



National Geographic Photographer Volkmar Wentzel

"Give me," he said, "samples of ancient materials of known age. Let me burn them and test them in my counter to see if the ages I get are the same."

The scientists responded eagerly, for they recognized what such a dating system could mean to their work. Into Libby's laboratory streamed a bizarre procession of packages, bearing postmarks from all parts of the world. Museums sent many of the samples, sacrificing them in the interests of science.

A King of Egypt Lends a Hand

The first sample was acacia wood, part of a beam from the tomb of Djoser, one of Egypt's early kings (page 236). Scholars who study Egyptian dynasties and tie them to records of ancient eclipses have worked out a fairly accurate chronology back to about 2000 B. C. With somewhat less certainty they can go back to the first Egyptian dynasty at about 3000 B. C. They know that Djoser ruled about 2700.

Libby's date? A little older than 2000 B. C. Not too good, and Dr. Libby was discouraged, although the sample had been very small.

He fared much better with another Egyptian sample, a piece of the deck planking from a 32-foot cedar boat in the Chicago Nat-

Scientists Examine Indian Sandals Woven 9,000 Years Ago in Oregon

Dr. Libby (center), a nuclear chemist, began radiocarbon work at the University of Chicago about a decade ago. Among the hundreds of materials he has dated are the sagebrush-bark sandals (close-up, below) found in Fort Rock Cave, Oregon.

Their radiocarbon age shows that Stone Age Americans learned the weaving art thousands of years before they settled down on farms and created pottery.

Now a member of the Atomic Energy Commission, Dr. Libby shows the sandals to author Lyman J. Briggs (right) and Dr. Hessel de Vries, head of a radiocarbon laboratory in Groningen, Netherlands.

Paul Schiller

ural History Museum. This barque formed part of the funeral procession of King Sesostris (Senusret) III some 3,800 years ago; it was buried near his pyramid at Dahshur, presumably to transport the king's soul across the waters of the nether world (page 237).

Dr. Libby's date—3,621 years—was off by only 4½ percent.

Other good results were obtained with cypress wood from the tomb of Egypt's King Snefru; with pine wood from the floor of a large Syro-Hittite palace at Tayinat; and with part of a mummy coffin of the Ptolemaic period in Egypt.

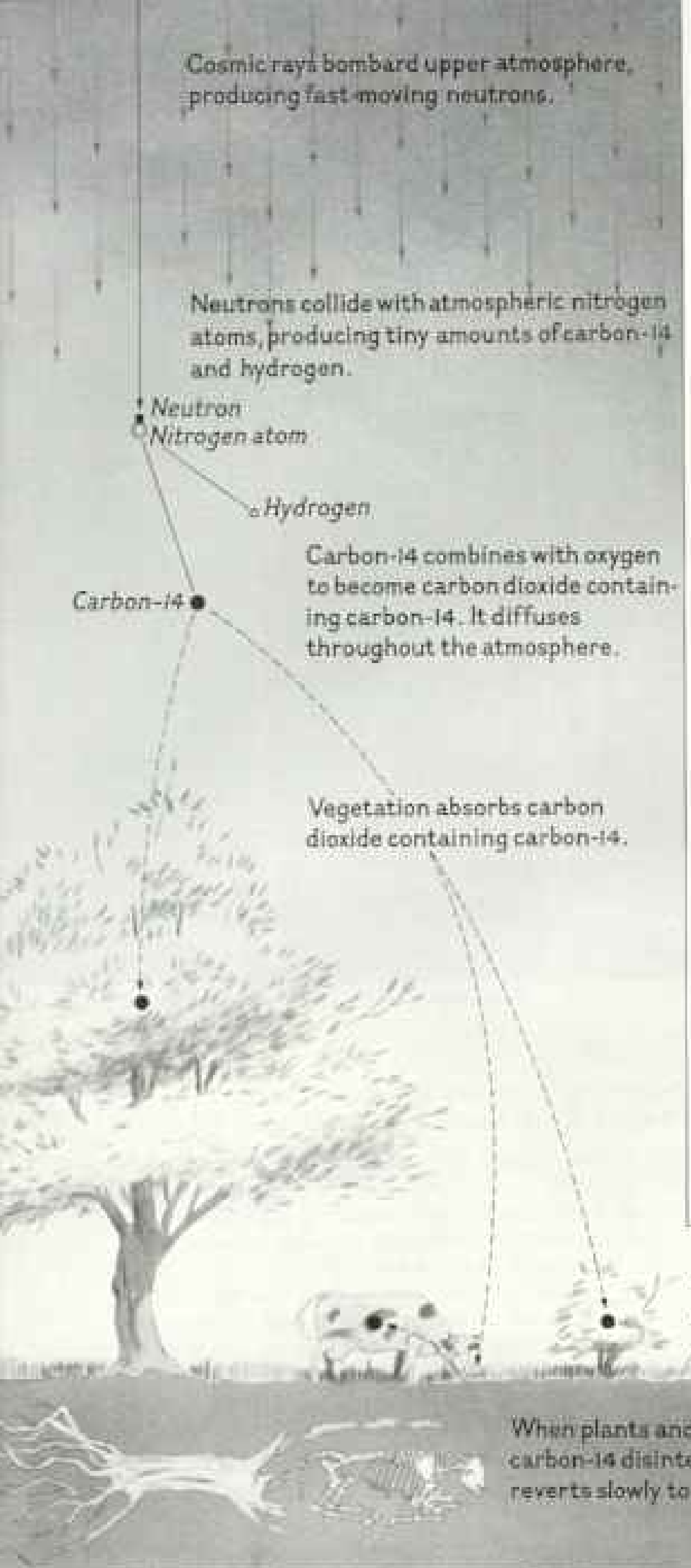
"Case of the Counterfeit Coffin"

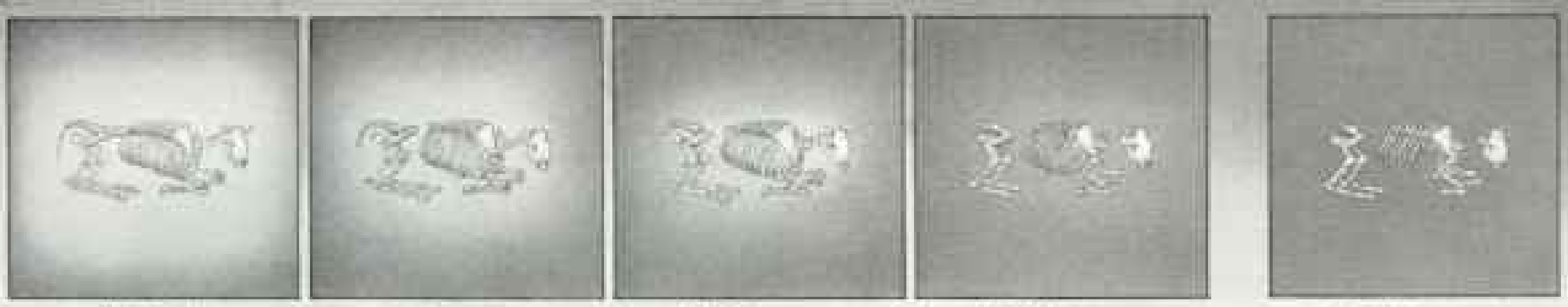
Dr. Libby still chuckles about the "Case of the Counterfeit Coffin," another Egyptian sarcophagus.

"It wasn't funny at the time," he recalls. "For one of our tests of the carbon-14 method, we obtained part of the lid of a sarcophagus from one of our best museums. It was supposed to be about 2,200 years old.

"You can imagine our shock when our instruments registered less than a century. This, we thought, was impossible. We checked our equipment and took another reading. Again we got the same answer.

"Finally we realized that the instruments





All living organisms contain the same proportion of carbon-14. After death, organic materials lose their carbon-14 at the same rate. Half disappears in 5,568 years, a half life. Three-fourths dissipates in two half lives, and so on. Radioactivity at any point, compared to radioactivity of modern carbon, tells the amount of time elapsed since death.

Drawn by Irvin L. Allaman © N.G.S.

were correct. The coffin lid was modern wood, cleverly antiqued to seem very old. The hoax had fooled the experts and would in all probability have gone undetected except for carbon-14."

Perhaps the most convincing test of all was one which matched radiocarbon dating against another type of chronology—that derived from tree rings.

For more than half a century men have recognized a connection between the growth of a tree and the rings observable in the cross section of its trunk. During the growing season, most trees lay down large, thin-walled cells in the growth layer immediately under the bark. As growth slows, small, thick-walled cells are added; they form a dark ring that marks the end of the year's growth.

In many cases it is possible to count these rings and tell how many years ago the tree sprouted. The oldest known living things, the bristlecone pines, show rings going back more than 4,000 years.*

A fine system of tree-ring chronology for archeology in the Southwest was worked out in the 1920's by Dr. A. E. Douglass of the University of Arizona, with the support of the National Geographic Society.† Beams in Spanish missions and Indian pueblos can be dated by matching them against a master pattern showing closely spaced rings in drought years and broad bands in rainy periods.

Sequoia Tests the Carbon Method

Dr. Libby chose heartwood from a sequoia nearly 3,000 years old to see if carbon dating would show the same age as the tree rings. This gigantic tree, known as the Centennial Stump, was felled in California in 1874. The fragment for carbon testing spanned rings that grew from 1031 B. C. to 928 B. C.

Three tests gave a carbon age averaging about 2,710 years. Although this was some 200 years low, it was still remarkably close. And it amply justified Dr. Libby's conclusion that "every piece of wood has its age carved in it."

The test proved also that the radiocarbon in each year's growth is securely held in chemical combination in the cellulose of that ring, and is not contaminated by carbon from other rings.

In 1949 Dr. Libby began dating in earnest, testing the major archeological treasures of the previous 25,000 years. His work, with that of other laboratories which followed, has proved tremendously valuable in recent investigations carried out by the National Geographic Society at Russell Cave in Alabama,‡ at Santa Rosa Island off the coast of California (pages 261 and 266), and in archeological sites in Mexico.

Not only scientists but even practical-minded businessmen find carbon-14 useful. Two oil companies in Texas maintain carbon laboratories to study the age of recent sediments. Such knowledge helps in the search for older petroleum deposits.

And in the Netherlands, government experts date materials dug along the seashore to find out how rapidly the coast is sinking below sea level. Fortunately the rate is slowing: 7,000 years ago the drop was 14 inches every century; today it is only 4 inches a century.

Wood and Bone Reveal Their Age

We have been astonished at the variety of materials scientists send to radiocarbon laboratories. Dr. Meyer Rubin, director of the Geological Survey radiocarbon laboratory, showed us such items as a piece of whale baleen, a chunk of wood from King Solomon's mines, and a weathered length of spruce wood once buried by glacier ice in Wisconsin.

And neatly tied in plastic bags were numerous samples of charcoal—the carbon dater's favorite subject—taken from ancient hearths all over the world. One was hearth material from Shanidar Cave in northern Iraq, where recent excavations have gone down 45 feet to reveal several skeletons of Neanderthal men.

In other carbon laboratories we have seen the bones of Arizona mammoths killed by early hunters some 12,000 years ago; charred potatoes from the Andes; antlers and walrus hide from Alaska; shells from the Red Sea; salts extracted from South Atlantic waters; mountain sheep dung 11,000 years old from Danger Cave, Utah.

Dr. H. R. Crane, of the University of Michigan laboratory, tells of dating scores of human bodies found preserved in the ice near a frozen lake in the high Himalayas.

"They turned out to be more than 600 years

* See "Bristlecone Pine, Oldest Known Living Thing," by Edmund Schulman, National Geographic Magazine, March, 1958.

† See "Secret of the Southwest Solved by Talkative Tree Rings," by Andrew Ellicott Douglass, National Geographic Magazine, December, 1929.

‡ See, in the National Geographic Magazine, "Life 8,000 Years Ago Uncovered in an Alabama Cave," October, 1956, and "Russell Cave: New Light on Stone Age Life," March, 1958, both by Carl F. Miller.

old." he says. "Now the natives call the place Haunted Lake, and historians are searching for accounts of an army that may have vanished in that area."

The Magnolia Petroleum Company research center in Dallas, Texas, showed us a jar of wheat from a Moabite home in Jordan. The kernels—many of them still perfectly formed—have oxidized until they are as black as if they had been charred in an oven. Their carbon date puts them around 850 B. C.—not long after the time when Ruth the Moabitess was gleaning the fields of Boaz.

In the early stages of carbon dating, fairly large samples were needed—enough to give several ounces of carbon. Today's far more sensitive equipment makes it possible to measure the radioactivity of as little as one hundredth of an ounce of charcoal.

Whether large or small, the sample is treated with acids and alkalies to remove contamination, then burned in a heavy glass tube.

Carbon-containing gas from this combustion moves through a vacuum line—a system of tubes and flasks from which all air has been evacuated; in them it comes in contact with chemicals that extract impurities. Refined, the gas passes into the counter (page 245).

Radioactivity of the sample is there measured by an electronic mechanism similar to the Geiger counter used to locate uranium ore. This counter is hidden inside a steel tomb, with walls sometimes nine inches thick, to shield out radioactivity from other sources. To double the safeguard, the counting tube is surrounded by an "electronic umbrella," a ring of smaller Geiger counters that detect any cosmic rays that penetrate the shield. These counters cannot stop cosmic rays, but they turn off the main counter for an infinitesimal fraction of a second while a cosmic ray is passing through.

Telling Ticks from Tocks

The two kinds of counters explain the tick . . . tick . . . tick . . . *tock* we heard in the laboratory. The frequent soft clicks come from the cosmic ray recorder; each one signifies that 64 cosmic rays have passed through. The louder clicks represent the radioactivity of the sample itself—each one records the disintegration of a carbon atom.

Actually a few of the discharges detected by the main counter come from sources other than carbon-14. Even when the counter is empty, it is impossible to free it entirely from the slight radioactivity of the very materials of which it is made. These materials give off spurious counts which are referred to as the "background" of the counter.

Refinements of equipment are steadily reducing this background. One of the leading laboratories now holds background count to two discharges a minute, compared to the 35 counts per minute produced when modern carbon-14 is being tested in the same apparatus.

Background count is determined by running such "dead" samples as coal, which is so old that it contains no carbon-14 at all. This figure must be subtracted from the total count, and what is left represents the number of disintegrations of carbon atoms.

When Did Hammurabi Live?

Most laboratories now get reasonable results from a radiocarbon test overnight. However, the longer a test is run, the more accurate are the findings.

On one set of tests, Dr. Libby ran his counters for three months. This extremely long and expensive test was an effort to settle an old dispute of much interest to historians: What are the actual dates for Hammurabi, the Babylonian king who lived nearly 2,000 years before Christ and drafted the first code of laws known to history?

Here's how Dr. Libby tells the story:

"The entire Babylonian calendar over a period of hundreds of years has been carefully worked out from king lists and astronomical evidence, but theories about where it should fit into the Western calendar differ by several hundred years.

"To make our tests, we chose a roof beam that burned during the reign of a king who preceded Hammurabi by about 250 years. If the date of this charcoal could be determined accurately, then Hammurabi could be given his proper place in the Western calendar.

"The carbon date for the charcoal came out 1993 B. C. ± 106 years. That little plus-or-minus tail wagging at the end of the date is an expression of statistical error that accompanies every radiocarbon date. The longer the test is run, the smaller the plus-or-minus factor becomes; when the length of the test is increased four times, the error is cut in half.

"In this case the plus-or-minus factor means that, two chances out of three, the burned beam came from a tree that died between 1887 B. C. and 2099 B. C."

"What about the other one chance out of three?" we asked Dr. Libby in surprise.

"There's one chance in three that the true date falls outside those limits," he said. "However, if we double the margin of error, we can be sure that 19 times out of 20 the date will fall within our limits. And if we triple the error, no reasonable doubt is left at all.

"In Hammurabi's case, the radiocarbon evidence suggests that he came to the throne about 1750 B. C., give or take a century. This does not prove conclusively when Hammurabi lived, but it brings us closer to a definite date and helps clarify the whole interwoven fabric of historic relationships in western Asia and Egypt."

Another ancient calendar which had never been satisfactorily related to the Western calendar is that which the Maya of Central America began using approximately 600 years before the Christian Era. Interpretations of the carved symbols found on Maya doorways and monuments give two possible correlations, 260 years apart.*

Again Libby tried to settle the dispute. He ran his test for many weeks, hoping to get the margin of error so low that the results would clearly confirm one of the two correlations. His sample was a piece of a door lintel from the ruined city of Tikal in Guatemala. Its carved inscription carried a Maya date that according to the Goodman-Thompson correlation would be A. D. 741, but according to the Spinden correlation would be A. D. 481.

Libby's carbon date for two samples averaged A. D. 451 ± 110. By coincidence, another laboratory tested a different beam with the same carved date and hit the exact year of the Spinden correlation—A. D. 481 ± 120.

In the early days of carbon dating, contamination threatened every test. Solid carbon lampblack, then used in

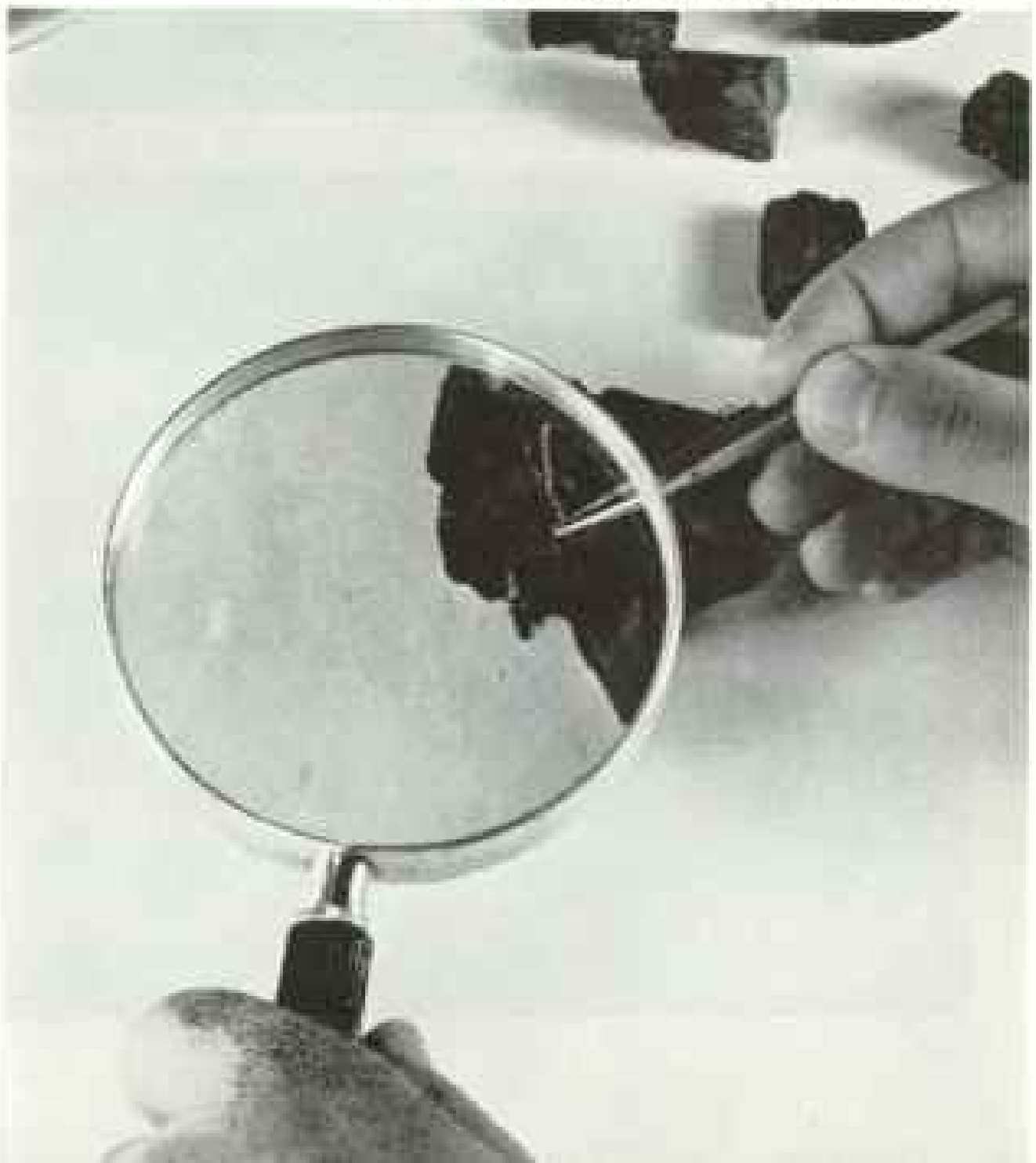
* See "Discovering the New World's Oldest Dated Work of Man," by Matthew W. Stirling, NATIONAL GEOGRAPHIC MAGAZINE, August, 1939.

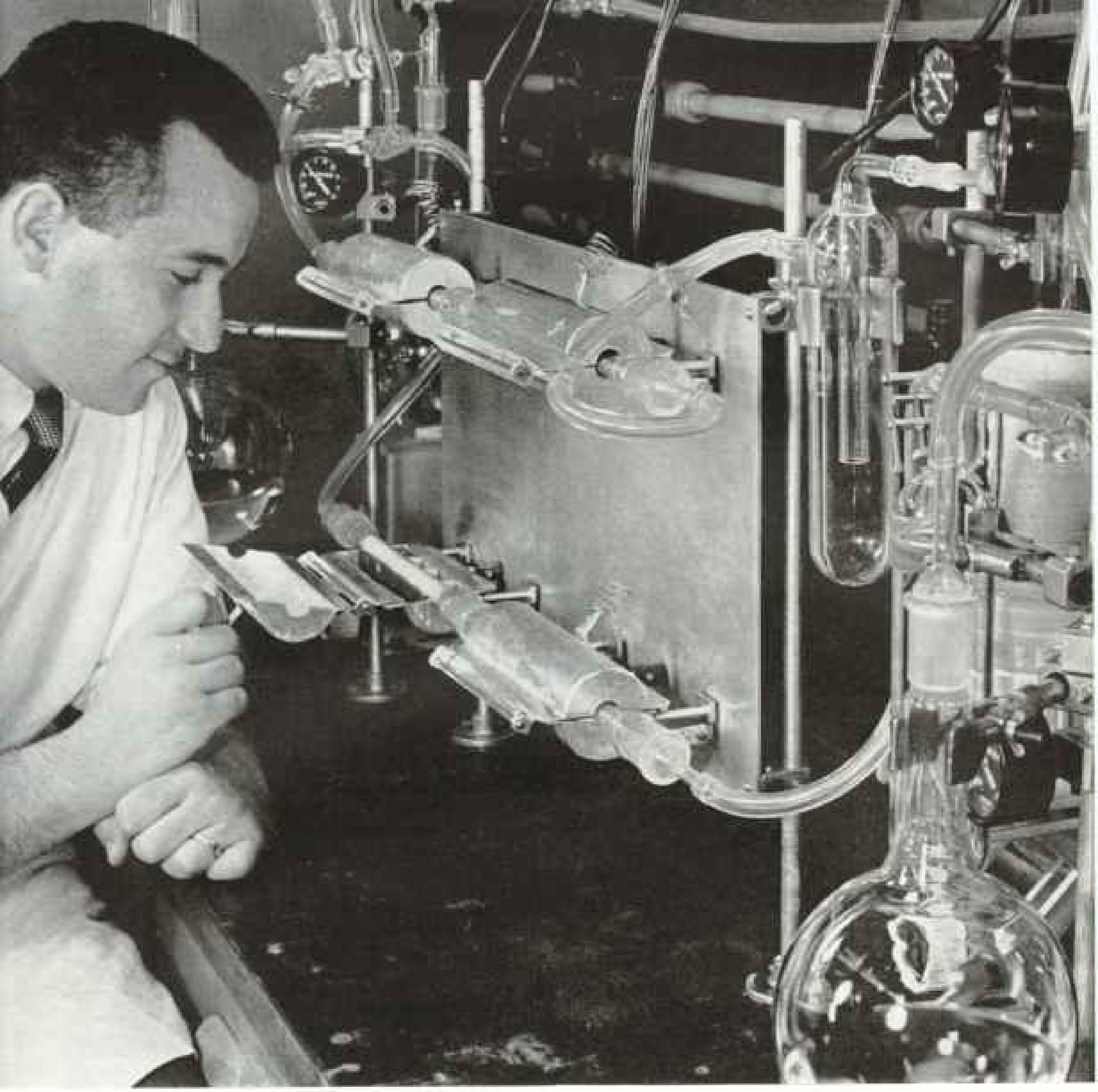
University of Pennsylvania Museum

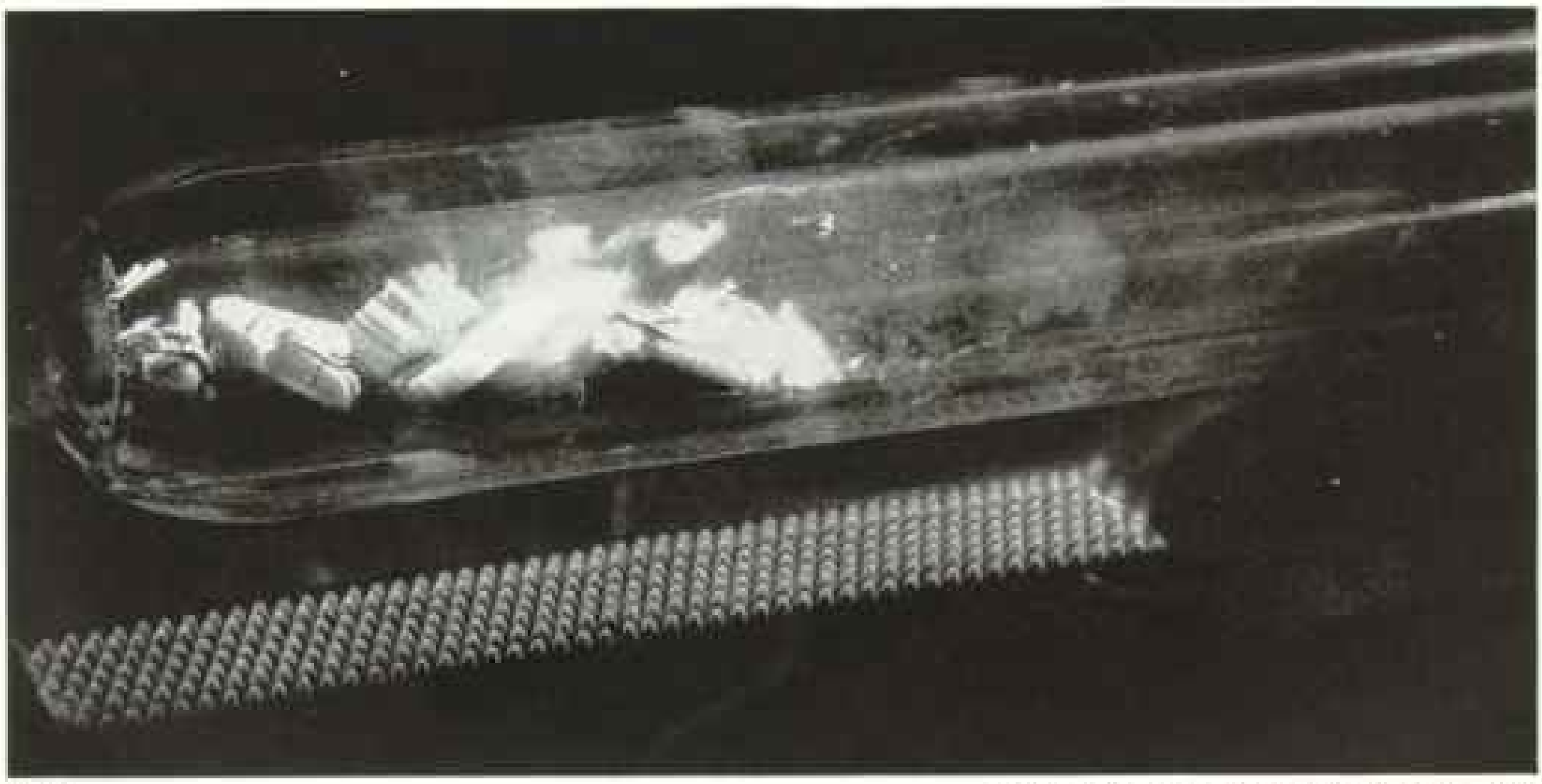
In a Syrian cave, excavators delicately probe for charcoal from a long-buried hearth. Carbon-dating archeologists now value charcoal as a major find on any expedition.

In the laboratory, tweezers pull a slender rootlet from a charcoal fragment. Such modern contamination would lend a false age to an ancient sample. Purification is the biggest problem in carbon dating.

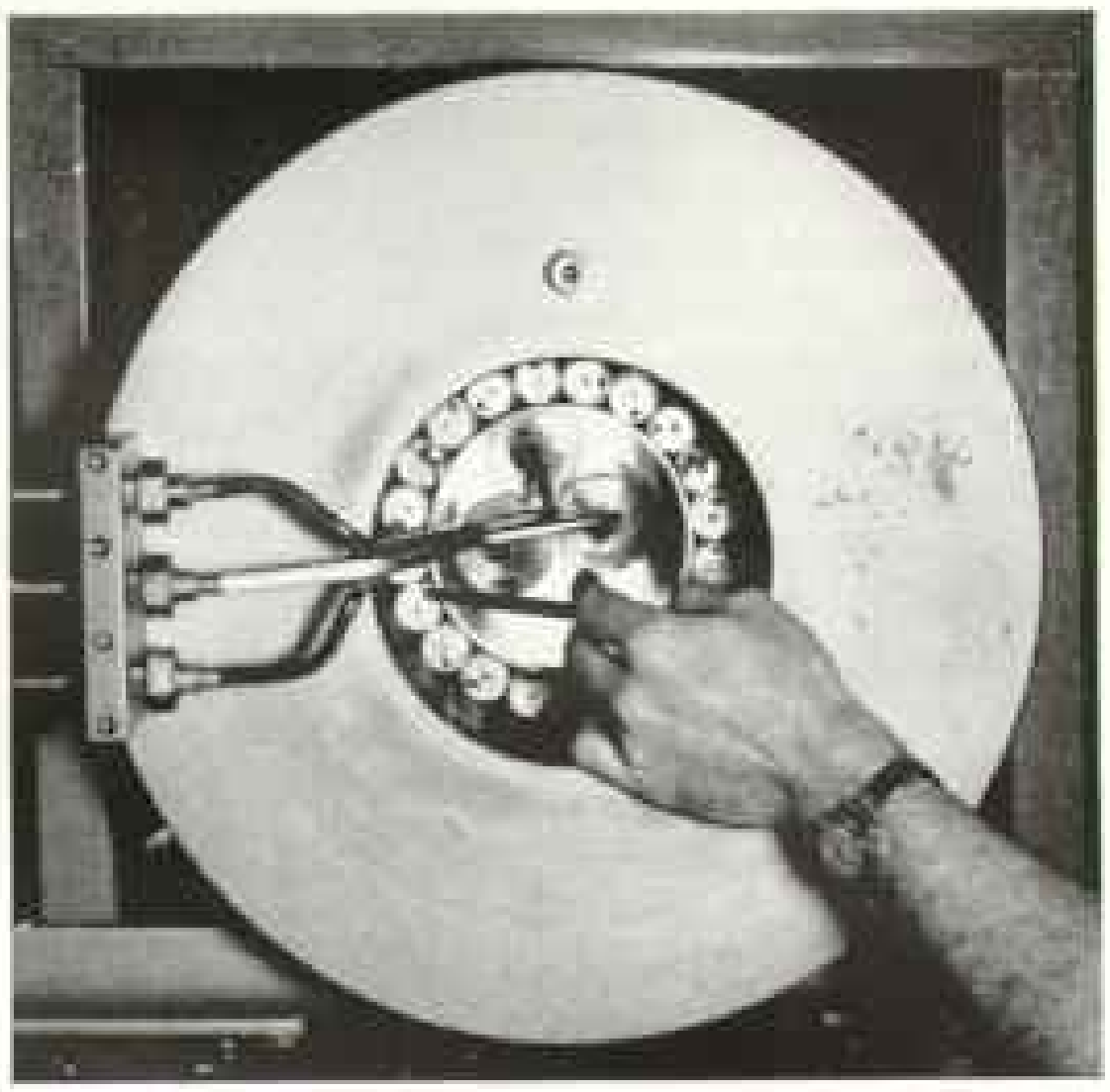
National Geographic Photographer Robert F. Sisson







National Geographic Photographer Robert F. Sisson



Heart of the carbon laboratory: the counter tubes at the ends of the three lead-in pipes (three samples can be tested simultaneously in this multiple counter). They hide deep inside a cannonlike steel jacket filled with mercury and lead. Any cosmic ray that sneaks past this shield must penetrate the circle of Geiger counters (indicated by pencil). These turn off the main counters when extraneous radiation passes through.

Tiny fingers of light flash on an electronic panel as carbon-14 atoms break down. Dials work like an electric meter, so the operator can read the total number of disintegrations at any time.

Most laboratories run their tests at least 1,000 minutes; some continue two days.

Chemistry, Physics, and Electronics Combine Their Skills to Date Carbon

Many visitors to a radiocarbon laboratory feel that they have stumbled onto a Rube Goldberg apparatus. The technique calls for batteries of complicated equipment.

◆Dating begins in the burning tube. There chunks of charcoal, bathed in a flow of oxygen, glow briskly at 2,000° F. Proper combustion leaves little ash.

Carbon dioxide from the firing now courses through a tangle of pipes, flasks, and valves, where chemicals extract impurities (above).

This Humble Oil & Refining Company geochemist inspects a bank of tiny electric furnaces at Houston, Texas. Carbon dioxide is passing over heated metals—silver wire and copper chips—that remove oxides of nitrogen and sulphur and other contaminants.

Substances vary widely in carbon content. It takes more bone than wood, for example, to produce the precise amount of gas needed for testing.

the counters, often picked up radioactivity while being dried in the laboratory.

To avoid this problem, most laboratories no longer put solid carbon into their counters. Instead they convert it to a measured amount of a gas containing carbon—carbon dioxide, acetylene, or methane. This gas, highly purified, stays inside the vacuum line; it is never exposed to the open atmosphere after the original sample is burned.

Air conditioners keep the air clean; in the Humble Oil & Refining Company laboratory at Houston, Texas, an electronic device precipitates any dust that might have sneaked past the air conditioners.

Such care is essential in these days of nuclear weapons testing. When solid carbon was still in use, radiocarbon laboratories had to close down for a month after each bomb test because of radioactive fallout.

Dr. Hessel de Vries, who runs an outstanding radiocarbon laboratory at the University of Groningen in the Netherlands, tells us that the amount of carbon-14 in the atmosphere has increased substantially since the beginning of hydrogen-bomb testing in 1954. Some recent studies show the increase to be as much as 10 percent.

"I first detected the change in the lowly snail," says Dr. de Vries. "We tested the

Deep in Shanidar Cave, Neanderthal Man Glowers Beneath Hooded Brows

Kurdish goatherds of Iraq's wild Zagros Mountains have long used Shanidar as a rude shelter from winter's blasts. Little did they realize that the cave's trampled floor is a deep refuse heap—that it tells a story of almost continuous habitation for perhaps 100,000 years.

American archeologists, slicing through yards of debris, last year uncovered spectacular remnants of Neanderthal Man, an Old Stone Age cousin of *Homo sapiens*. They found this individual beneath the rockfall that killed him. Carbon dating of strata above suggests that the man lived about 45,000 years ago, when the Neanderthal was dying out.

Apparently the right arm had withered and suffered amputation at the elbow. Smithsonian Institution scientists believe this to be the oldest known example of human surgery.

Ralph S. Solecki, Smithsonian Institution

flesh and the shell separately in our counters, and found to our surprise that the radioactivity of the flesh was higher than that of the carbonate in the shell.

"What has happened is clear: Bombs have added to the radiocarbon of the atmosphere, and plants quickly pick up the increased radiocarbon as they breathe in carbon dioxide. Snails eat the leaves, and their constantly changing body tissues in turn assimilate a higher proportion of carbon-14. But the shells, which do not change, reflect the smaller amounts of carbon-14 available when growth began."

Carbon dating is now so advanced that the technique itself offers few difficulties. The chief problem is to get samples that are free of impurities.

Worst enemy of the carbon dater is a tiny intruder, often so small that it can hardly be seen. Dr. Rubin showed us a piece of wood that was riddled with root hairs from other plants.

"This wood is useless for dating unless we can get rid of the rootlets," he pointed out. "The log may have been buried for thousands of years, yet the roots may have infiltrated it only recently. One percent modern carbon in a sample that is millions of years old will make the sample seem to be a mere 37,000 years."

Who Built Zimbabwe?

Even when the carbon scientist has pure samples and gets accurate dates, careful interpretation of the findings is important. A good example is the case of Zimbabwe, the mystery city of Southern Rhodesia.*

No historian can tell who built this dead city, nor can the Bantu-speaking tribesmen living near by. But its towered ruins and 30-foot-high walls of dry-stone masonry have excited speculation for generations: H. Rider Haggard wove his novel *King Solomon's Mines* around the mystery.

Could the founders have been Phoenicians? Or the ancient Sabaeans ruled by the Queen of Sheba? Could the crucibles for smelting found within the ruins mean that this was the gold-producing Ophir of Solomon's day?

Carbon-14 says that none of these theories is correct. Wood from Zimbabwe gives a carbon date of about A. D. 575.

But is Zimbabwe even that old? Experts point out that the wood in question is from the tambootie tree, which, when cut, releases an unpleasant, caustic sap. Since the wood decays very slowly, the Africans often use tambootie trees that have been dead for centuries, rather than cut new ones. So Zimbabwe may have been built much later than the carbon date suggests.

This story carries a moral that laymen (and sometimes even archeologists) tend to forget: Radiocarbon can date a tree and tell approximately when it died, but it can only *suggest* when the wood was turned into a beam or a coffin or a piece of charcoal. Interpretation by the archeologist must begin at that point.

More than a score of laboratories in the United States and abroad are now doing radiocarbon work. Veritable "date factories," some of them process a sample a day. In the words of one archeologist, "Dates are coming in like popcorn off the fire." The ages of more than 3,000 specimens have been published.

Carbon Dates the Ice Age

Which dates are most significant? Which best illumine the dateless oblivion of prehistory? We have posed this question to archeologists and geologists across the country. Their answers center on several momentous high lights.

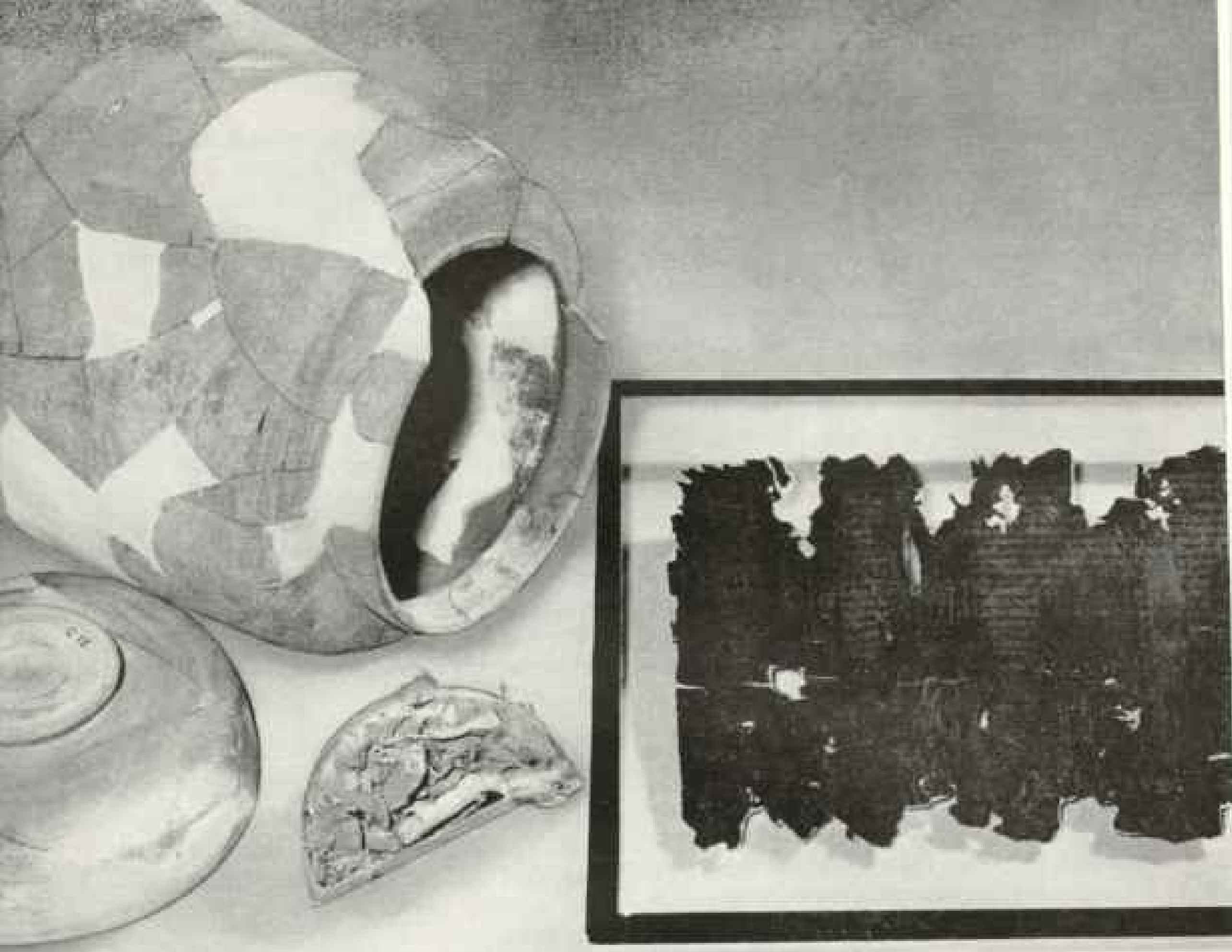
For one, radiocarbon has produced the first reliable chronology of the last glaciation. We now know that the Ice Age ended barely 10,000 years ago, only half as far back as scientists used to think.

Near the Wisconsin town of Two Creeks, along the western shore of Lake Michigan, the glacier's trail is clearly visible. The top layer of the shore cliffs, to a depth of about 20 feet, is nothing but glacial debris—red clay and rock bulldozed from the Lake Superior region, carried great distances by the advancing ice, and left behind as the glacier retreated.

Below this layer lies a stratum of peat, the remains of a spruce forest. Twisted stumps and splintered trunks, still preserved, bear witness to the relentless force of the giant ice sheet.

Geologists have long recognized that if the Two Creeks peat bed could be dated, we would know when the ice last invaded the United States. This so-called Valders advance, which killed the spruce forest, stopped only a few miles below Two Creeks. It was the last major thrust of the Wisconsin glaciation.

* See "Safari Through Changing Africa," by Elsie May Bell Grosvenor, NATIONAL GEOGRAPHIC MAGAZINE, August, 1953.



David S. Boyer, National Geographic Staff

which about 8,000 years earlier had crunched almost as far south as Cincinnati, then retreated.

Estimates had placed the destruction of the Two Creeks forest at about 23,000 B. C. But radiocarbon tests of the spruce wood and peat show that this date is much too high; the forest was overwhelmed at approximately 9000 B. C. Lake Huron and Lake Michigan were still half choked with glacier ice a thousand years later, and the ice did not completely leave the Lakes area until about 5000 B. C.

Pollen Tells the Story of Climate

A long list of carbon dates for other locations gives us a picture of the alternate dwindling and readvancing of the Wisconsin ice sheet over a period of 30,000 years. This timetable has been closely tied by radiocarbon to the movements of the Scandinavian ice sheet in Europe.

Three additional techniques of chronology assist radiocarbon in surveying glacier movements. One is the counting of varves, the thin annual layers of sediment left in glacial lakes by the melting ice.

Another is pollen analysis. Pollen, one of the most indestructible of organic things, survives for thousands of years in bogs and peat beds, silt deposits, and lake sediments.* When these geological formations are excavated, pollen samples can be taken from each layer, identified, and counted. The predominating pollen of each stratum tells what kind of vegetation thrived when the layer was deposited, and from this information specialists can deduce the climate of that period.

Spruce and fir spell cold weather; these trees grew right up to the edge of the glacier. But the appearance of pine pollen indicates retreating ice, and large amounts of oak and hickory pollen mean warmer weather.

A third piece of supporting evidence for the glacial chronology comes—surprisingly enough—from tiny marine animals known as

* See "Lifelike Man Preserved 2,000 Years in Peat," by P. V. Glob, National Geographic Magazine, March, 1954.

foraminifera. Shells of these abundant ocean dwellers make up the schoolroom chalk with which we are familiar. They collect in thick deposits laid down over thousands of years on the ocean floor.

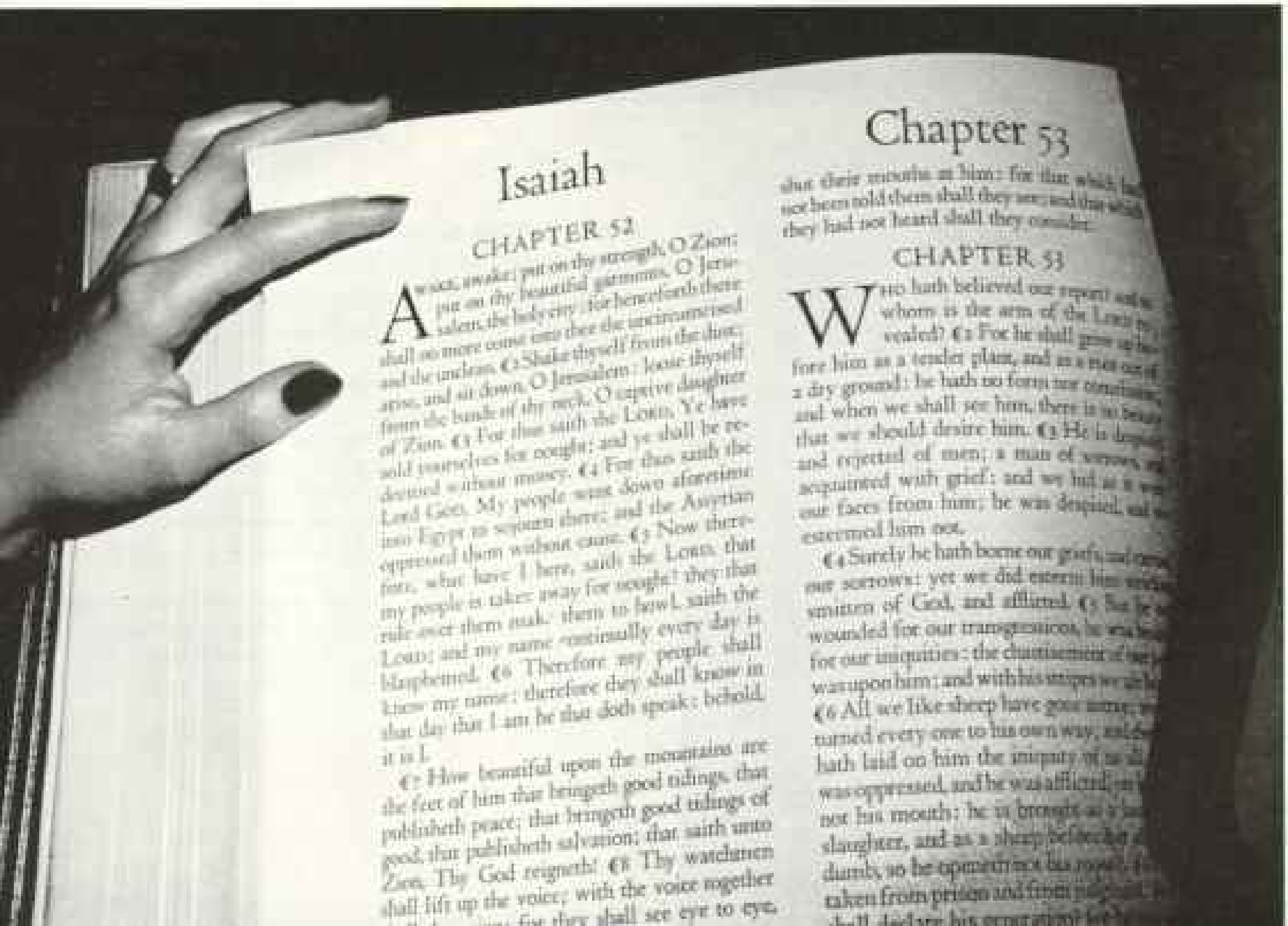
Dr. Cesare Emiliani at the University of Miami's Marine Laboratory can tell a good deal about the climate of the past by studying the shells of foraminifera picked out of long cores taken from the bottom of the sea. He gleans this information from a comparison of the amount of two kinds of oxygen—oxygen-16 and oxygen-18—found in the shells of different levels. His analysis hinges on the fact that foraminifera take up a smaller proportion

Carbon Dating Authenticates the Controversial Dead Sea Scrolls

Arabs discovered this copy of the Old Testament's Book of Isaiah in Palestine's 'Ain Fashkha Cave. Hand copied, the tattered document antedates other Hebrew Biblical manuscripts by 900 years. Testing of the scrolls' linen wrappings settled a conflict over their age and fixed them at about the beginning of the Christian Era.

Isaiah's familiar passage. "How beautiful upon the mountains are the feet of him that bringeth good tidings," appears below in the King James translation. An early Hebrew version, beginning with part of this verse, comes to light in the leather fragment at left. Latest editions of the Revised Standard Version of the Old Testament incorporate a number of minor changes based on the scrolls.

National Geographic Photographer John E. Fletcher



Isaiah

CHAPTER 52

Awake, awake; put on thy strength, O Zion; put on thy beautiful garments, O Jerusalem, the holy city: for henceforth there shall no more come into thee the uncircumcised and the unclean. ¶ Shake thyself from the dust; arise, and sit down, O Jerusalem: loose thyself from the bands of thy neck, O captive daughter of Zion. ¶ For thus saith the LORD, Ye have sold yourselves for nought; and ye shall be redeemed without money. ¶ For thus saith the Lord GOD, My people went down aforetime into Egypt to sojourn there; and the Assyrian oppressed them without cause. ¶ Now therefore, what have I here, saith the LORD, that my people is taken away for nought? they that rule over them make them to howl, saith the LORD; and my name continually every day is blasphemed. ¶ Therefore my people shall know my name: therefore they shall know in that day that I am he that doth speak: behold, it is I.

¶ How beautiful upon the mountains are the feet of him that bringeth good tidings, that publisheth peace; that bringeth good tidings of good, that publisheth salvation; that saith unto Zion, Thy God reigneth! ¶ Thy watchmen shall lift up the voice; with the voice together shall they sing: for they shall see eye to eye,

Chapter 53

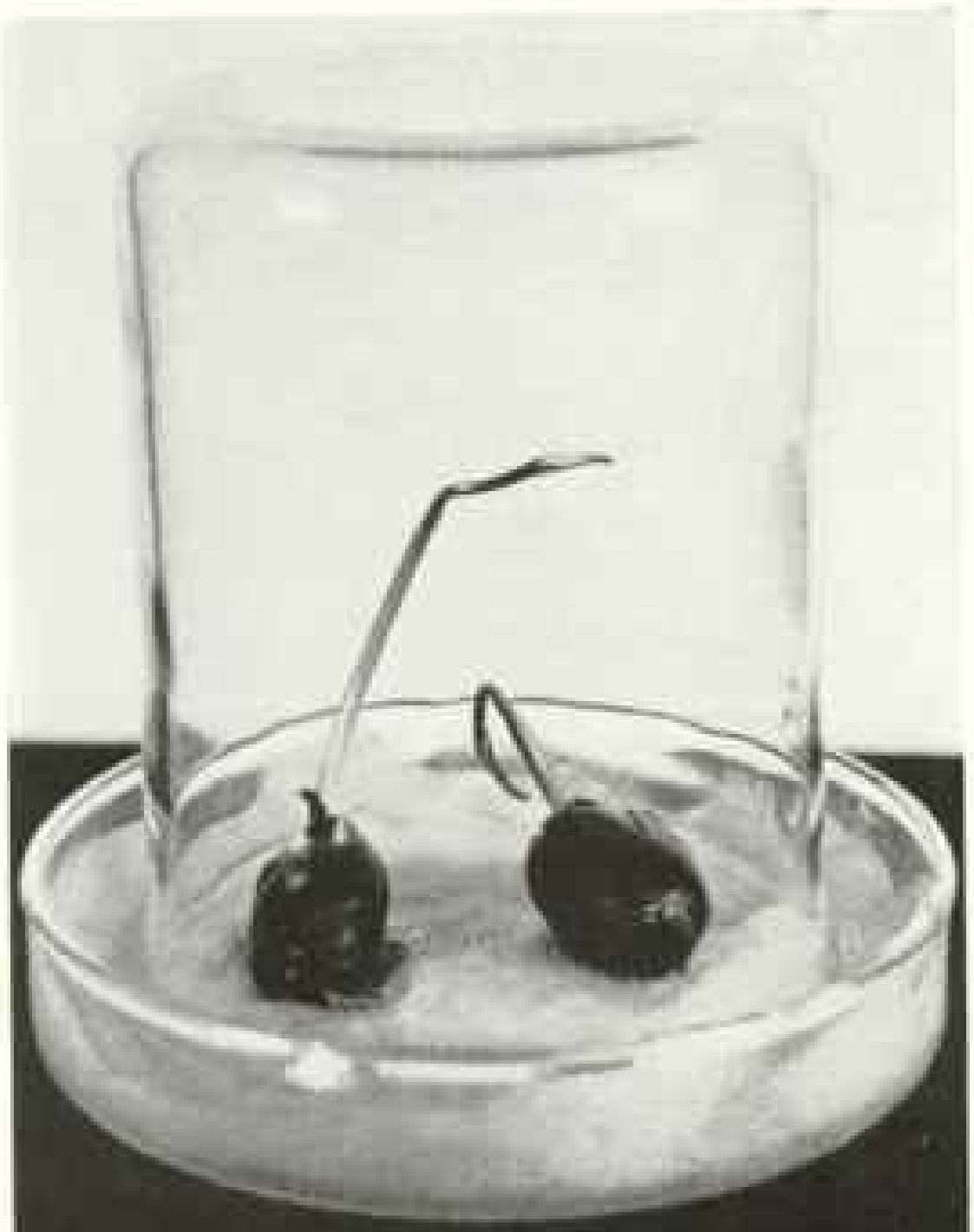
that their iniquity is pardoned: for she hath received of the LORD's hand double for all her sins. ¶ The voice of him that crieth in the wilderness, Prepare ye the way of the LORD, make straight in the desert a highway for our God. ¶ Every valley shall be exalted, and every mountain and hill shall be made low: and the crooked shall be made straight, and the rough places plain: ¶ And the glory of the LORD shall be revealed, and all flesh shall see it together: for the mouth of the LORD hath spoken it. ¶ The voice said, Cry. And he said, What shall I cry? All flesh is grass, and all the goodliness thereof is as the flower of the field: ¶ The grass withereth, the flower fadeth: because the spirit of the LORD bloweth upon it: surely the people is grass. ¶ The grass withereth, the flower fadeth: but the word of our God shall stand for ever. ¶ O Zion, that bringest good tidings, get thee up into the high mountain; O Jerusalem, that bringest good tidings, lift up thy voice with strength; lift it up, be not afraid; say unto the cities of Judah, Behold your God! ¶ Behold, the Lord GOD will come with strong hand, and his arm shall rule for him: behold, his reward is with him, and his work before him. ¶ He shall feed his flock like a shepherd: he shall gather the lambs with his arm, and carry them in his bosom, and shall gently lead those that are with young.

CHAPTER 53

Who hath believed our report? and to whom is the arm of the LORD revealed? ¶ For he shall grow up before him as a tender plant, and as a root out of a dry ground: he hath no form nor comeliness; and when we shall see him, there is no beauty that we should desire him. ¶ He is despised and rejected of men; a man of sorrows, and acquainted with grief: and we hid as it were our faces from him; he was despised, and we esteemed him not.

¶ Surely he hath borne our griefs, and carried our sorrows: yet we did esteem him stricken, smitten of God, and afflicted. ¶ But he was wounded for our transgressions, he was bruised for our iniquities: the chastisement of our peace was upon him; and with his stripes we are healed. ¶ All we like sheep have gone astray; we have turned every one to his own way; and the LORD hath laid on him the iniquity of us all. ¶ He was oppressed, and he was afflicted, yet he opened not his mouth: he is brought as a lamb to the slaughter, and as a sheep before her shearers is dumb, so he openeth not his mouth. ¶ He was taken from prison and from judgment:

Abbie Rowe, National Capital Parks



A Seed That Slept a Thousand Years Gave Birth to This Lotus Blossom

Carbon-14 startled the biological world when it dated living lotus seeds from an ancient Manchurian lake bed as 10 centuries old.

Horace V. Wester of the National Park Service has demonstrated they can grow and flower. He filed through the rock-hard outer husks, then nursed the seeds on wet cotton (left). Within a week they germinated. In the Kenilworth Aquatic Gardens at Washington, D. C., Mr. Wester was rewarded with a pink bloom (above). Visitors see a new burst of flowers each July.

This link with the ancient world has since been surpassed by much older living lotus seeds from an excavation in Japan. Samples of wood found with the seeds registered 3,075 years in Dr. Libby's counter (page 237).

of oxygen-18 when the climate is warm than when it is cool.

Dr. Emiliani's cores give striking evidence of strong oscillations in world temperature. And the curves he has drawn to show these fluctuations closely parallel the picture of glacial retreats and advances sketched by radiocarbon, varve, and pollen studies.

Man Becomes a Farmer

A second contribution of the new dating techniques is to extend our knowledge of the beginning of agriculture back an additional 2,000 years. For this we can thank Dr. Robert J. Braidwood, of the University of Chicago's Oriental Institute, who has excavated, in the Kurdish hills of northern Iraq, the earliest known agricultural village. Its name is Jarmo, and its radiocarbon age is about 9,000 years, determined just a few months ago by Washington's Geological Survey laboratory.

"Some 4,000 years before historic times, Jarmo's people grew barley and two kinds of wheat," says Dr. Braidwood. "They made flint sickles with which to reap their grain, milling stones on which to crack it, and ovens in which to parch it. We are sure they had the domesticated goat, and possibly also sheep, pigs, dogs, cattle, and horses. They left behind an astounding variety of bracelets, magnificent stone bowls, and figurines."

Why should a forgotten mud town like Jarmo be important to us today? Because civilization was not possible until man gave up hunting and the gathering of wild food as a way of life, settled on the land, and learned the time-saving skills of agriculture. The time at which man first became a farmer is therefore regarded by scientists as the first truly crucial period in history, even greater in its impact than the industrial revolution. Only after this development do we see the appearance of political organization, architecture, temples, public works, monumental art, and writing—the hallmarks of civilization.

Early Man Comes to America

The third major contribution of radiocarbon is the light it throws on the history of man in the New World.

The first creatures who could be called human presumably lived in Africa or southeastern Asia. There we find a few crude stone tools and extremely old fossil remains estimated to be roughly half a million years old.

Apparently it took a very long time for Early Man to discover the bridge between Asia and the Americas and to cross the Bering Strait. Skeletal remains of ancient men in the Americas are so rare that it used to be a common notion that the Indians had been in the New World only a few centuries before Columbus. As recently as the 1930's, so well known an anthropologist as Aleš Hrdlička scoffed at scientists who suggested that the Indians might have been here much earlier than the beginning of the Christian Era.

If Dr. Hrdlička were alive today, he would be forced to revise his views substantially. Radiocarbon says that men armed with stone-tipped spears were hunting mammoth, bison, horse, and tapir in Arizona at least by 10,000 B. C., and quite possibly earlier. These early Americans were inhabiting Illinois's Modoc Rock Shelter by 8000 B. C. and Alabama's Russell Cave by 7000 B. C. They had pushed all the way to the Strait of Magellan, near the tip of South America, by 6700 B. C.*

The dim beginnings of agriculture in the New World seem to go back beyond 4000 B. C., for primitive maize appears in New Mexico's Bat Cave with charcoal of that age.

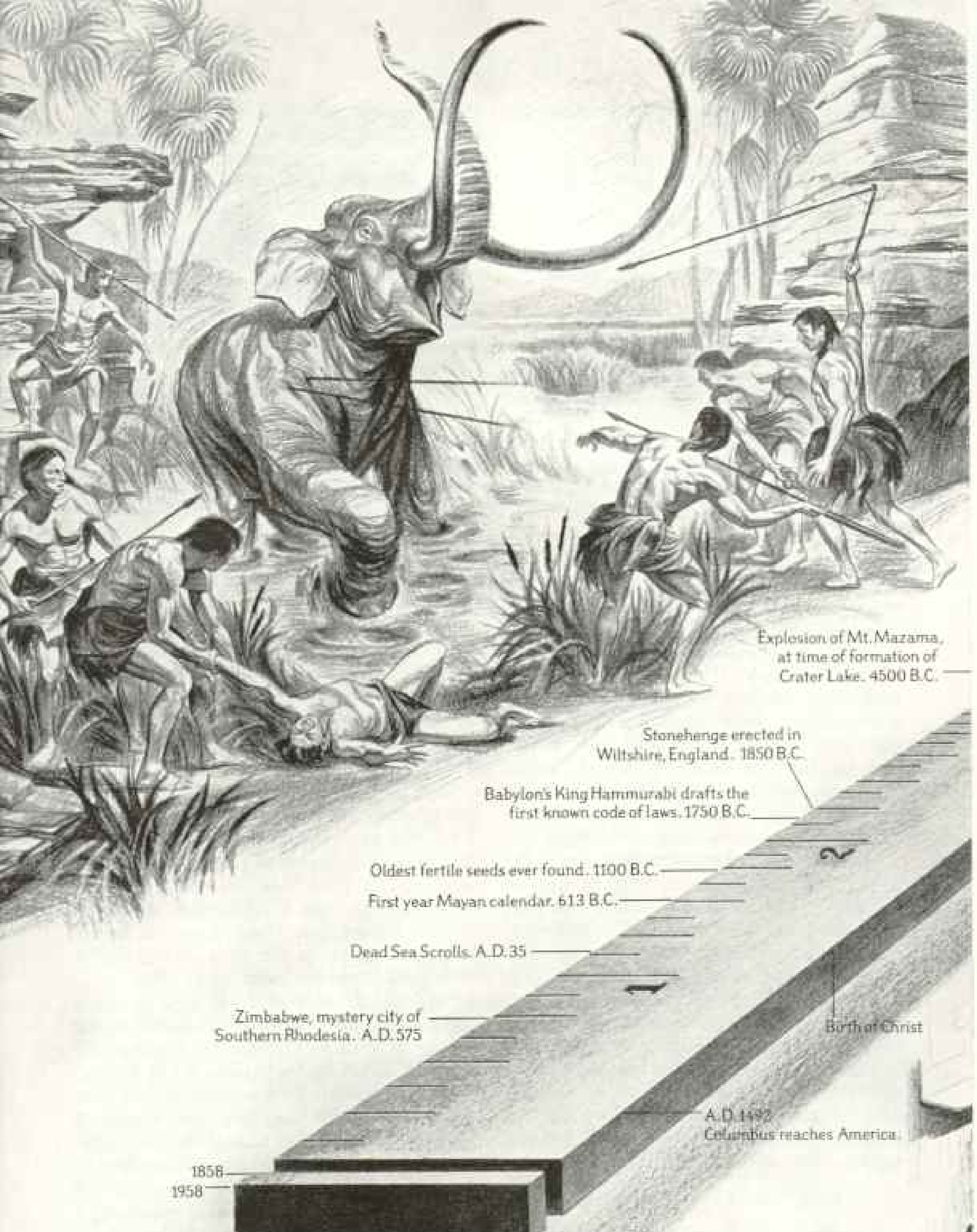
Ancient Copper Mines on Isle Royale

How old is America's copper industry? Few would guess the answer: nearly 4,000 years. That long ago, charred wood tells us, aborigines worked thousands of pits on Isle Royale, Michigan, in Lake Superior, now a national park. For at least a millennium these prehistoric miners, who threw water on heated rock to crack loose the pure metal, traded their product as far south as Florida.

Benjamin Franklin may well have known of the ancient mines when he arranged at the Treaty of Paris in 1783 for the boundary of the new United States to include Isle Royale.

One somewhat controversial radiocarbon date suggests an antiquity for aboriginal Americans of 35,000 B. C. and beyond. After recent excavations for a Trinity River dam at Lewisville, Texas, near Dallas, a number of "hearths" came to light. These consisted of circular patches of fire-reddened clay, which yielded quantities of charcoal and animal bones and a beautifully worked flint spearhead. Two samples of the charcoal, tested at the Humble laboratory in Houston, showed so

* See "Ice Age Man, the First American," by Thomas R. Henry, National Geographic Magazine, December, 1955.



A Radiocarbon Yardstick of Time

Carbon-14 Throws a Searchlight Beam into Man's Misty Past

Before development of radioactivity techniques, scientists could seldom date the scraps of the past unless they had the rare assistance of king lists or native calendars. Even tree-ring chronologies, valuable as they are, can go back no farther than the bristlecone pine (above), whose 4,600 years make it the oldest known living thing.

Now, in the carbon laboratory (left), science pushes man's dim horizons back 60,000 years. Radiocarbon's atomic clock unfolds dramatic glimpses of our remote forebears evolving from primitive hunters to civilized agriculturists.

little radioactivity that they were beyond the 37,000-year range of the equipment.

It is only fair to say that many archeologists raise their eyebrows over this case. The spearhead is of the fluted Clovis variety, frequently found all over the United States and usually estimated to be 10,000 to 15,000 years old. Nowhere in the Old World, where flint working had developed for hundreds of thousands of years, is anything as fine as this known to have been produced by 35,000 B. C.

So it is that radiocarbon, in helping to solve the riddle of when man first came to the New World, has temporarily, at least, helped create new riddles of its own.

Carbon Reaches Back 70,000 Years

Most American laboratories find 35,000 to 45,000 years about maximum for their equipment. But Dr. de Vries at the Groningen laboratory has worked out a method of concentrating his samples until he can detect radiocarbon with as little as 1/2000 of the original radioactivity left. He has dated 60,000-year-old wood unearthed at Amersfoort in the Netherlands, and he reports that his instruments are delicate enough to go back 70,000 years. This, Dr. de Vries believes, may well be the practical limit for radiocarbon.

Fortunately, where carbon leaves off, a variety of other substances takes over.

At the recent end of the scale is tritium, a radioactive variety of hydrogen, produced by cosmic rays in the upper atmosphere. Like ordinary hydrogen, it combines with oxygen to form water, and in exceedingly small quantities is found in rain. It disintegrates very rapidly.

Because nuclear bomb tests in the 1950's have greatly increased the amount of tritium in the atmosphere, this rare substance can be used to tell how long water has been underground. A rancher in the arid West, for example, can have his well tested for tritium. If the water shows a high concentration of this "heavy" hydrogen, the well is being replenished by recent rainfall that has been "tritiated," and, with reasonable use, the water supply will probably continue.

At the ancient end of the scale such radioactive substances as uranium, rubidium, and potassium enable us to date the rocks and the earth itself.

"The poor world is almost 6,000 years old," wrote Shakespeare in *As You Like It*. This figure apparently had ecclesiastical support in that day, for in the middle of the 17th century Anglican Archbishop Ussher proclaimed that the earth was created in 4004 B. C. A few years later a vice chancellor of Cambridge University refined this estimate by declaring that Adam's creation took place at 9 o'clock on Friday morning, September 17!

With the growth of scientific knowledge, man soon found that he must raise his sights regarding geologic time. Studies of the rocks suggested that they might be millions of years old. Then about 1900 an Irish scientist named Joly calculated an age for the earth by measuring the amount of salt in the oceans. He figured that it must have taken close to 100 million years for rivers and streams to pour that much salt into the seas.

For a quarter of a century people generally accepted Joly's estimate of 100 million years. But by 1930 new discoveries in geology and radioactivity persuaded geologists to increase this figure 20 times, and an age of two billion years for the earth became fashionable.

Quite recently scientists have more than doubled this figure. Their newest calculations, based on measurements of the decay of radioactive materials in the rocks, such as potassium and rubidium, show an age of about 4.5 billion years for our solar system, including the earth. "Now," in the words of Adolph Knopf, one of the most distinguished of American geologists, "the end of the enormous lengthening of time appears to be in sight."

Meteorites Are as Old as the Earth

Oddly enough, the oldest formations which have been dated so far—from Southern Rhodesia—are only about 3.3 billion years old. Before that time the earth's crust was presumably still undergoing tremendous transformations from heat and pressure.

For this reason geologists date meteorites as a final check on earth's antiquity. Astronomers believe that meteorites are part of the debris left over from the formation of the sun and its planets, and are therefore of the same age as the solar system. Geochemists have made exquisitely delicate measurements of radioactivity in meteorites, and their findings support the figure of 4.5 billion years since the start of earthly time.

With our new knowledge about the age of the rocks, we know something about the age of life itself on earth, for we find fossil algae in the oldest rocks yet dated. Actually such ultraprimitive fossils are about all we do find

in the rocks for 90 percent of the earth's history. Only in the great geologic era known as the Paleozoic, beginning about 500 million years ago, do usable fossil records of more advanced types of life appear. And man himself did not come on the scene until about the last half-million years—within the last few moments of geologic time.

The Age of the Stars

In the past several years the oldest of all things have been dated with new accuracy. Research in astrophysics has told us a great deal about the atomic furnaces we call stars and has substantially increased the ages we give them.

By the color and brightness of a star, astronomers can tell its temperature. Blue stars are the hot ones; they are rapidly using up their supply of hydrogen and will soon burn out to become clinkers on the stellar ash heap. Red stars are cooler; they burn more leisurely and last for vastly longer periods. By studying star clusters and calculating to what level of brightness the stars in the cluster have already burned out, the astronomer can get a good approximation of how long the cluster has existed.

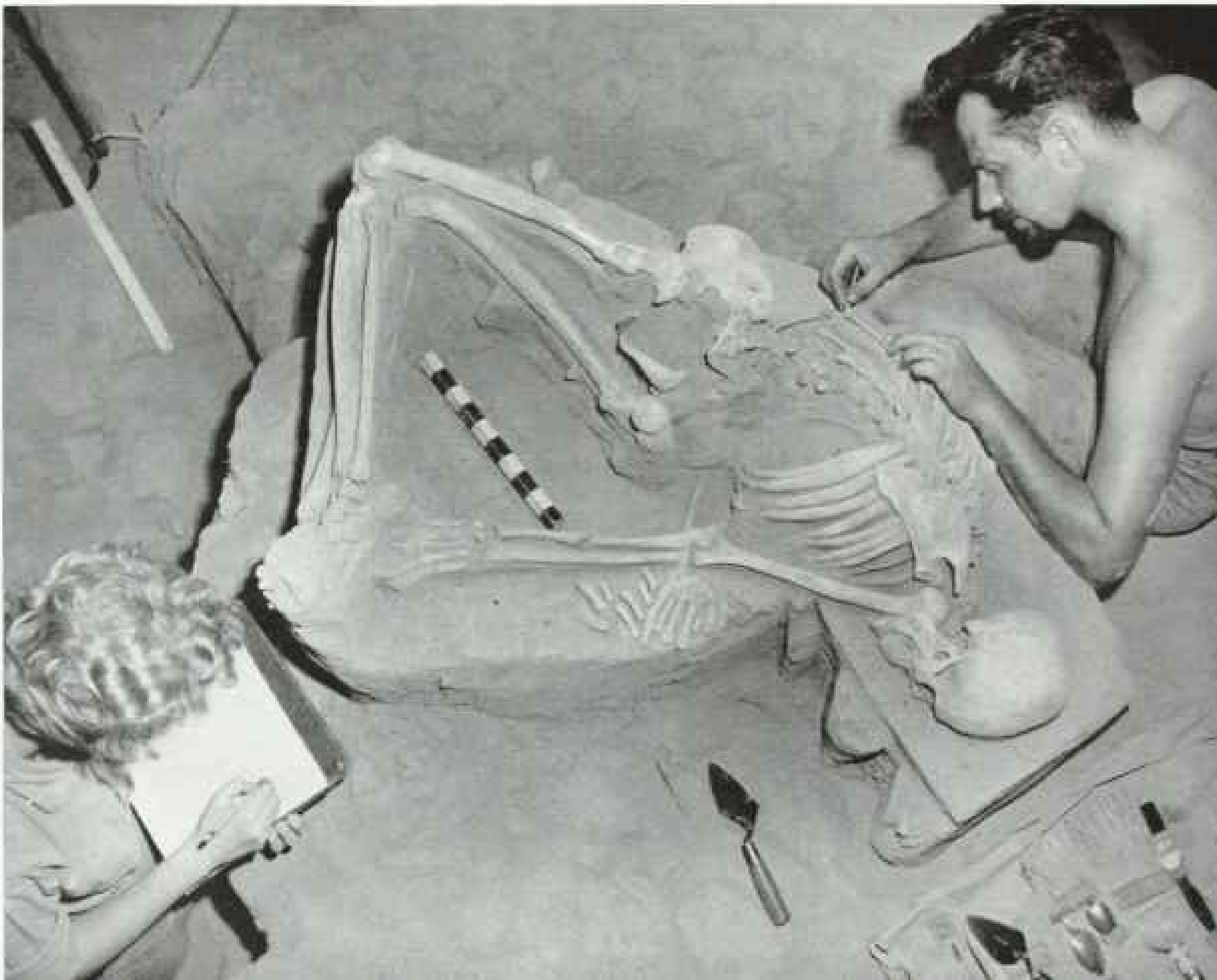
The youngest stars yet observed are a mere million years old. The oldest cluster we know has been blazing for six billion years, about a third longer than the life of the earth itself.

When man contemplates his own youth and insignificance in the face of such incomprehensible age, he can but recall the words of the Psalmist: "For a thousand years in thy sight are but as yesterday when it is past, and as a watch in the night."

Early American Comes to Light: Carbon Says He Lived in 4000 B. C.

What appears to be man's earliest record in the eastern United States has been found at the Modoc Rock Shelter in southern Illinois. Evidence from the lower levels of the cavelike shelter indicates that Early Man lived there 10,000 years ago. Here archeologists from the Illinois State Museum meticulously excavate a find. No one knows why the skeleton lies in its peculiar twisted position, with legs seemingly bent the wrong way.

John H. Gerard



OFF SANTA BARBARA:

California's Ranches in the Sea

BY EARL WARREN, JR.

Illustrations by National Geographic Photographer Bates Littlehales

GULLS clamored in the wake and porpoises played in our bow wave as *Seeker*, her twin engines thundering, moved away from the California coast in the early morning.

"Full speed for the islands, skipper," said Reg Parton. "I can't wait to see Bates taking pictures of the hogs that charge trucks."

"And the sheep that can run 30 miles an hour," chimed in Pete Peterson from the wheel of the 38-foot cabin cruiser.

"How about the cave of the swimming lions?" I asked.

"And the mermaids with the brown eyes big as tennis balls," countered Bates Littlehales, National Geographic photographer. "You fellows have any more cock-and-bull stories for me this morning?"

"Sure," I said. "Prehistoric men may have barbecued midget elephants in the Santa Barbaras 30,000 years ago." But Bates had gone below to

Pacific swells wash rocky Anacapa and distant Santa Cruz

The Author

Earl Warren, Jr., has been interested in the Santa Barbara Islands since boyhood visits with his father, former Governor of California, now Chief Justice of the United States and a Life Trustee of the National Geographic Society. After graduation in animal husbandry from the University of California, the author studied these lonely islands in detail and wrote an authoritative treatise on the agriculture of Santa Cruz, largest of the group.

With their two small children and large black dog, a Labrador retriever, the Warrens live in Oakland, California. Mr. Warren, until recently a State agricultural officer, is now studying law.

---

sort out his cameras. We three chuckled. We had been to the Santa Barbaras before. Cock-and-bull stories? Bates was due for some surprises.

From Point Conception to Ventura the coast of California trends east and west. Within 30 miles of the mainland lie the four Santa Barbara Islands—Anacapa, part of a national monument; Santa Cruz and Santa Rosa, privately owned ranches; and San Miguel, an old ranch that is now a military rocket and bombing range (map, pages 260-61).

Islands Mapped 400 Years Ago

With four others they make up the Channel Islands of California. To the south and east lie the other four, one of them the famed tourist isle of Santa Catalina, known far and wide. But our concern this cruise was with the northern group.

A lot of people do not even know these islands exist. This is strange, for they have been on maps for 400 years and loom out of the blue ocean within sight of one of the most densely populated parts of the United States.

Present owners encourage the isolation. To visit any of the Santa Barbaras except in emergency, you must have a written landing permit, and you need good reasons to get it. Laws against trespassing are rigidly enforced. The ranching companies of Santa Rosa and Santa Cruz have told me why they are so exclusive.

"We used to welcome visitors," one cowman said, "but the price we paid was too high. Our worst trouble was with carelessly set fires. Some of the land burned over this way will never produce grass again. Sometimes for meat, other times for no good reason, people killed our stock. They even took shots at our cowboys."

Obviously, the Navy can't have unheralded visitors on San Miguel. An erratic rocket might hit somebody. Quite as obviously, rifle plinkers aren't needed on Anacapa, where there is an important light and a complement of Coast Guard families to serve it.

We knifed across wind-swept Santa Barbara Channel with its swirling currents, our destination Santa Rosa. All necessary landing permits were stowed with the charts. Handling the boat was a blue-ribbon crew—tough, capable outdoorsmen Preston Peterson and Reg Parton, both motion picture stunt men.

Pete is a remarkable waterman. As swimmer, skin diver, water skier, surfer, and boatman he has few equals. Reg Parton falls off galloping horses expertly, but he can also handle an underwater fight scene.

Seeker, lavishly equipped for cruising, belongs to movie star Rory Calhoun. We had the use of her through Pete and Reg, for they and Rory are good friends. She started life as a Navy picket boat.

Bates, through previous assignments afloat, and I, from years of skin diving, at least knew enough about boats to keep out of the crew's way. This we did as Pete and Reg rounded up in Beechers Bay at Santa Rosa and dropped anchor off the long ranch pier (page 269). Bates, still half-seriously complaining about tall stories and what did we take him for, anyway, nevertheless consented to join us in the dinghy, and we rowed ashore.

Sheep and Hogs Run Wild

A brisk walk inland brought us to the ranch house, where three shaggy dogs noisily announced our arrival. Hayden Hunt, ranch foreman, quieted them.

"Howdy," he said. "Don't mind the dogs. Come in and have some coffee." While the pot was going the rounds, Hayden told us tales of the islands.

Wild sheep and hogs, he said, have roamed here for a very long while. According to tradition, early Spanish explorers, cruising the

Divers Pluck Spiny Lobsters from Rocky Lairs off Santa Cruz Island

Author Warren and three companions explored these volcanic crags while cruising among the seldom-visited Santa Barbara Islands. On the four lonely islets, only a few miles from the California mainland, they found extremes of verdant growth and desolation and a variety of unusual wildlife. Few people live there now, but Indian inhabitants roamed the islands for thousands of years.

Here at Santa Cruz, largest of the chain, the visitors turn lobster hunters. Rubber suits protect them from the chill water as they plunge to depths of 30 feet.

Mountaintops Jutting out of the Pacific Form California's Channel Islands; Only

California coast, left ancestors of these animals on the larger offshore islands as a possible food supply.

The sheep do indeed possess many of the best characteristics of old Spanish stock. Over the years, however, they have mixed with other strains brought to the islands. In most cases today the wild sheep and hogs are regarded as nuisances.

"On Santa Rosa we've eradicated almost all of them," said Hayden. "The hogs were big rangy fellows that looked like European wild boars. They tore down fences and rooted up hillsides. Then, after the rains, topsoil on the hill washed into the valley."

He admitted that hogs, when provoked, had occasionally attacked his cowboys.

"And trucks, too?" asked Bates.

"Didn't Earl tell you?" replied Hayden. "He has the mounted head of an old boar that kept charging a power wagon until he knocked himself out."

Bates mumbled something about a conspiracy and subsided.

A Sheep That Herds Dogs

The Vail & Vickers Company of Los Angeles owns Santa Rosa. It specializes in Hereford cattle, but runs a few Aberdeen Angus there as well. Except at roundup time, when extra hands come from the mainland, five cowboys, a cook, and Hayden Hunt operate the big ranch.

Until the turn of the century Santa Rosa was a sheep ranch, carrying as many as 80,000 head. Borrego, a ranch pet living a lazy barnyard life, is the last of them, except for a few wild strays on a remote part of the island. Several years ago cowboys found Borrego as a lost lamb.

The big wether's ears were tipped with brown, indicating North African blood that was probably brought to Spain by the Moors. A fold, or "apron," across his chest showed kinship with Spanish Merinos. His face was black, showing the infusions of Hampshire or Suffolk blood introduced by ranchers in modern times.

"He sure gets his manners from the conquistadors," observed Reg. Borrego was pushing the three dogs around as though he were a haughty don and they were the poor Canaliño Indians the Spaniards found on these islands 400 years ago.

Grass to Delight a Rancher's Heart

In a converted military cross-country vehicle we struck out on a good dirt road through the range. Peaks towered 1,500 feet above lush green fields. Here and there lay bare arroyos, brushy ravines, and wooded canyons, but mostly there was grass on the land to delight a cattleman's heart.

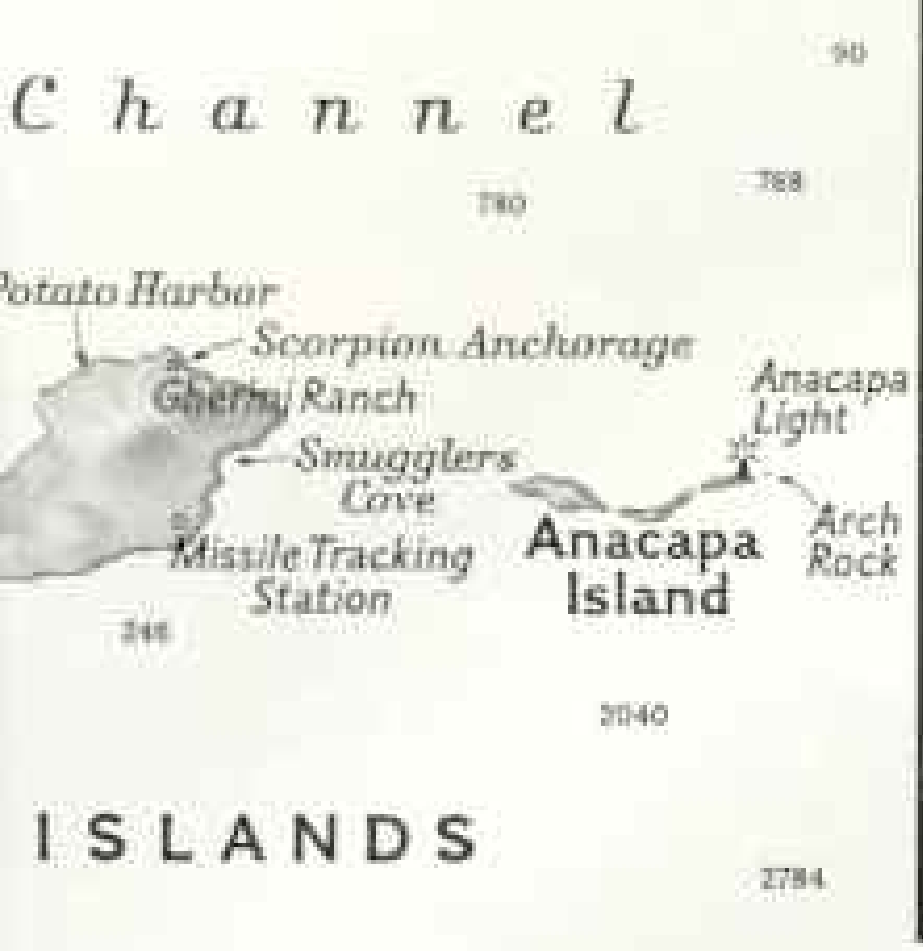
A tiny fox with big ears peered at us from tall grass beside the road. We stopped. The animal showed no sign of fear. At Hayden's suggestion Bates crouched behind a rock. The curious fox trotted over to see what was going on, and Bates had it in range to make its portrait (page 268).

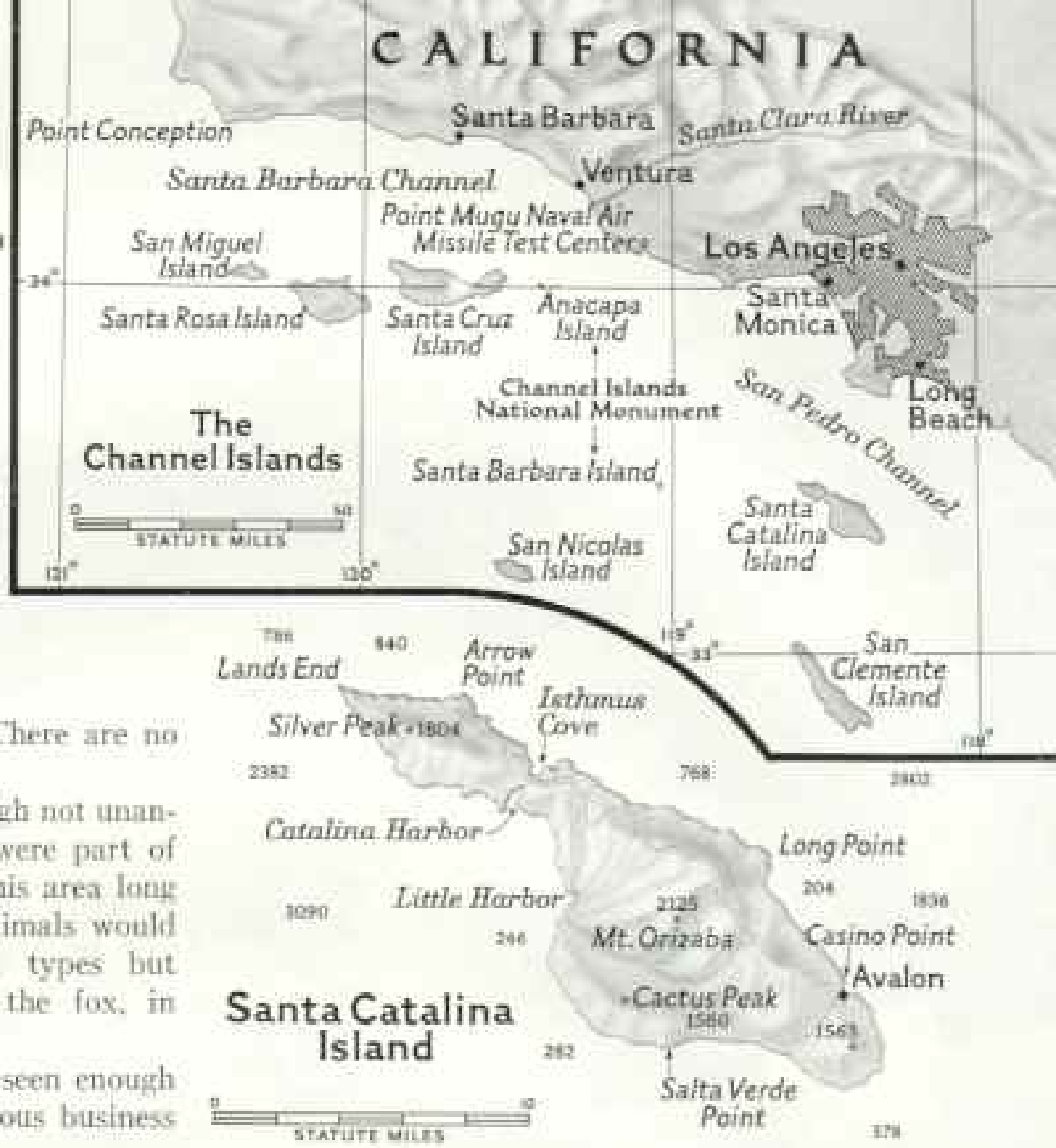
"If you lie down, they'll come and sniff you, or maybe walk on you," said Hayden.

This was the celebrated island fox, a dwarf species of gray fox, one of several kinds of animal life that exist nowhere except on the strange Channel Islands. The others include a spotted skunk, a large white-footed mouse, and a friendly jay.

About the size of a large cat, the fox was bright orange and silver gray. I commented on its tiny muzzle.

"Maybe that's because he eats only grasshoppers and mice and other small things," said Hayden. "Mainland foxes have jaws





Santa Catalina Welcomes Visitors

big enough to handle rabbits. There are no rabbits on Santa Rosa."

The scientific consensus, although not unanimous, is that the islands once were part of the mainland. The sea rose in this area long ago (page 266). The native animals would thus have started as mainland types but changed physically, as witness the fox, in the new island environment.

The fox finally decided it had seen enough of us and went on about the serious business of chasing grasshoppers.

"Ah, what a life," said Pete. "Chow everywhere, nobody to hurt him. . . ."

Then, from the sky above, two black feathery missiles dove on the tiny fox and tumbled it end over end. Leaping to its feet, the fox stood on hind legs and held off a second attack with wildly waving forepaws. Before its attackers could regain altitude for a third dive, it ducked under an overhanging rock.

"Blasted ravens," growled Hayden. The American raven looks like an outsized crow but has a somewhat different voice.

We took to the truck again. Crossing a ravine we flushed a wild hog. It went charging off into a stand of cactus that would have stopped a horse. Bands of cattle bounced playfully in our wake, heads tossing in mock challenge. Horses, their chunky bodies and fine limbs showing good Morgan blood, seemed to be everywhere.

"We work hard here on the islands," said Hayden, "but give the horses long rests between working days. The system calls for plenty of mounts."

Radar Keeps 24-hour Watch

On a ridge we saw a big Air Force radar station. Here the 669th Aircraft Control and Warning Squadron keeps a 24-hour watch on the sky approaches to southern California, checking every aircraft that comes into range.

Let an unidentified plane appear in the scopes, and instantly the duty men on Santa Rosa alert the nearest mainland-based fighter group to challenge the intruder. More than 200 men operate the station.

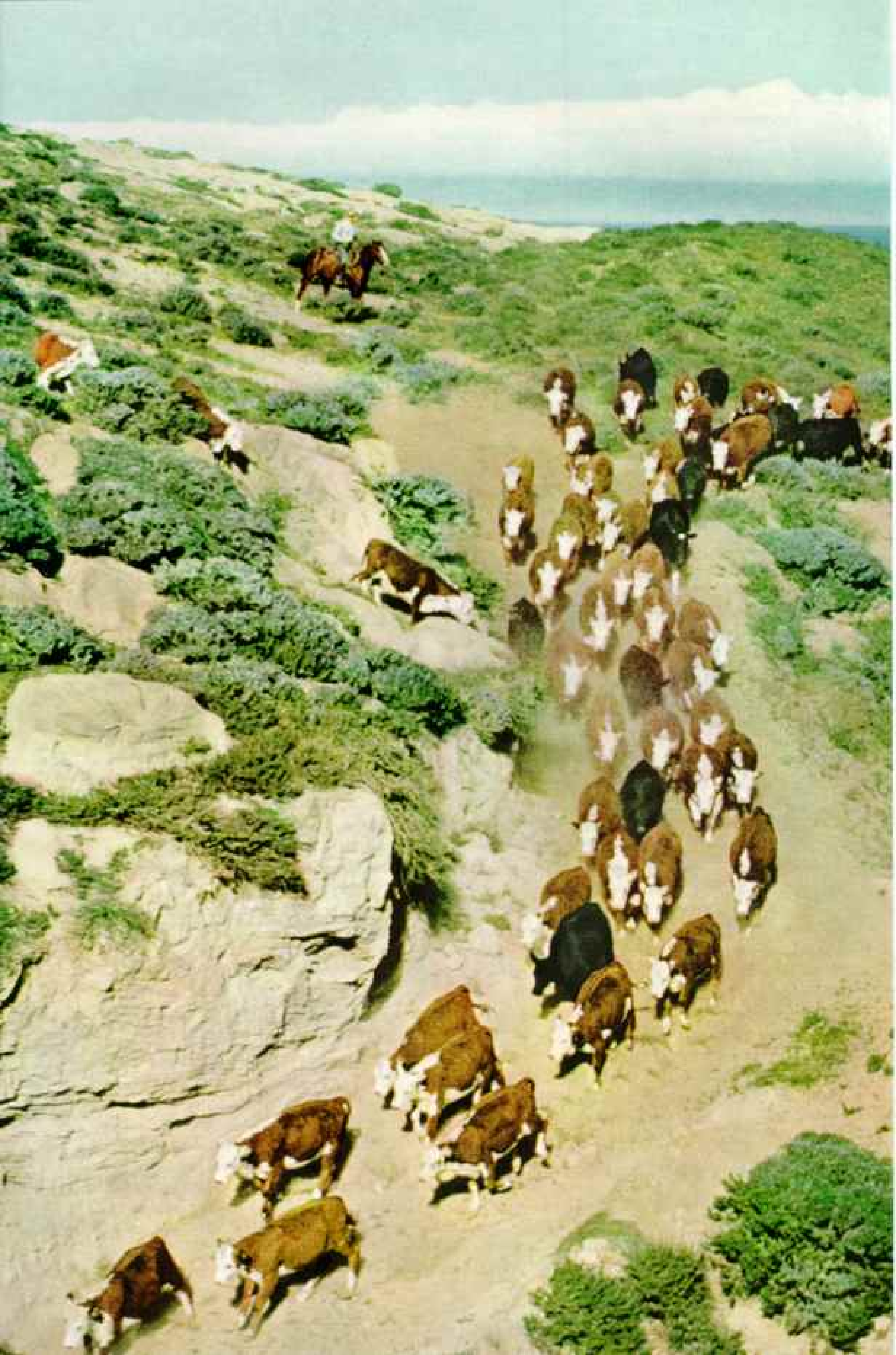
Archeologists were busy on the island; in the past decade the remains of 160 Indian villages have been discovered. The latest excavations were conducted by the Santa Barbara Museum of Natural History, the Western Speleological Institute, and the National Geographic Society.

Were Men Here 30,000 Years Ago?

"On Santa Rosa," said Phil C. Orr, director of the Speleological Institute and leader of the expedition, "we've found evidence to suggest that men barbecued a dwarf mammoth about 30,000 years ago. Radiocarbon tests on the charred bones gave us the figure."

"And a dwarf mammoth was a midget elephant, Bates," said Reg with a grin.

As day drew to a close, we turned onto high ground and headed back for the ranch. The cold island wind, mixed with fog, struck through our jackets and chilled us to the marrow. The Santa Barbaras are swept by perpetual damp breezes from the sea. Their



Herefords and Angus Tramp a Dusty Trail on Santa Rosa's Blue Sage Slopes

Thousands of cattle fatten on 17-mile-long Santa Rosa Island. Except at roundup time, a foreman, five cowboys, and a cook run the 53,000-acre ranch of the Vail & Vickers Company. Barges transport the stock to mainland markets.

Seaside slopes, too salty for grass, sustain only blue sage, but farther inland lush green ranges alternate with brushy ravines and wooded canyons.

Visitors need permits to land on Santa Rosa. Once they were welcome, but many came ashore with high-powered rifles. They killed cattle and sheep and even shot at the cowhands, and their fires burned out precious pastures.

Since 1946 archeologists have been digging on the island, seeking evidence that Early Man lived here during the last Ice Age.

Expeditions of the Santa Barbara Museum of Natural History, led by anthropologist Phil C. Orr, have uncovered the charred bones of dwarf mammoths. The six-foot-high creatures possibly were roasted by man in primitive barbecue pits. Radiocarbon tests have dated the bones at about 28,000 B. C.

Last year the National Geographic Society and the Western Speleological Institute joined the museum in sponsoring another major dig. So far more than 160 prehistoric village sites have been discovered, representing at least three distinct cultures of the past 7,000 years (page 266).

temperatures are neither very warm nor extremely cold.

Back at Beechers Bay the wind was kicking up a choppy sea. The dusk had an ominous feel. We moved *Seeker* close under the lee of the land and turned in. It fell calm during the night, and we woke to brilliant sunshine, snowy clouds, and sparkling water.

"This is the day for the cave of the lions," I said as we finished breakfast aboard our comfortable boat, whereupon Bates assumed his skeptical look again.

We took the anchor aboard and raced eight miles for our next island, Santa Cruz, under a canopy of gulls (page 278). Beneath 500-foot volcanic cliffs Pete kept *Seeker* circling while the rest of us loaded the dinghy with diving gear and made ready to hunt spiny lobsters. High on the jagged rocks perched sea birds—western gulls, California murres, and Baird's, Brandt's, and double-crested cormorants.

Down on ledges near the water, whence sometimes they took wing to escape breaking waves, sat comical little red-billed black oyster catchers and pigeon guillemots. Occasionally a stately bald eagle soared overhead in the sea wind.

In protective suits to keep warm, we swam 10 to 30 feet down into the chilly water at the base of the cliff. When we were lucky, we found lobsters peering from crevices, and we seized them with gloved hands before they could dart back into their lairs (page 259).

Divers Fish with Crowbars

Here, too, we introduced Bates to diving for abalone. The abalone is a shellfish that looks to the man under water like a piece of stone. It has a single oval shell worn turtle fashion over its back. Anchored by a strongly muscled foot, it lives on rocky submerged ledges and the sea bottom.

To feed on algae that grow on the rocks, it raises its shell half an inch. The trick in catching it is to slip a tire iron or small crowbar beneath the shell before the abalone can pull it down flush with the rock. Prying loose a buttoned-up abalone is quite a feat.

You eat only the foot of the creature. You trim the fleshy parts away, cut the tough muscle into thin slices, pound unmercifully until tender, then fry or broil (opposite).

I consider abalone one of the most delicious of seafoods. In Mexican and California waters, heavy fishing pressure is endangering the supply. California in recent years has enacted legislation designed to conserve it.

We came to regret the stop, for kelp flies came aboard in thousands and competed for our lunch. The gangly half-inch insects cannot bite, but they are determined, bumblesome clingers; despite steady swatting we had them with us for three days.

The "cave of the lions" has a map name: Painted Cave. We easily spotted its 100-foot-high mouth among dozens of lesser grottoes on the Santa Cruz shore. The water within is deep; we took *Seeker* inside, as into a giant boathouse.

Sea Lions Roar Back at Intruders

For 50 yards we coasted on water so eerily clear we could see the weedless bottom three fathoms below. Small fish swam by, hanging above the clean rock as though suspended in air. Above us, in the soft light, green ferns grew upside down from the roof.

Where seas had splashed and mineral-laden water had seeped through the volcanic rock of the domed ceiling, blotches of soft greens, reds, and browns, and vivid streaks of yellow and white made the walls look like the palette of some Gargantuan painter. A deep stillness reigned; human voices died as though muffled in soft blankets.

We lowered the dinghy.

"Quiet, don't scare the lions," I whispered as we paddled deeper into the inky cave.

"Phooey," said Bates, and let out an unearthly yell.

Instantly ear-splitting roars and barks tore the quiet asunder. Huge bodies plunged unseen into the water, and we heard great wheezings as monstrous beasts rushed at us from the gloom.

Bates let out an unintelligible cry and fell down.

"Lions!" yelled Pete. "Look under the boat!"

Black bodies flashed beneath us, the currents of their passing whirling the skiff like a chip. At least a hundred surged by, rushing pell-mell out of the cave into the open sea. Finally all was still again, and we helped Bates up from the bottom of the dinghy.

"A whole herd of sea lions, and you didn't even open your camera," chided Pete.

Nobody seems to know exactly why the big animals like to congregate in the pitch darkness of Painted Cave, but you can almost always find a herd on the shelf at the back of

the grotto. I think they come in simply because it is quiet and sheltered. All too many passing boatmen, especially fishermen bent on eliminating competition, take shots at sea lions on open beaches.

From Painted Cave we set out for Prisoners Harbor, a Santa Cruz cove that takes its name from an experiment that failed. It seems that the Mexican Government, which owned the island in the early 1800's, sought a place to deposit certain "cutthroats, thieves, and the like."

These worthies were marooned on the island with a few provisions. They stayed as long as the supplies held out; then they built a raft and sailed back to the mainland.

We were going to Prisoners because it is the harbor for the Santa Cruz Island Company, whose ranch covers about nine-tenths of the 60,000-acre island. Largest of all California's Channel Islands, Santa Cruz has, I think, the most colorful past.

Even before California became a State, Santa Cruz was a famous sheep ranch. In 1865 a remarkable Frenchman named Justinian Caire first took over supervision of the ranch, then bought out the English company that employed him. He turned the island into a feudal estate along European lines.

Island Supported Pioneer Winery

Except for a few mainlanders imported during rush seasons, Caire's workers were French and Italian laborers fresh from Europe. Fine artisans, they made bricks, tools, and almost everything else that was needed. Hand-wrought iron balconies attest to their skill at the forge. Substantial houses, barns, bunkhouses, a chapel, and other buildings they made are still in use, with plumbing and electricity added.

Caire planted grapes and made wines that long enjoyed wide popularity; he was one of the earliest successful wine makers of California, so famed today for its fine vintages. His sheep interbred with the descendants of the old Spanish flocks.

Caire died in 1898, leaving the ranch to heirs. In 1937 businessman Edwin L. Stanton of Los Angeles bought control of the company. The transaction gave him some 54,000 acres;

Slicing and Pounding, Seagoing Chefs Prepare Abalone for Supper

This shellfish of California waters is a prize delicacy. Its powerful muscle clamps so tightly to submerged rocks that a crowbar is needed to pry it loose. Any diver whose fingers get caught between shell and rock is in for a struggle.

Aboard *Seeker*, Earl Warren, Jr., trims an abalone's "foot"; Preston Peterson tenderizes another with a mallet. The mollusk's shell makes buttons and jewelry.

Pipe and Skull in Santa Barbara Museum Recall Vanished Santa Rosa Cultures

The Dune Dwellers, says Museum Curator Phil Orr, were an ancient people who lived atop huge mounds of shell and wind-blown sand. They buried their dead in a sitting position, adorned with red abalone shells and steatite pipes (left). Carbon 14 dates some of the shells as 7,000 years old. A recovered Dune Dweller skull (below) is still crowned with part of a bead headdress.

Less is known about the Highlanders, who built their villages on high, inland terraces, well away from the Dune Dwellers' sites.

Canaliño Indians took up residence on Santa Rosa some 2,000 to 4,000 years ago. Expert fishermen and canoe builders, they dwelt in hemispherical houses of thatched sea grass. Their descendants were still on Santa Rosa as late as the 19th century.

Plaster model shows how a rising sea has changed Santa Rosa's shoreline during the past 40,000 years. At each new level the battering waves carved a shelf farther inland. Once the sea level was 350 feet lower than now, and the four Santa Barbara Islands were linked together. Only a two-mile passage separated them from the mainland.

This model is being prepared for display at the Santa Barbara Museum of Natural History.

the Gherini family, related to Caire, kept the remaining 6,000.

Mr. Stanton is a family friend of long standing. My father, when he was Governor of California, frequently visited Santa Cruz. Despite our ties, Mr. Stanton only reluctantly consented to let me write about his ranch, for more than any other of the Santa Barbaras, Santa Cruz with its inviting harbors has suffered from the depredations of water-borne vandals.

The morning after our arrival in Prisoners Harbor we were able to return Mr. Stanton's favor. His company's sturdy old converted schooner *Santa Cruz*, which hauls livestock to the mainland, parted her mooring line with nobody aboard.

When we saw what was happening, she was half a mile away and drifting fast for the rocky shore at the other end of the harbor. With *Seeker*'s engines at full throttle, we took up the pursuit. We caught the *Santa Cruz* with only minutes to spare. Pete jumped aboard with a line, made fast to the schooner's windlass, and shouted at us to snub.

But *Seeker* had no towing bitts, and when the strain came, an inadequate cleat started pulling out of the afterdeck. Quickly we belayed to another and tried again.

The cleat held. Slowly, painfully, the schooner came head to wind. The *Santa Cruz* was heavy. It took us nearly an hour to get her safely back to the pier.

Old Signs Teach Table Manners

Leaving Pete to do a few chores on the boat, Bates, Reg, and I drove the three miles to ranch headquarters in a pickup truck. Headquarters lies in a fertile valley, an idyllic, isolated place out of sight and sound of the sea (page 275).

In one of the old Caire buildings we sat in a dining room where the foreign sheepherders of the old regime used to eat. Signs in Italian still hung on the walls.

"Caire must have tried to teach good table manners to his people," grinned John Imhoff, cattle foreman. "This sign here, for example, says the dogs should not be fed at table. And that one warns against annoying your neighbor while he eats."

For the benefit of Reg and Bates, Imhoff told us something of the island's history.

"When Mr. Stanton took over," he said, "he decided at first to stay in the sheep business. Trouble was the animals were scattered all over the place and so wild you almost had to shoot them to catch them.

"So we bought 10,000 nice tame sheep and turned them loose, figuring they'd calm their wild friends down. It worked out the other way—the tame sheep went wild."

The decision was made to switch to cattle, he went on. The first thing to do was to get rid of an unknown but large number of sheep that could climb like goats, jump like deer, and run like the wind.

Wild Sheep Caught by the Thousands

"How fast would you say those sheep could run?" Bates put in.

"Well, the boys have clocked them at better than 30 miles an hour. Of course, they can't keep it up all day."

Bates took on a surprised look.

"I'm almost ready to apologize," he told Reg and me, "but I think I'll wait until I see that mermaid with the tennis-ball eyes."

"Sorry," said Imhoff. "We've never tried to wrangle anything like that. It's hard enough work to catch sheep. But we did round up 35,000 the first few years and sell them off to the mainland.

"We thought we had the problem solved; so we put in our cattle, the purebred Herefords you saw on your way from the harbor. But in 10 years the sheep were coming back strong and ruining the grass.

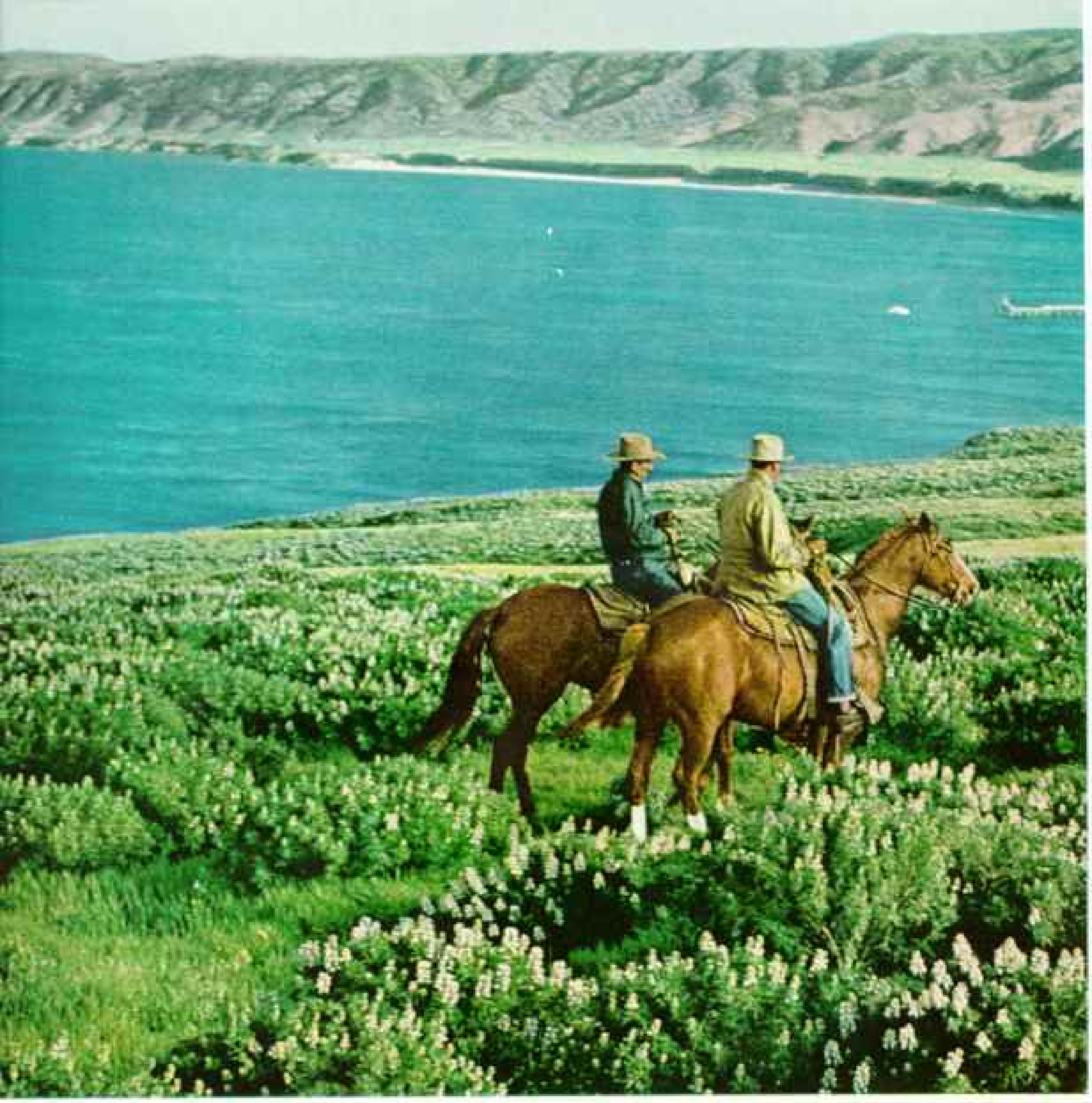
"In 1955 we built a series of huge wing traps, fences that funnel down to a corral a mountain goat couldn't jump out of. In three more years we caught 24,000 sheep—about a million and a half pounds of meat. Eventually we'll clean the rest of them out."

Imhoff took us on a quick jeep tour. He pointed out fields overrun with cactus, result of past overgrazing by sheep. Now and again we saw them in little flocks grazing on steep hillsides or in inaccessible canyons. As soon as they saw the jeep, they bounded away.

Like Santa Rosa, Santa Cruz has a government station. Perched on a ridge some distance from the ranch buildings, this Navy facility helps track the guided missiles shot from Point Mugu on the mainland. Some 30 people man it.

On the way back to the boat we saw large coveys of valley quail, the State bird of California.

"We imported Chinese ringneck pheasants," said Imhoff. "They did fine the first few years, but we don't see them much any more.



Rolling Green Hills Shelter the Crescent of Beechers Bay

Sea mists, borne on chilling winds, produce magnificent pastures on Santa Rosa. The Channel Islands often stay green even when California's mainland experiences dry spells. *Seeker*, the cruiser that carried the author through the islands, lies at anchor off the pier.

Santa Rosa fox, big eared and small jawed, is one of half a dozen creatures that exist only on the island chain. Scarcely larger than a house cat and almost as tame, the dwarf hunts mice and insects for his fare.

Santa Cruz jay, unusually fearless, feeds on pine seeds.

Kodachrome (above) and Anscochrome by National Geographic Photographer Bates Littlehales © N.G.S.

Maybe the skunks, foxes, and ravens break up their nests."

Bates spotted a Santa Cruz jay, similar to the California scrub jay, but listed by ornithologists as a subspecies unique to this one island. The bird exhibited only mild interest as Bates took its picture (page 269).

"He'd eat off your plate if you camped here a few days," Imhoff commented.

Ravens Attack Ewe and Lamb

Imhoff drove us to the pier. As we were about to get into the dinghy, Bates turned to the foreman.

"Tell me," he said, "are there birds on these islands that kill lambs? These fellows have been kidding me so much I hardly know what to believe."

"You bet there are. Some are flying over your head this minute." He pointed to ravens wheeling above. "One of those will kill a newly dropped lamb in jig time, and may peck out the weak mother's eyes, too."

Ravens look mischievous, but not murderous. Killing out of hunger is natural enough, but the thought was chilling. These islands are often beautiful, but a note of the sinister attaches to them as well.

We headed *Seeker* eastward, and at dusk nosed into Potato Harbor, another Santa Cruz cove, this one a long, fingerlike depression. I thought it an ideal anchorage. Pete and Reg, however, were restless, walking around the boat nervous as cats, peering back at the cove entrance, and listening to the rumble of surf breaking on the cliffs outside.

Suddenly, without words, Reg brought the anchor in and Pete started the engines.

"What's the trouble?" I wanted to know.

"With a swell like this Potato can close up before you can get out," said Pete. "Seas break right across the entrance. We'll run to Scorpion. That's Gherini's harbor anyway."

Santa Cruz Shears Prize Wool

In the morning we landed at the pier that serves the Gherini ranch. Whereas Stanton switched to cattle, the Gherinis have stuck with sheep. They have modernized with new blood, but their flocks, like the tame Borrego at Santa Rosa, still show the old Spanish characteristics. We saw rams carrying spectacular four-foot-wide horns with more than two complete curls.

The annual roundup had begun, and shearing was in progress (pages 272-3). We watched a wool buyer from the mainland as he inspected the animals.

"What wool!" he exclaimed. "There's not another clip like this in California and possibly not in the United States. See that ram in the corner of the pen? I'll bet his fleece will go 20 pounds, as fine almost as cashmere."

We climbed a hill to watch two Gherini brothers, Pier and Francis, bringing sheep in from the range. On horseback the Gherinis moved a skittish flock along a steep, rocky hillside, herding them inexorably toward a fence that would press them into a series of field-sized traps.

Sometimes when animals tried to double back, a thrown rock was enough to turn them, but once in a while it took a rifle bullet thumping into the ground ahead of them to do the trick. The only sound was the bleating of the sheep and the occasional crack of the rifle. The drive moved at a slow pace.

"I should think they'd yell and whoop and scare 'em in fast," said Bates.

"If they did," said the wool buyer, "you'd see half the sheep shoot back through the horsemen, even going under the horses' bellies. The other half would pour over these fences like birds. You've never seen these island sheep jump!"

Sheep Clear a High Hurdle

A moment later we did. A ewe and her two lambs, smarter or wilder than the rest, sailed over a five-foot fence with ease and vanished over a ridge.

"There go three more!" laughed Pier Gherini, reining up his horse. "We lost maybe 400 before we even got to the wire. But we brought in a couple of thousand."

Francis Gherini took us into the next valley to the south, a sun-dappled spot reminiscent of the Italian Riviera. Groves of olive trees, blue-green leaves shimmering, covered the hillsides. Full-crowned walnuts and fruit trees shaded the valley floor to the long, curving beach of Smugglers Cove.

At ranch headquarters Francis showed us the brothers' little Indian museum, a shed filled with projectile points, bone fishhooks, stone pipes, and the like. Most of these things had belonged to prehistoric tribes, but some were relics of the more recent Canaliño Indians who once thickly populated the Channel Islands.

The first account of the Canaliños came from Juan Rodriguez Cabrillo, a Portuguese

Proud Descendant of Conquistador Flocks, Borrego Enjoys a Pet's Life

Early Spanish explorers presumably introduced sheep to the Santa Barbaras as a food supply. For many years their progeny roamed both Santa Rosa and Santa Cruz amid ranchers' flocks.

Today on Santa Rosa cattle have taken over, and sheep are considered a nuisance. Except for a few wild strays, the lone survivor is this ranch pet. Cowboys who found him as a lamb gave him the name Borrego, a Spanish colloquialism for "simpleton."

explorer in Spanish pay, who landed on the islands in 1542 during the voyage that discovered California for Europeans. He described a friendly island folk who "are very poor. They are fishermen; they eat nothing but fish; they sleep on the ground; all their business and employment is to fish."

Canaliños Fade into Extinction

As more and more white men visited the islands, European diseases took a heavy toll of the natives. Russian otter hunters cruised these waters, dropping off savage warriors from the Aleutian Islands to trade with the Canaliños and hunt otters until the Russians returned. These visitors—and Anglo-Saxon hunters also, sad to say—killed many island Indians in fights over their women.

Finally the Franciscan missions took the survivors to the mainland, and there they lost their identity among the coastal tribes. No pure Canaliño exists today.

Next day we sped to Anacapa with a rollicking breeze at our backs. This island is a weather-beaten spine of rock jutting out of the Pacific only 13 miles from the mainland. Actually it is three islands, for there are two breaks through which the sea rushes at high tide (pages 256-7).

With Santa Barbara Island, 42 miles to the southeast, it forms Channel Islands National Monument. Here the National Park Service, in a rare departure from usual policy, looks askance at visitors, preferring to reserve the area as a haven for seals, sea birds, and possibly sea otters, which are making a comeback along the California coast.

Although Anacapa has no fresh water, it was once a sheep ranch of sorts. An old story tells how the flocks may have survived there: After heavy night fogs soaked their wool, each morning the animals munched the dew from one another's coats!

Below the light on Anacapa's eastern seg-

Santa Cruz Sheep Jump Like Deer and Outsprint Horses

While Santa Rosa has worked to get rid of its sheep, on Santa Cruz the Gherini ranch still runs flocks of thousands. Breeding has modernized the bloodline, but Spanish Merino characteristics still predominate. Tightly curled ram's horns measure up to four feet, tip to tip.

Excited ewes, stripped of their thick coats, bound from the corral.

Because of the agility of Santa Cruz sheep, roundup requires skillful herding. The skittish animals dart up and down rocky hillsides to elude the traps. The author watched a ewe and two lambs easily clear a five-foot fence.

A big ram may yield as much as 20 pounds of high-grade wool almost as fine as cashmere. A shearer with electric clippers can complete the fleecing in three minutes.

ment we steered *Seeker* carefully into a cleft in the rock that passes for a harbor. A wharf has been somehow glued to the lava cliff, but the lighthouse crew never leaves its boat long in the water for fear the swells will smash it against the rocks. Instead, a big crane lifts the craft onto one of several concrete platforms (page 277).

We climbed a dizzying staircase to the top of the cliff. Engineman 1st Class John Freie led us to four white stucco houses in a brilliant sea of flame-flowered ice plant, introduced to keep the dust down and make the bleak place a bit more attractive (page 276).

"Home, sweet home," said Freie. "Three families each have a house; five bachelors live in the fourth.

"Home—and sometimes an Alcatraz. When seas are rough, we may be stranded here for two weeks. But in emergency a helicopter can land on our concrete water catchment."

"What do you do to keep from getting bored?" we asked our Coast Guard host.

"You'd be surprised," replied Freie. "We hike, go out fishing, skin dive, and look for Indian sites. The women do as they do anywhere—they phone each other. Actually, they need only to lean out their windows to talk, because our houses are so close together."

Rabbits Took Too Well to Anacapa

A fence surrounds the dwellings. Freie told us it keeps the children from wandering to the cliff's edge and the rabbits from getting into the family flower beds. Rabbits were introduced here a few years ago to see how they'd fare, and they have done much too well. The big black and mottled-white animals would eat the island bare if not thinned out from time to time.

We visited 600,000-candlepower Anacapa Light. In the radio building technicians were

compiling weather data for transmission to the mainland every three hours.

As we walked around, foolishly I volunteered to go out onto a high, thin ridge of rock on the tip of the island for a picture. Freie looked dubious but said nothing. I went about 50 feet and looked down. It was a straight 250 feet to the sea on either side of my perch, a bit of rock only 18 inches wide!

In a sudden panic I sat down—and chunks cracked from both sides of my eyrie and fell silently into the void. I remembered something I had read: "Anacapa is an old crumbling ridge steadily tumbling into the sea."

"But not with me on it," I decided. "This is learning geology the hard way."

Summoning up courage, I inched backward until I could turn around, and then shakily rejoined my companions.

"I didn't make a picture," said Bates. "You didn't give me enough action."

Returning to the radio room, we tuned in on the weather report our hosts had helped assemble. The nearest storm was 1,000 miles north, we learned. This gave us a perfect chance to run for San Miguel 55 miles due west, the forbidding, uninhabited isle we planned to make our last port of call in the Santa Barbaras.

San Miguel: Island of Ghosts

It was dark when we reached San Miguel. We anchored in Cuyler Harbor and let the long Pacific swell lull us to sleep. In the morning we pulled ashore, landing on a beach of dazzling sand unmarked by a human footprint. Despite the bright sun we were cold.

Pete put our thoughts into words.

"Brrr," he said. "This place is dead."

What at first we took to be waterfalls leaping from steep hills turned out to be cascades of sand, the very substance of the island, slipping away into the sea. We made our way inland, climbing steadily. Sliding dunes made the going difficult (page 282).

We came onto flat ground at the top, and all around us was barren, dusty desolation, except for a green patch around the ranch buildings where the destroying sheep had not been allowed to graze. Dust devils danced with the everlasting wind from the Pacific.

As we reached the ranch compound, a hollow booming sound startled us, but it was only the doors of a weathered barn banging in the wind. A crumbling ram's horn, a horseshoe, and a rusted plow lay on the ground.

Ruined Ranch Hints of Tragedy

Spirits sinking with every step, we explored an outbuilding where harness hung on hooks, each labeled with a horse's name. Fleeces lay on a skirting table, awaiting a trimmer who would never appear. A crimson geranium grew beside the long, narrow ranch house; once it had brightened a woman's existence in this lonely spot.

Now we went into the house, and there lay furniture all wrecked by vandals. A marble-topped table had been wantonly smashed. Window frames were ripped out.

"Look at this," said Reg quietly.

He stood in a child's bedroom. There was a crib, a small bed, and a playpen awaiting a tiny tenant; even vandals have hearts. When I saw a set of children's blocks lying as they had fallen when a little girl sent her make-believe house tumbling, I could stand no more. I left, and my friends came with me.

The story of San Miguel is a tragic one. Once a man and his wife lived here with their two small daughters, tending the island sheep. It was a lonely life without neighbors, but the family was together, and they were happy at first. Authorities on the mainland sent schoolbooks. The mother held classes for her children.

Then one terrible day the father took his own life. The mother and little girls went back to the mainland, too heartbroken even to pick up a set of tumbled blocks. In time the Navy came. Although it practiced bombing here some years back, the ranch buildings were spared.

We slid down the dunes, dispelling gloom with violent physical exercise. We boarded *Seeker* and ran at full throttle around the island, until we came to a wind-lashed peninsula where huge animals lay basking on the sand like so many giant sea slugs. "At least

(Continued on page 283)

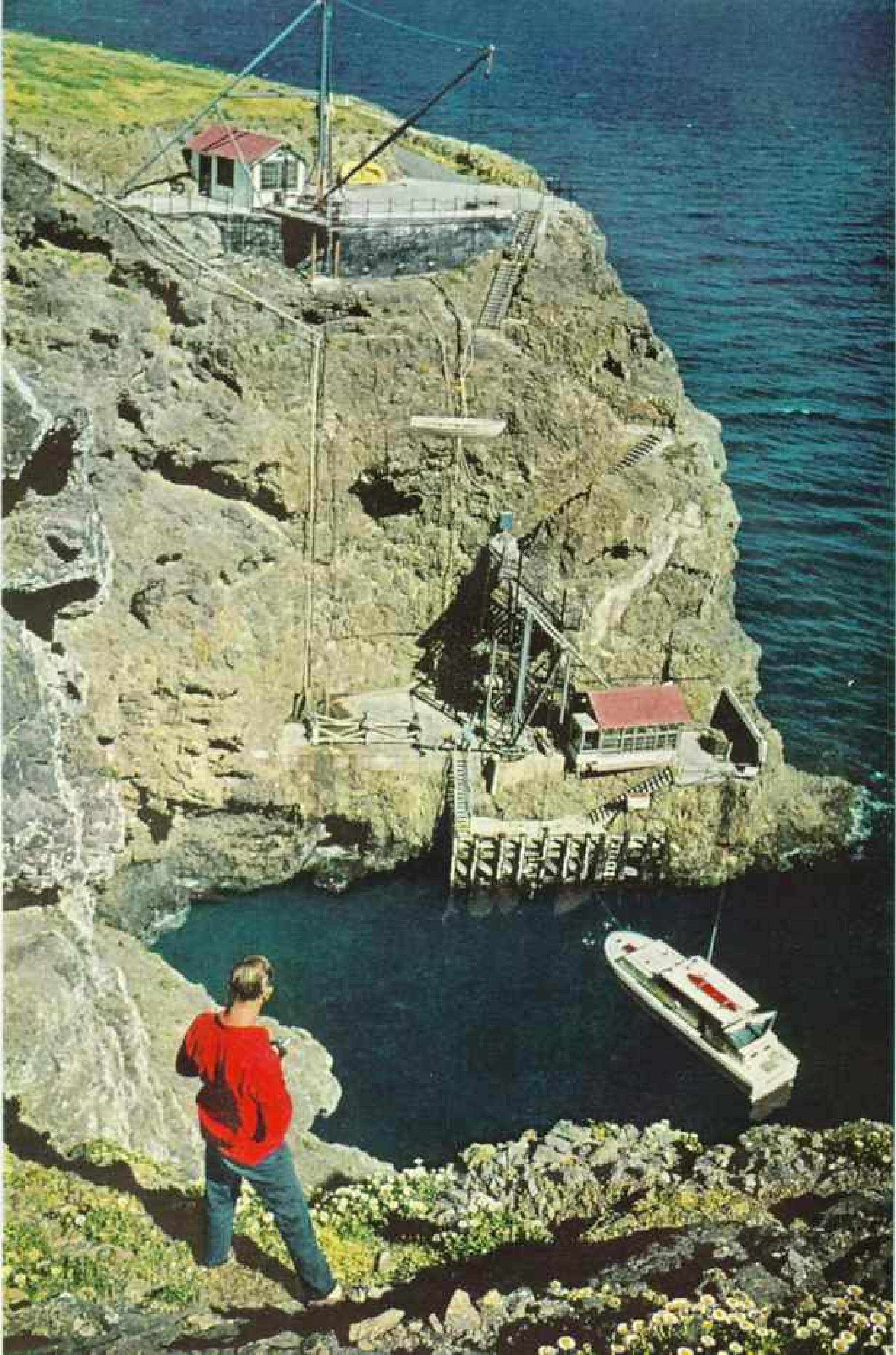
Switzerland or Pacific Isle? Hills of Santa Cruz Hide an Idyllic Vale

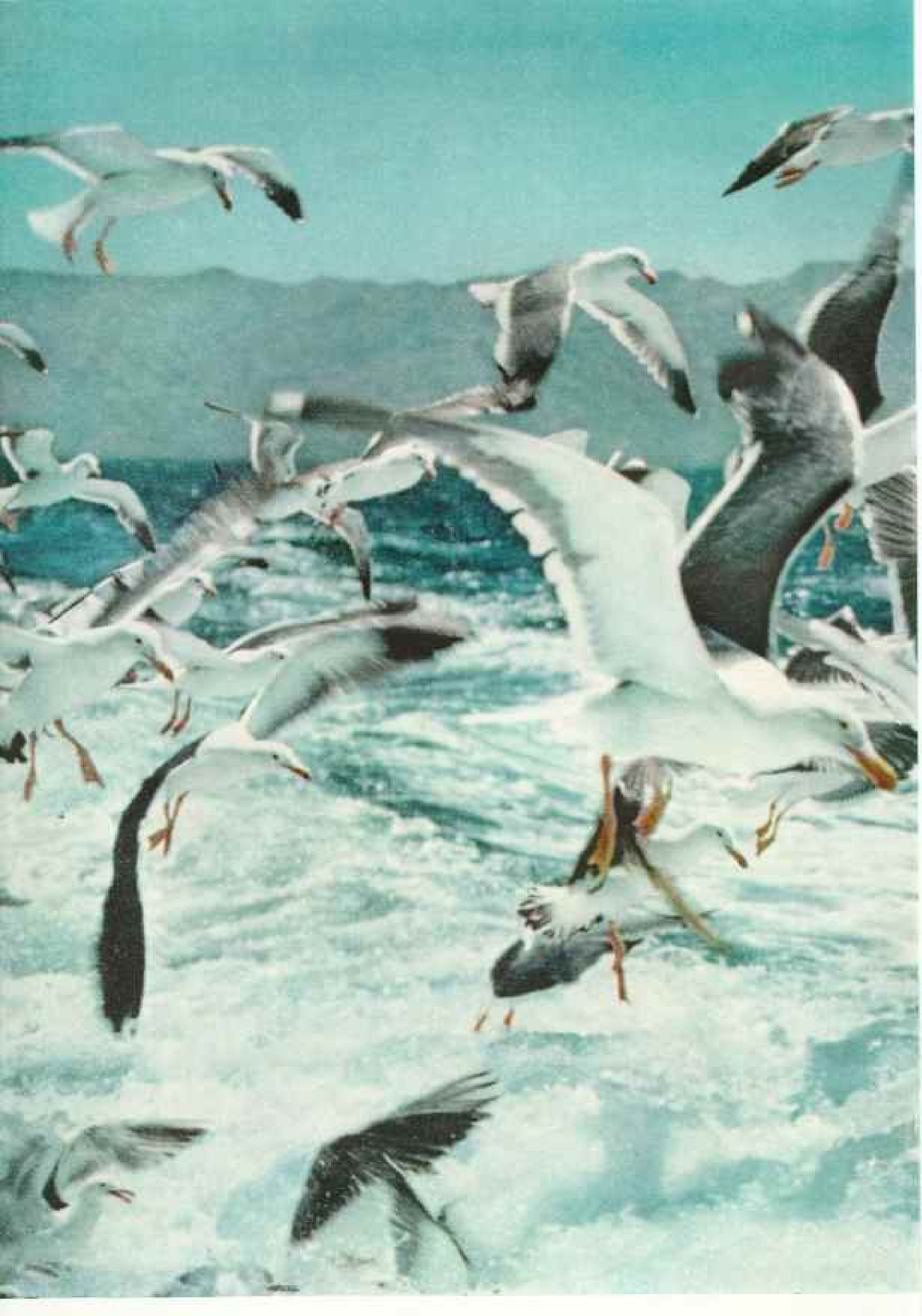
Ranch headquarters of the Santa Cruz Island Company sprawl along this fertile valley, shielded from sight and sound of the sea by steep brush hills. Red roofs identify main living quarters; gleaming tin covers the old winery (extreme left) and the T-shaped equipment building. European artisans built the barns and ranch houses in the 19th century.

A blanket of ice plants helps keep down the dust on windy Anacapa, where the U. S. Coast Guard maintains a light. The mainland is only 13 miles away.

Author Warren rides atop the cabin as *Seeker* cruises past Arch Rock off Anacapa's eastern tip. Thousands of California brown pelicans nest on the natural bridge.

Power crane hoists a small boat from a cliff-girt light on Anacapa's sheer coast. Passengers must climb zigzagging iron steps to reach the Coast Guard station. Anacapa and Santa Barbara Island, its tiny neighbor to the southeast, make up the Channel Islands National Monument.





278 An Ever-present Canopy of Western Gulls Skims *Seeker*'s Frothy Wake Across

Santa Barbara Channel. Wheeling and Dipping, They Dive for Scraps from the Galley 279

Cornered, a bull roars in protest and threatens with gaping mouth. The author easily dodged its clumsy lunges.

The sea elephant's big canine teeth can inflict an ugly wound. On an earlier visit to San Miguel, Mr. Warren's companion stepped too close to a cow and had his hand and wrist caught by viselike jaws. The victim finally beat off the animal with feet and free fist, but not before suffering a severe mangling.

Sea Elephants, Homeliest of Sun Bathers, Bask on the White Sands of San Miguel

Mirounga, largest of seals, may stretch 20 feet and weigh more than 5,000 pounds. Carrying a thick layer of blubber beneath its rough hide, the gross creature quivers like gelatin as it shuffles along on land.

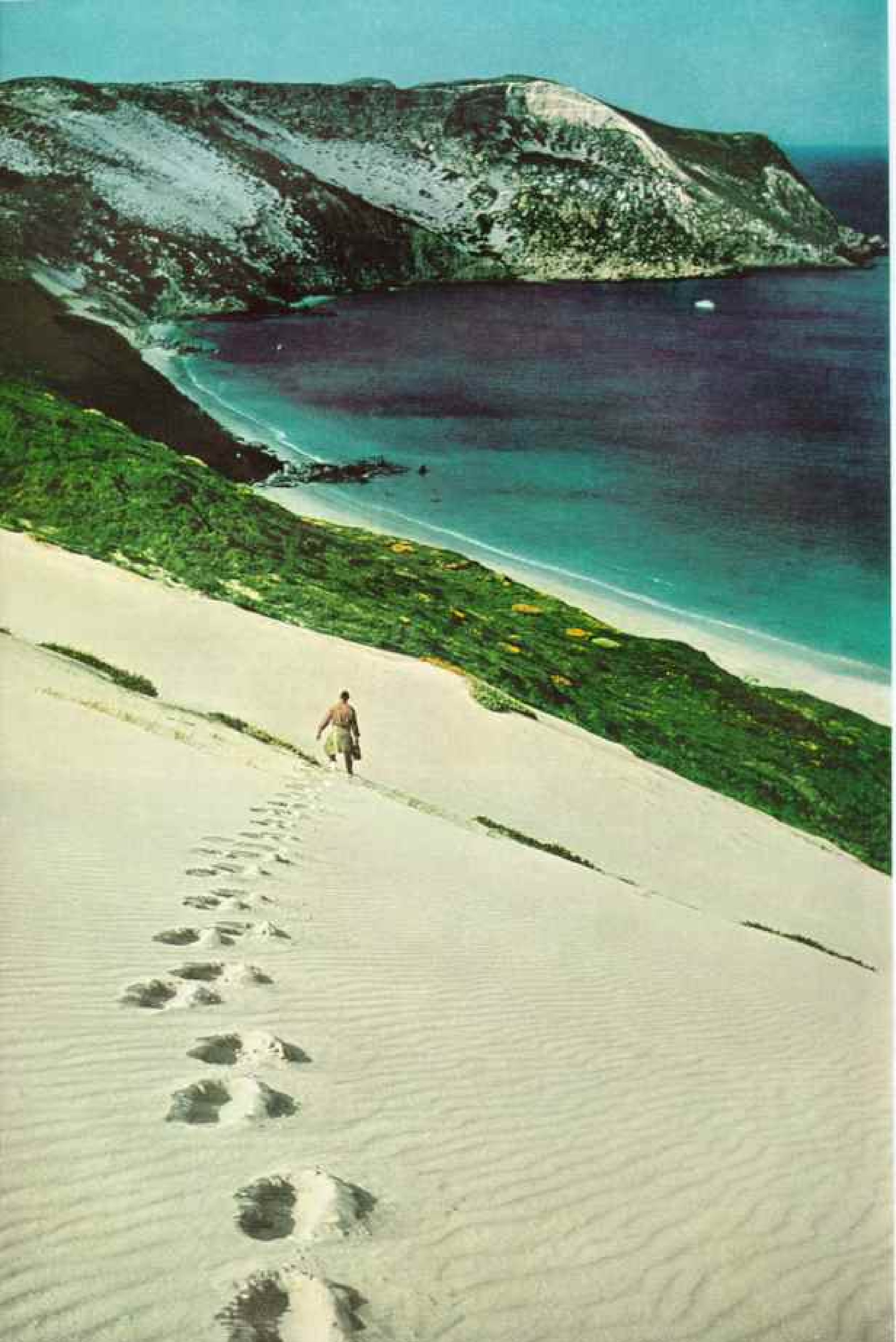
A monstrous snout distinguishes the male. Relaxed, the hollow proboscis droops several inches below the mouth. But when the bull barks, the appendage swells with air. It serves no known useful purpose.

Herds of thousands once inhabited the California coastal islands, but commercial sealers nearly exterminated the species. Protected now, the beasts have staged a remarkable comeback in the past 50 years.

Like a pile of fat sausages, sluggish sea elephants mass together in a tangled heap. Fighting and mating cries fill the air. Stains and scars blemish the leathery hides.

In August males come ashore on uninhabited San Miguel to select their harems. In late winter and spring the cows give birth to single black pups.

Huge brown eyes have an appealing quality, reports the author. He dubbed the females "mermaids with tennis-ball eyes."



something is alive around here," we said, and rowed ashore. Bedlam broke loose as the dinghy grated on the strand. Sea lions, roaring their annoyance at the intrusion, arched their necks and skip-hopped for the water with surprising agility.

But the sea elephants, the elephant seals we had come to see, merely moved nervously, as measuring worms move, and waited to see what would happen.

Once-rare Sea Elephants Make a Comeback

Their presence here, and elsewhere along the California coast, marks a milestone on a heart-warming comeback trail. Once whalers hunted these huge creatures almost to extinction, boiling down their carcasses for oil. Now they are growing numerous again. Their invasion of the sea lions' old hauling-out beaches on San Miguel is quite recent.

Bates focused his camera on a bevy of cows. Then he leaped into the air with a whoop.

"The mermaids!" he shouted. "The mermaids with the big brown tennis-ball eyes! Oh, you jokers!"

He was dancing around so much we had to shout a warning.

"Watch it! Step back into the jaws of one of those beauties and you'll lose a foot."

We moved closer. The sea elephants were friendly enough until we came within a few feet of them. Then they hissed, showed their savage teeth, and sometimes made short lunging charges.

Oddly, the big bulls were the friendliest. One of them, however, did get a bit vexed with me. I got between him and the water, whereupon he inflated his monstrous proboscis and came lumbering for me. I do not know whether he would have bitten me, but he surely would have run me down, and since he weighed perhaps two tons, I stepped quickly and politely to one side.

The elephant seal gets its name from the proboscis, an adornment of the bull only (page 280). When he is excited the male inflates this leathery appendage. Then he deflates it suddenly, with disagreeable belching sounds.

After we had been around awhile, the seals decided we meant them no harm, and some of them went to sleep. They were sound sleepers.

"Hello, dear," said Bates, shaking flippers with a bulky mermaid. "I love you." She never stirred.

Reg, Hollywood stunt rider, speculatively eyed a somnolent bull.

"I wonder . . ." he began.

But we seized him and led him away, and we all went back to *Seeker* the way we had come, in the dinghy.

A cross on lonely San Miguel honors the discoverer of the Santa Barbaras: Juan Rodriguez Cabrillo, a Portuguese navigator who sailed under the Spanish flag. Many believe Cabrillo died on the island, but his burial place remains a mystery. The memorial follows the Portuguese spelling of his name.

Glaciers of Sand Cascade Down the Windy Cliffs of San Miguel

Rolling dunes and desolate cliffs overlook one of the few sheltered boat anchorages on this uninhabited island. Ruins of a pier recall a time when San Miguel harbored a prosperous sheep ranch. Today the deserted wastes serve as a tri-service bombing range. 283

Marching troops circle the Arc de Triomphe and parade down the Champs Elysées as Paris pays tribute to her war dead on the 39th anniversary of the Armistice of 1918. Within the arch a huge Tricolor flutters above the tomb of France's Unknown Soldier and the eternally burning Flame of Remembrance. Begun by Napoleon in 1806 and finished under Louis Philippe 30 years later,

Paris

VIBRANT HEART OF FRANCE

Maurice Jarnoux from Paris Match

the memorial rises 160 feet above the Place de l'Etoile, so named because 12 avenues radiate from it like the points of a star. The top of the span offers a superb panorama of the city.

"PARIS is in a state of perpetual growth . . . all that there is of sap, of life, of soul, in a people, filters through and collects incessantly, drop by drop, century by century."

Victor Hugo's words ring as true today as in 1831. Paris is two thousand and seven years old this summer. She still demands, and receives, the best from her subjects, the 88 million people of the far-flung French Union.

Whether to the Algerian soldier parading her wide avenues, the Flemish artist painting in a musty garret, or the holidaying Breton relaxing in a sidewalk cafe, the challenge is clear: make the most of life.

Paris: the magic city where past blends into present; the city of glittering boulevards and dark, crooked little streets; the city that offers something for everybody!

She is a vista of smoke-gray buildings, their mansard roofs snug beneath a tangled cluster of chimney pots. She is a helter-skelter torrent of traffic, of nonchalant jaywalkers squeezing between files of moving fenders.

No man would presume to divine all her secrets, for she is inexhaustible. Age will not wither her; she grows more charming, more lovely even as she grows older.

Where Terror Once Reigned, the Place de la Concorde Glitters Like a Fairyland by Night:

This majestic square was designed to enhance a statue of Louis XV erected in 1763. When revolution flamed, the statue fell and in its place rose a new ruler, the guillotine. Here Louis XVI bowed his neck to the blade, crying: "I die innocent . . . may my blood consolidate the happiness of France." His beautiful queen, Marie Antoinette, followed, and after her thousands of others.

Today the center's 3,300-year-old Egyptian obelisk commemorates deeds of Rameses II; its splashing fountains copy Maderna's masterpieces in St. Peter's Square, Rome, and its corner monuments honor French cities (Marseille, left). But, despite its name, the Place de la Concorde cannot rejoice in abiding harmony. Here last May riot troops battled thousands protesting the government's handling

Wide World

By Day It Swirls with Traffic

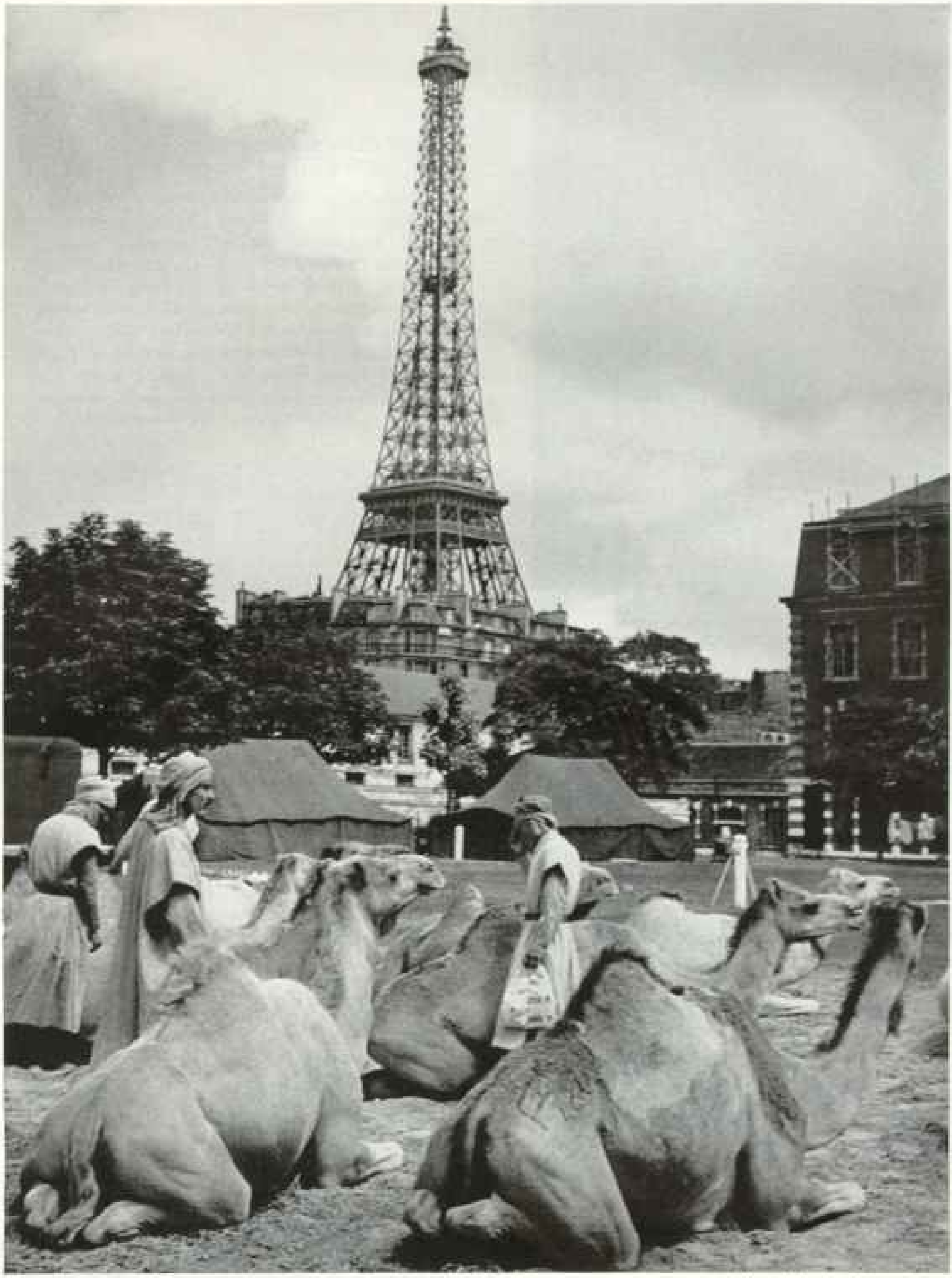
of the Algerian crisis. Shadowy Bourbon Palace (upper right), seat of the National Assembly, was the demonstrators' goal. Close by, the spire-topped dome of the Hôtel des Invalides hangs above the tomb of Napoleon, who desired that his ashes "lie on the banks of the Seine."

Stilt Walkers from Southern France Take the High Road Through Their Capital

For centuries the dunes and marshes of the Landes region on the Bay of Biscay appeared fit only for sheep. To navigate the shifting, boggy flatlands, shepherds mounted stilts. These they strapped to their legs, leaving hands free. Many shepherds became extraordinarily agile on their wooden legs.

Today grasses anchor the dunes, forests grow in the drained marshes, and few working stiltmen remain. These youngsters, parading across the Place de la Concorde, keep the tradition alive. Boys wear the sheepskin coats of shepherds.

Robert Cohen, Black Star



Atlantic Press from European

Sahara Patrol's Camels and Riders Camp Beneath the Eiffel Tower

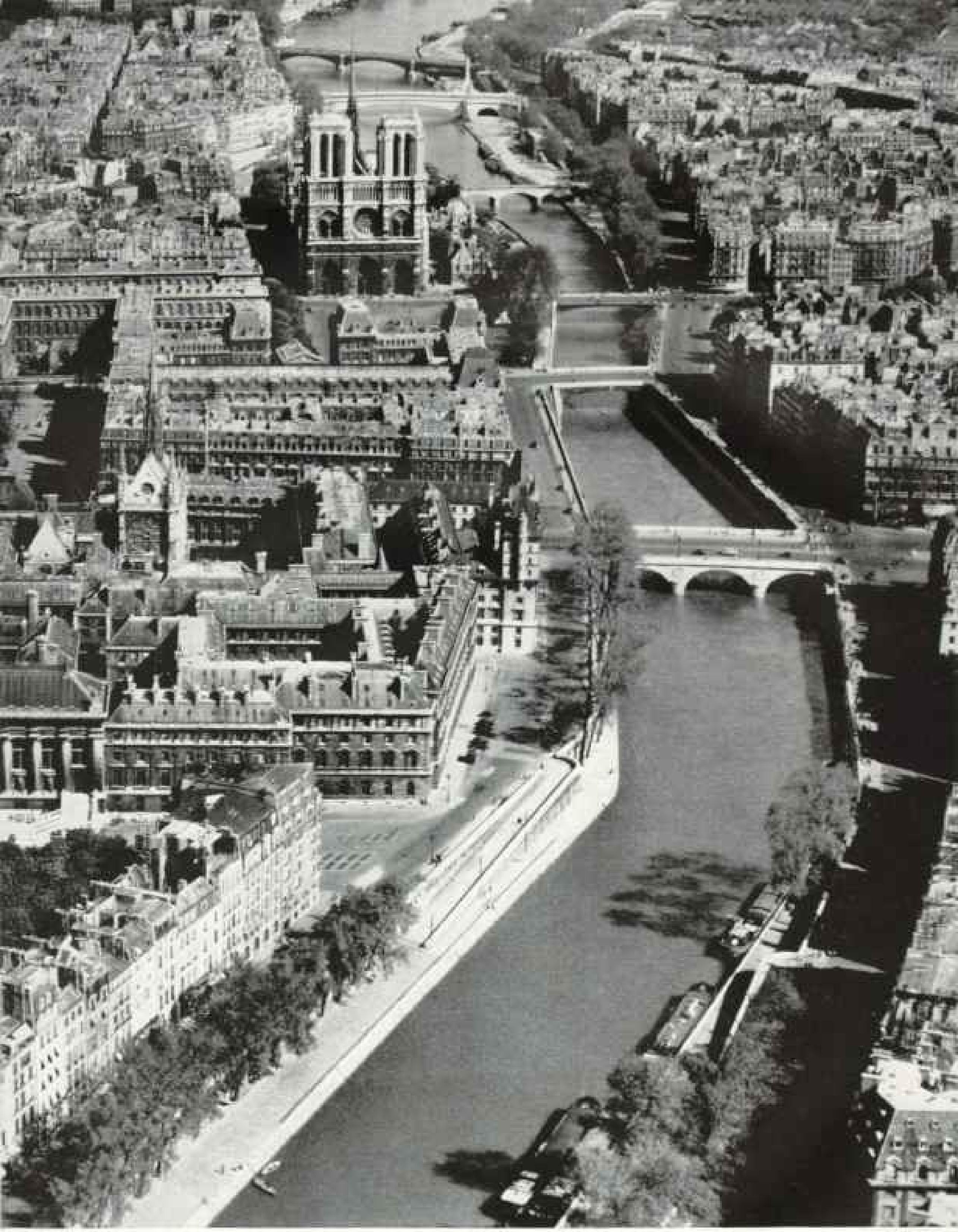
Napoleon formed this desert police corps while in Egypt in 1799. Today the all-volunteer force of more than 1,000 meharists (camelcers) keeps order among nomadic tribes in the French Sahara, an area larger than continental France. Each trooper has two dromedaries for prolonged marches across the trackless sands.

Louis Fabiani

Liberty Holds Sons in Her Arms. Parisians Demonstrate in the Place de la République 289

Ile de la Cité, Birthplace of Paris, Rides the Seine Like a Treasure Ship

Capital of the Parisii of Gaul and colony of Rome, the island served for centuries as a walled fortress. Under Capetian kings, the city overflowed the island, merchants occupying the Right Bank (left) and the University the Left Bank; but the Ile remained the center of power. Here, behind



Boner Bernard from Paris Plantation

triangular Place Dauphine, sprawl the numerous buildings of the Palace of Justice, seat of law courts. Louis IX built rose-windowed Sainte Chapelle (center) in the 1200's to house holy relics. Pointed towers mark the riverside Conciergerie (left), the prison where Marie Antoinette, Robespierre, and other victims of the Terror awaited the guillotine. Square at the Ile's center separates the Prefecture of Police (right) and Tribunal of Commerce. Behind them stretches the long Hôtel Dieu, a hospital since the 7th century. Towering Notre Dame saw Napoleon crown himself.

ENGLAND
English Channel
Isle of Wight
Bay of Biscay
FRANCE
SPAIN
ANDORRA
CHANNEL ISLANDS
U.K.
Alderney
Guernsey
Carteret
Sark
Jersey
St. Helier
Cap de la Hague
Cherbourg
Coutances
Granville
St. Malo
Dinan
Mont St. Michel
St. Brieuc
Perros Guirec
Lannion
Morlaix
Brest
Guingamp
Châteaulin
Douarnenez
Quimper
Lorient
Quiberon
Belle Ile
Ploërmel
Fougères
Rennes
Vitré
Laval
Redon
Vilaine
Auray
Vannes
La Baule
St. Nazaire
Nantes
Ile de Noirmoutier
Ile d'Yeu
Les Sables d'Olonne
La Roche sur Yon
Cholet
Angers
Château-briant
Mayenne
Sarthe
Loir
Loire
Saumur
Chinon
Parthenay
Fontenay le Comte
Niort
La Rochelle
Ile de Ré
Ile d'Oléron
Rochefort
Marennes
Saintes
Royan
Cognac
Jonzac
Angoulême
Ruffec
St. Junien
Limoges
Bellac
Vienne
Guéret
Aubusson
Riom
Clermont-Ferrand
Thiers
Issoire
Ambert
Montbrison
Brioude
Tulle
Brive
Périgueux
Lesparre
Blaye
Libourne
Bordeaux
Montignac
Bergerac
Sarlat
Gourdon
Dordogne
Arcachon
Langon
Garonne
Marmande
Villeneuve sur Lot
Agen
Cahors
Lot
Figeac
Aurillac
St. Flour
Mauriac
Rocamadour
Aveyron
Rodez
Villefranche de Rouergue
Millau
Mende
Florac
Lodève
Montpellier
Sète
Agde
Béziers
Mazamet
Castres
Albi
Montauban
Castelsarrasin
Condom
Mont de Marsan
Dax
Adour
Auch
Toulouse
Tarn
Orthez
Oloron
Pau
Mirande
Muret
Tarbes
Bagnères
St. Gaudens
St. Girons
Pamiers
Foix
Limoux
Carcassonne
Narbonne
Perpignan
Prades
Port Vendres
Port Bou
Lourdes
Cauterets
Pyrénées
Bagnères de Luchon
Pic de Aneto
Andorra
Pamplona
Vitoria
Ebro
Aragón
Logroño
Burgos
Santander
Bilbao
San Sebastián
Biarritz
Hendaye
Bayonne
Cabo Machichaco
Mimizan
Morcenx
Nérac
Dieppe
Abbeville
Somme
Fécamp
Bolbec
Le Havre
Deauville
Honfleur
Elbeuf
Lisieux
Bayeux
Caen
Rouen
Beauvais
Oise
Montdidier
Amiens
Arras
Béthune
Boulogne sur Mer
Le Touquet Paris Plage
St. Omer
Calais
Dunkerque
Lille
Roubaix
Douai
Valenciennes
Cambrai
Péronne
St. Quentin
Laon
Aisne
Compiègne
Soissons
Chantilly
Evreux
Bernay
Argentan
Alençon
Flers
Vire
Versailles
PARIS
St. Denis
Meaux
Château Thierry
Epernay
Provins
Melun
Fontainebleau
Chartres
Dreux
Rambouillet
Romilly sur Seine
Sens
Joigny
Montargis
Auxerre
Avallon
Clamecy
Vézelay
Nevers
Moulins
Digoin
Vichy
Montluçon
Bourges
Vierzon
Romorantin
Issoudun
Châteauroux
St. Armand Mont Rond
La Châtre
Argenton
Le Blanc
Poitiers
Montmorillon
Châtellerault
Loches
Tours
Amboise
Blois
Vendôme
Orléans
Loiret
Gien
Sologne
Châteaudun
Sarthe
Le Mans
Laval
Mayenne
Vitré
Fougères
Rennes
Ploërmel
Redon
Vilaine
Châteaubriant
Angers
Cholet
Saumur
Loire
Nantes
St. Nazaire
La Baule
Auray
Vannes
Quiberon
Belle Ile
Lorient
Quimper
Douarnenez
Châteaulin
Brest
Guingamp
St. Brieuc
Dinan
Mont St. Michel
Granville
Coutances
Saint Lô
Caen
Deauville
Honfleur
Elbeuf
Lisieux
Bayeux
Cherbourg
Cap de la Hague
Alderney
Guernsey
Carteret
Sark
Jersey
St. Helier
CHANNEL ISLANDS
U.K.
Plymouth
Portsmouth
Southampton
Brighton
STATUTE MILES
©N.G.S.

Brussels
Leuven
LGIUM
Namur
Charleroi
Maubeuge
ARDENNES
Charleville
Sedan
Mézières
Rethel
Reims
Thionville
Verdun
Châlons sur Marne
Bar le Duc
Vitry le François
St. Dizier
Toul
Nancy
Troyes
Colombey les deux Eglises
Épinal
Bar sur Aube
Chaumont
Langres
Châtillon sur Seine
Montbard
Vesoul
Gray
Dijon
Besançon
Dole
Beaune
Le Creusot
Chalon sur Saône
Montceau les Mines
Lons le Saunier
St. Claude
Mâcon
Bourg
Roanne
Nantua
Villefranche
Annecy
Lyon
Villeurbanne
La Tour du Pin
Vienne
St. Étienne
Aix les Bains
Chambéry
St. Jean de Maurienne
Tournon
Grenoble
Valence
Die
Privas
Montélimar
Alès
Orange
Carpentras
Nîmes
Avignon
Tarascon
Arles
Salon
Aix en Provence
Marseille
La Ciotat
Toulon
Hyères
Barcelonnette
Digne
Grasse
Cannes
Antibes
Nice
Menton
Monte Carlo (MONACO)
Fréjus
St. Raphaël
Draguignan
St. Tropez
Sainte Maxime
Îles d'Hyères
Briançon
Massif du Pelvoux
Gap
Cottian Alps
Susa
Pinerolo
Bra
Asti
Cuneo
Mondovì
Savona
Albenga
Imperia
San Remo
Golfo di Genova
GENOVA (GENOA)
Novi Ligure
Voghera
Alessandria
Biella
Vercelli
Novara
Pavia
TORINO (TURINO)
Piacenza
Cremona
Lodi
Milano
Varese
Como
Monza
Bergamo
Brescia
Verona
Mantova
Venezia (Venice)
Treviso
Vicenza
Padua
Ferarra
Parma
Carpi
Modena
Reggio Emilia
Bologna
Lugo
Imola
Forlì
La Spezia
Massa
Lucca
Pistoia
Prato
Firenze (Florence)
Arezzo
Volterra
Siena
TUSCANY
Viareggio
Pisa
Livorno (Leghorn)
Piombino
Grosseto
Elba
Capraia
Cap Corse
Golfe de St. Florent
Bastia
St. Florent
Calvi
CORSICA (FRANCE)
Monte Cinto
Corte
Golfe de Lion
Mediterranean Sea
Aachen
KÖLN
Bonn
Neuwied
Koblenz
GERMANY
Mainz
Metz
Trier
LUXEMBOURG
Luxembourg
Esch
Kaiserslautern
Saarbrücken
Baden
Sarreguemines
Strasbourg
Colmar
Sélestat
Mulhouse
Belfort
Basel
Biel
La Chaux de Fonds
Lausanne
SWITZERLAND
Bern
Genève (Geneva)
Paris
Nancy
Strasbourg
Stuttgart
GERMANY
Munich
Zürich
Basel
Bern
SWITZERLAND
Genève
Nantes
FRANCE
Bordeaux
St. Étienne
Lyon
Milan
Turin
Genoa
ITALY
Toulouse
Nice
Marseille
Toulon
ANDORRA
Zaragoza
Barcelona
SPAIN
Ajaccio
Bastia
Corsica (FRANCE)
Sardinia (ITALY)
Valencia
Balearic Islands (SPAIN)
Cagliari
Philippeville
Bizerte
Bône
Tunis
Algiers
Blida
Bougie
Constantine
Sétif
Batna
Tebessa
Sousse
Sfax
Oran
Relizane
Mascara
Sidi bel Abbès
Tlemcen
Djelfa
Biskra
Bou Saâda
Laghouat
Ouargla
Touggourt
Railroad
Oil pipeline
Hassi Messaoud
Ain Sefra
Saharan Atlas
Mostaganem
Orléansville
Algiers
Delly Ibrahim
Tizi Ouzou
Ujda
ALGERIA
STATUTE MILES
Mediterranean Sea

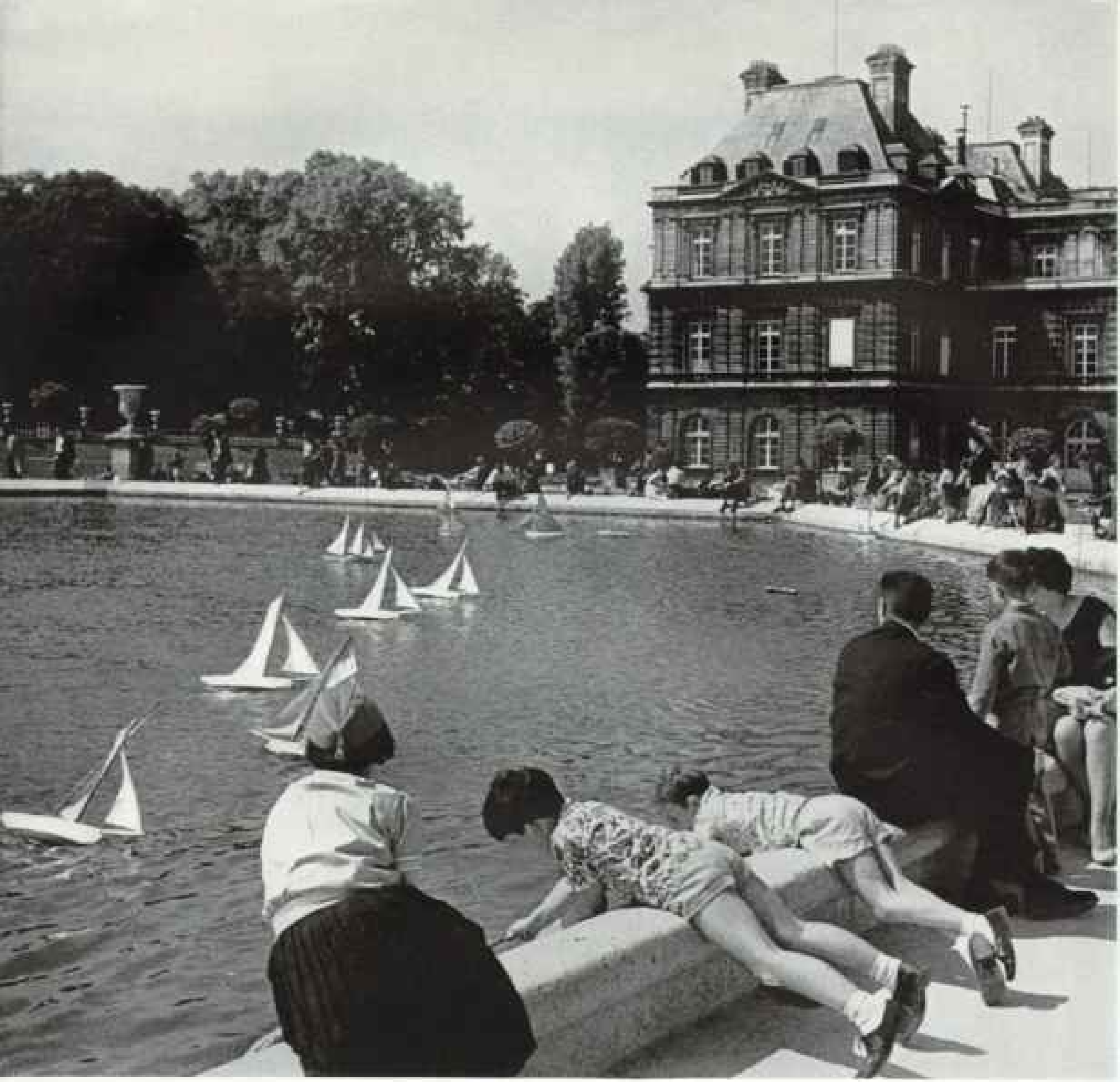
A Sidewalk Cafe Offers Ringside Seats to the Passing Parade

Paris lives much of her life on her broad sidewalks. There flower and vegetable vendors spread their markets; bookstalls induce the reader to browse, perhaps even to buy; department stores display their bargain tables, and showmen set up carnivals for children. There is scarcely a street in Paris that does not harbor at least one open-air cafe, where an apéritif buys the right to watch the world go by.

Rows of cane chairs, often painted a brilliant orange, blue, or yellow, and tiny round marble tables rimmed with brass cluster beneath fluttering umbrellas or an overhanging awning emblazoned with the cafe's name in bold letters.

Spacious, tree-lined streets invite strolling. Here promenaders swing leisurely along the Champs Elysées in the shadow of the Arc de Triomphe.

Walter Meayers Edwards, National Geographic Staff



Toy Sailboats Ply the Basin Beside Luxembourg Palace

Marie de Médicis, widow of Henri IV, grew homesick for her native Italy and ordered a palace and garden in Florentine style. Completed in 1630, the estate gave her fleeting pleasure. Estranged from her son, Louis XIII, the queen fled France and died in exile in 1642. Her palace served the Revolution as a prison; it now houses the Council of the Republic, upper chamber of the French Parliament.

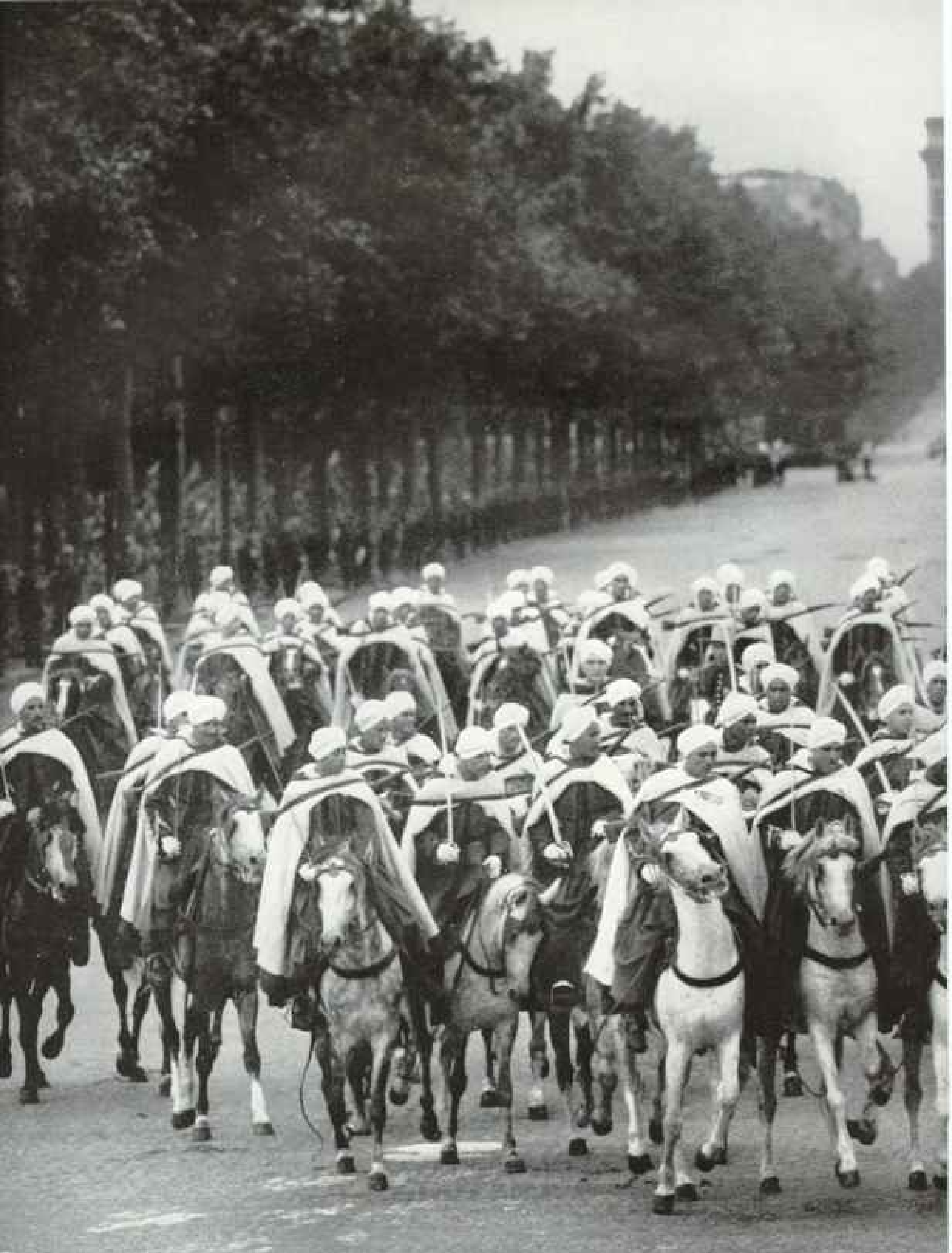
Luxembourg Gardens, onetime haunt of philosopher Jean Jacques Rousseau, welcomes children. This skipper launches his boat with mature advice.

Walter Meayers Edwards, National Geographic Staff

Napoleon Atop His Column Eyes the Place Vendôme

Bonaparte erected the 144-foot pillar to honor his soldiers. Melted cannon taken at the Battle of Austerlitz provided bronze for the sculptured sheathing. The memorial echoes Rome: Trajan's column served as model, and Napoleon appears as Caesar.

Buildings lining the square rose as a unit in the late 1600's. Now preserved as a historical monument, they hold the Ritz hotel and some of the world's most expensive shops.



298 Spahis, Algerian Cavalrymen Loyal to France, Gallop Down the Champs Elysées;

Wide World

Sabers in Hand, Rifles Across Shoulders, Turbaned Riders Parade in Tight Ranks 299

Deputies of the French People Hear Their New Premier, General de Gaulle

Charles André Joseph Marie de Gaulle, called to office after weeks of crisis, addresses the National Assembly at the fateful Sunday session of June 1, 1958.

In a seven-minute appeal, the wartime Free French leader requested extraordinary powers to deal with problems at home and abroad. The Assembly quickly invested him as head of the 26th French Government since the liberation of Paris in August, 1944. Two days later, at de Gaulle's request, the Deputies adjourned until October.

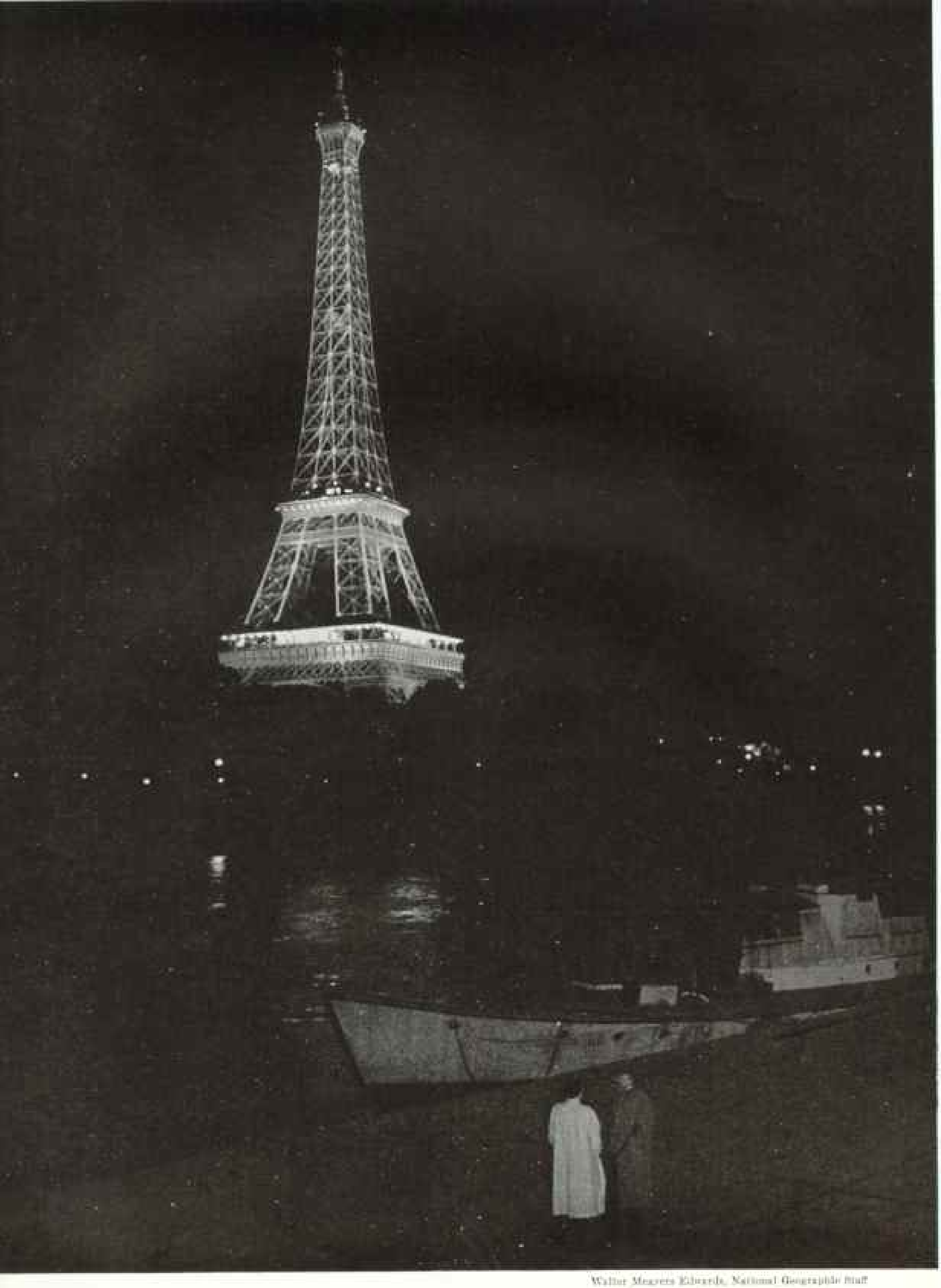
The lower house of the French Parliament makes the laws of the Fourth Republic in this steeply banked, semicircular chamber of the old Bourbon Palace on the Left Bank of the Seine. Its 590 members, crowding benches covered in red plush, represent the many parties of French politics.

Election Day demonstrates the important role of women in the nation's political life. Frenchwomen voted for the first time in 1945 under the new constitution's preamble, guaranteeing "... to women in all spheres rights equal to those of men." The National Assembly (above) includes 19 women Deputies. The last census counted 117 registered women voters to every 100 men.

Here an election official checks the registration of Sisters of Charity as they place their votes in the ballot box. Members of the Order of St. Vincent de Paul, the nuns wear wide-winged cornets and blue habits similar to the common garb of the Parisian poor in the early 1600's.

Voting booth with a high hemline gives privacy to a Parisienne marking her ballot. A four-buttoned future voter accompanies her.

Wide World (above); Robert Cohen, Black Star (left), and Pictorial News from Black Star



Walter Meayers Edwards, National Geographic Staff

Symbol of the City of Light, the Eiffel Tower Glows with New Radiance

Last May, when crisis hung like a dark cloud over the city, Parisians looked to the heavens and saw the 69-year-old tower brave with newly installed floodlights.

(Based on Company File #35EE5315)

I came to...in a cast

Only a tiny patch of ice. *Bang!* Down I went —shattering my elbow.

I woke up in this cast. Long weeks in the hospital, and then home—still in a cast. I couldn't do a thing for myself for *four months.*

It was a long and trying ordeal. Luckily we had the right kind of insurance. My husband had taken out a Hartford Family Major Medical Expense Policy only a few weeks before.

I'd have had a much more difficult time. I'm sure, if it hadn't been for the kind and considerate attitude of the Hartford people. Our Hartford Group Agent and the claim man were both so helpful. All my needs were well taken care of—they did everything they possibly could to see that I was comfortable.

My husband and I were concerned about having such a large claim so soon after taking out our insurance. But the Hartford's payments toward my medical bills were made promptly and without question. Altogether they came to $1,592—and what a wonderful help they were in saving us from financial disaster.

I guess you can see why my husband and I both think the Hartford is a pretty good company to be insured with!

You get all three when you're insured through the Hartford Group:

1. Peace of mind. The Hartford is a financially strong organization with a 148-year record for prompt and fair payment of claims.

2. Capable insurance counsel. Hartford Group Agents and brokers of Hartford insurance are trained, experienced men, qualified to help you with your insurance problems.

3. Service that meets your needs. The Hartford has 33,000 Agents . . . more than 200 claim offices . . . a staff of 9,500. Wherever you may be, there is an Agent or a broker close by to provide the dependable Hartford protection you need for family . . . home . . . car . . . business.

Year in and year out you'll do well with the

HARTFORD

Fire Insurance Company

GROUP

Hartford Fire Insurance Company
Hartford Accident and Indemnity Company
Hartford Live Stock Insurance Company
Citizens Insurance Company of New Jersey, *Hartford 15, Connecticut*
New York Underwriters Insurance Company, *New York 38, New York*
Northwestern Fire and Marine Insurance Company
Twin City Fire Insurance Company, *Minneapolis 2, Minnesota*

Coed Schools

ELGIN ACADEMY College preparatory. Coed, grades 7-12. Small classes. Individual PAR goals through personalized guidance. Balanced activities. Sports, gym, pool, music, drama. Art gallery. Modern dorms. Endowed. Est. 1839. Write for catalog. **M. L. Brett, 117 Academy Pl., Elgin, Illinois**

FENSTER RANCH SCHOOL
Nationally known ranch school for boys and girls. Grades 1-12. College preparatory. Riding, swimming, other activities in warm, dry climate. Also summer camp. *Catalog.* **Mr. G. D. Fenster, Director, Fenster Ranch School, Tucson, Ariz.**

JUDSON SCHOOL Coed Ranch School, Grades 1 to 12. College preparatory. Healthful, warm climate, near Phoenix. Small classes. Accredited. Riding and polo included in tuition. Tennis, swimming, pack trips, fishing, riflery, music. 30th yr. *Catalog.* **David N. Wick, Hdm., Scottsdale, Ariz.**

Girls' Schools

KINGSWOOD-CRANBROOK
Thorough college preparation, general courses. Boarding, grades 8-12; day, grades 7-12. 50 acres on lake near Detroit. Unusual opp. in arts, handicrafts, sciences. Music, drama, sports, typing. Catalog. **156 Cranbrook Road, Bloomfield Hills, Mich.**

LINDEN HALL Junior College and School for Girls. Cultural and Vocational. Music, Home Economics, Secretarial Studies. Fine and Commercial Art. Dramatic Art. Preparatory and General Courses. Beautiful Campus. All Sports. Riding. Swimming Pool. Moderate Tuition. **B. K. Horne, D.D., Box 68, Lititz, Pa.**

OAK GROVE A Friends school for girls. Emphasizes Preparation for College and Gracious, Purposeful Living. Music, Art, Speech. Grades 7-12. International enrollment. Riding included. Indoor Ring. Winter Sports. Beautiful fireproof Quadrangle. **Mr. and Mrs. Robert Owen, Box 140, Vassalboro, Maine**

SULLINS COLLEGE For young women. Accredited Jr. Coll. Liberal Arts & Career Courses. Music, Speech, Art, Sec'l., Med. Sec'l., Mdsg., Home Ec., Phys. Ed., Ballet, Equitation. Outstanding social program. All sports. Lake, Pool, Golf, Riding. Est. 1870. Catalog. **William T. Martin, Pres., Box N-8, Bristol, Va.**

Languages

SEND FOR **Free Record**

START SPEAKING **FRENCH** OR **SPANISH** *ALMOST OVERNIGHT!*

HERE'S the easiest way to learn FRENCH, SPANISH, Russian, German, Italian, Japanese or Brazilian. Listen to FREE 2-sided non-breakable record. Let your eyes follow words in FREE sample lesson. Almost at once you'll be chatting in a new language **with a perfect accent! That's all you hear!** No dull, tedious work. Just listen—imitate! It's that easy! Offer may end soon. Rush 25¢ to help cover cost of special packaging, shipping of free record lesson. State language you want. We'll also send free information on full Cortina course. No obligation. **CORTINA ACADEMY, Dept. 228, 136 West 52nd Street, New York 19.**

It's Quick, Easy, Fun To Learn A LANGUAGE by LINGUAPHONE

At home, quickly, correctly master French, Spanish, German, Japanese, Modern Greek, Russian — any of **34** languages through Linguaphone's Recorded Conversational Method. World-wide educational endorsement. One million home-study students. Save time, money. WRITE for FREE BOOK.
LINGUAPHONE INSTITUTE
29-088 Radio City, N. Y. 20, N. Y.

Home Study

Calvert School
THE SCHOOL THAT COMES TO YOU

Kindergarten-8th grade. Accredited home-study courses. Complete teaching manual. Courses kept up to date by pretesting in Calvert's laboratory-school. Also used to enrich schooling of above-average child. Non-profit. 53rd yr. *Write for catalog.*

33 Tuscany Road, Baltimore 10, Maryland

Vocational

BRYANT COLLEGE B.S. DEGREE IN 2 or 3 YEARS. *Business Administration:* majors in Accounting, Management, Marketing. *Executive Secretarial:* majors in Administrative, Legal, Accounting, Medical. *Business Teacher-Education:* 4 years. Also 1-yr. Sec'l Diploma. Coed. Campus life. 24 bldgs. Dorms. Veteran approved. 93th year. Register early. Sept., Feb. entrance. Professional training for business leadership. For catalog write: **ENROLLMENT DIRECTOR, BRYANT COLLEGE, Providence 6, Rhode Island.**

INDIANA TECHNICAL COLLEGE B.S. Engineering degree in 27 mo. Aero., Chem., Civil, Elec., Mech., Electronics (inc. Radio & TV). B.S. in 36 mo. in Math., Chem., Phys. Prep. courses. 20 bldgs.; dorms. Earn board. G.I. appr. Enter Sept., Dec., March, June. Catalog. **198 E. Washington Blvd., Ft. Wayne 2, Indiana**

KATHARINE GIBBS Outstanding secretarial training for high school, private school graduates. Special course for college women. Resident facilities. Catalog: **Asst. Dean, 21 Marlborough St., Boston 16, Mass.; 230 Park Avenue, New York 17; Montclair, N. J.; 155 Angell St., Providence 6.**

TRI-STATE COLLEGE B. S. Degree in 27 months in Mech., Civil, Elec., Chem., Aero., Radio (TV) Eng. In 36 months in Bus. Adm. (Gen. Bus., Acctg., Mot. Tr. Mgt.). Fine campus. Prep courses. Approved for Vets. Grads successful. Enter Sep., Jan., Mar., June. Catalog. **1488 College Ave., Angola, Indiana**

Boys' Schools

AUGUSTA MILITARY ACADEMY
"The Friendly School." Distinguished ROTC school in Shenandoah Valley. Jr. & Sr. Divisions. Boys 8-20. Accredited. Graduates in leading colleges. All sports; pool, gym. Organized 1742. Rate $1050. Catalog. **Col. C. S. Roller, Box N, Ft. Defiance, Va.**

BOLLES OF FLORIDA

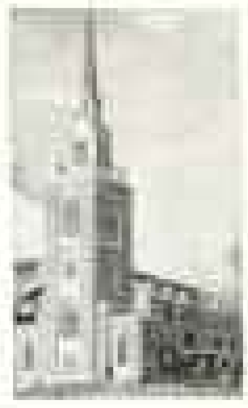
Fully accredited. Distinguished academic record. Grades 7-12. Conference-type classrooms. Varsity and intramural sports for all. Year-round golf, tennis, Sailing. Outdoor swimming pool. Military or naval training. Write for illus. catalog.
Registrar, Box 5037-N, Jacksonville, Florida.

BORDENTOWN MILITARY
Accredited. College preparatory. General courses. Aviation. Outstanding record of college entrance. ROTC. Boys taught how to study. Small classes. All sports. Jr. School. 77th yr. Summer session. *Catalog.* **Registrar, Box 656, Bordentown, N.J.**

CARSON LONG
Military School. Educates the whole boy—physically, mentally, spiritually. How to learn, how to labor, how to live. Prepares for college and life. Grades 6-12. 122nd year of character building. Overall charges $1275.00. **Box 21, New Bloomfield, Pa.**

CARTERET SCHOOL Superior College Preparation. Accredited. 1st Grade to College entrance. Small classes. Reading Techniques. Shops. Homelike dormitory. Large gym. 40 acres atop Orange Mt. Moderate rate. N. Y. trips 20 miles. Request Booklet B-C. **Carteret School, West Orange, N. J.**

CULVER



Grades 8-12. Thorough college preparation. Accredited. Develops initiative, self-reliance, courtesy, character, leadership. All sports. Exceptional academic, living facilities. ROTC: Artillery, Cavalry, Infantry, Band. 1000-acre campus on Lake Maxinkuckee. Catalog. **89 Pershing Terrace, Culver, Ind.**

FARRAGUT Fully accredited college preparatory. Toms River, N.J.; St. Petersburg, Fla. Naval training. Separate Junior schools. Guidance for college and career. Sports, boats; bands. Approved summer school and camp. Specify catalog desired. **Admiral Farragut Academy, Box L, Toms River, New Jersey**

FISHBURNE MILITARY A Distinguished military school for the young man seriously concerned with adequate preparation for college. Accredited since 1897. Grades 9-12. Highest ROTC rating. Summer school. *Catalog.* **Col. E. P. Childs, Jr., Supt., Box N, Waynesboro, Virginia.**

FORK UNION MILITARY ACADEMY
Our ONE SUBJECT PLAN of study

has increased honor roll 50%. In Upper School, grades 9-12. Develops concentration. Fully accredited. R.O.T.C. highest rating. 17 modern bldgs., 2 completely equipped gyms. Outdoor pools. Excellent health record. Separate Jr. School bandling grades 4-8. Housemothers. 60th year. For ONE SUBJECT PLAN booklet and catalog write:
Dr. J. C. Wicker
Box 308 Fork Union, Va.
★ ★ ★ ★ ★ ★ ★

GEORGIA MILITARY ACADEMY 8 Miles from Atlanta, Ga. Winter and Summer School. Accredited. R.O.T.C. Highest Gov't rating. Gym classes. Expert coaches. Indoor pool. Special Junior School. **Col. W. N. Brewster, President, College Park, Georgia.**

GREENBRIER MILITARY SCHOOL
★ 147th yr. The School of Achievement. 7th & 8th grades and H. S. & P. G. Dept. White Sulphur Springs. Golf & Swimming Pool. Modern Gymnasium & new Rifle range. ROTC. Develops leadership. Remarkable success records in College and Life. More graduates in "Who's Who" than 95% of all prep. & High schools in U. S. Accredited. 2300 ft. elev. Catalog, address **D. T. Moore, Box M 308, Lewisburg 3, W. Va.**

HARGRAVE MILITARY ACADEMY
Fully accredited. College preparatory, general courses. Grades 5-12. How-to-study training; remedial reading; individual guidance. Separate Jr. School. All sports. Summer School. Est. 1909. Catalog. **Col. Jos. H. Cosby, Box N, Chatham, Va.**

HOWE MILITARY SCHOOL
Academic training in spiritual environment. Accredited prep, business. Potential Achievement Rating gives each boy a goal. Jr. School. Sr. ROTC. Sports. New dorms and pool. Episcopal. Catalog. **B. B. Bouton, 988 Academy Pl., Howe, Ind.**

KEMPER
Leading Military School for 114 years. Accredited; highest academic standing. Individual attention to each student. Grades 8-12, Junior College. Modern buildings. All sports. Write to Director of Admissions. **Kemper Military School, 1088 Third St., Boonville, Missouri.** Our representative will call with complete details. No obligation.

KENTUCKY MILITARY INSTITUTE A school with a winter home at Venice, Florida. Preparation for college under ideal climatic conditions all year. Oldest Private Military School in America. For catalog, address: **Col. C. B. Richmond, Pres., Box N, Lyndon, Ky.**

McDONOGH A Leading preparatory school. Grades 1-12. Accredited. Prepares for all colleges, service academies. Small classes, guidance. Music. Dairy and animal husbandry. Semi-military. Sports; 80 horses; 2 gyms, indoor pool. 835-a. campus. Est. 1873. Catalog. **R.L. Lamborn, Ed. D., Box 106, McDonogh, Md.**

With so many hundreds of private schools from which to choose, the selection of the one school best suited to the needs of the individual student is quite often a problem. Each year in the March through August issues, The NATIONAL GEOGRAPHIC MAGAZINE presents the Educational Directory as a guide to the evaluation of the finest camps, schools, and colleges in America.

• • •

The educational institutions listed in the Directory will be pleased to send catalogues and viewbooks to any National Geographic families expressing an interest in receiving additional information. By mentioning The Geographic, your inquiries will be assured the best possible attention.

TELEPHONE MAN WORKING FOR YOU William T. Wright, Jr., regularly measures the pressure in telephone cables in order to help keep your telephone service trouble-free.

Taking the "blood pressure" of a telephone cable

Meet another specialist in service who works for the telephone company

This is Bill Wright, of the telephone company. One of his jobs is to head off trouble before it starts. His work takes him all around the neighboring countryside of Lovingston, Va.

THEY CALL HIM "MR. TELEPHONE" in Lovingston, Va. He's often stopped on the street to answer questions about telephone service or equipment. Here Mrs. Hattie Allen flags him down with a query. Bill takes time out to give her the information.

You see him here on a typical service check-up. Many telephone cables are filled with dry air, kept under pressure, like air in a tire. This pressurized air is important in the maintenance of good service — it protects the cable from moisture.

Bill regularly checks telephone cables for air leaks. He can easily detect any drop in pressure with a special gauge called a mercury manometer. If the air pressure reads below normal, Bill quickly locates the break in the artery and fixes it before telephone service is disrupted.

William T. Wright was born in the outskirts of Lovingston. And it is right in this neighborhood town that he has become virtually a "country doctor" for telephone service.

Even in high school days Bill played a key role in group activities . . . on the ball field, in amateur dramatics. He and Mrs. Wright, a Lovingston girl, devote much time to the busy community life of the town they love. Bill is a member of the volunteer fire department and of the county men's club.

Bill Wright is just one of the many thousands of telephone people who are working to give you fast and dependable service today — even better, more convenient service tomorrow.

BELL TELEPHONE SYSTEM

Taken on Anscochrome color film at f/6.3, 1/100 second

You couldn't get a picture so true-to-life except with an Anscochrome film

In bright sunlight or deep shadow—by candlelight or windowlight—you capture the *natural look of life* on Anscochrome® color films. They have the speed that stops action, too—even under conditions impossible for ordinary color films.

Regular Anscochrome — Film Speed 32— makes *any* camera fine for color. It's easy to use, and gives you beautiful color slides—plus, if you wish, lovely color prints.

Super Anscochrome — Film Speed 100—is the fastest color film ever created. It brings you—without time exposure, tripod, or extra lighting—low-light and high-speed shots no one has ever caught in color before.

Color slides from regular *or* Super Anscochrome will delight you with their depth and brilliance. And they cost *less than half* of what you'd pay for pictures from films that give you *only* color prints.

Color prints, too! You can have Printon® color prints made from Anscochrome or *any* color slides. Printon prints are plastic—no others compare in beauty, durability, economy.

ADVANCED PHOTO PRODUCTS

Ansco

FOR EVERYONE WHO TAKES PRIDE IN HIS PICTURES

Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corporation

TWO GREAT NEW LUXURY LINERS

S. S. BRASIL: Maiden voyage Sept. 12th, 1958. Her sister ship, S. S. ARGENTINA Dec. 12th, 1958. Barbados, Rio de Janeiro, Santos (São Paulo), Montevideo, Buenos Aires, Bahia, Trinidad, New York.

Mooremack announces SS BRASIL and SS ARGENTINA seagoing resorts to South America

Lunch by the pool and look through picture-window walls to spacious lounges. Evenings, the orchestra plays for dancing. A second pool in the Junior Play Center has its own soda-bar and hi-fi dance records.

Oversize outside staterooms

Marvelous Mooremack meals

LAUNCHED: A new way of life afloat. Two fast and fabulous seagoing resorts with country-club decks, outdoor restaurants, theater, night club—the perfect setting for your southern holidays.

Interiors by Loewy

World-famous Raymond Loewy Associates create a curtain-going-up excitement with this imaginative interior design, dramatic sun-and-sea colors. Great glass picture-window walls lend a sense of space unequalled in any other ships.

These are exciting ships. Even before they leave the pier you're *completely* out of your everyday routine.

Get away from it all

Plan *now* to get away from the grind of daily work. Enjoy nerve-unwinding days at sea and a holiday in South America's sunny climate!

The time, just one short month. *The cost*, no more than at a land-locked luxury resort.

Both ships air-conditioned, all first class, all outside staterooms. See your travel agent for schedules and reservations.

MOORE-McCORMACK Lines

Sail with the sun on a seagoing resort
...go MOOREMACK to South America