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U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

**Movie footage of the activity of Parícutin Volcano,  
Michoacán, Mexico, 1945-1952**

by

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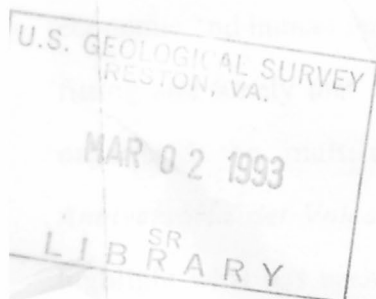
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**Open-File Report 93-197-A**

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## PREFACE

Following more than a month of precursory earthquakes, a fissure opened in a cornfield of Llano de Cuiyúsuru (a farm about 2 km southeast of Parícutin village) and began spouting ash and fume in the late afternoon of 20 February 1943 (Foshag and González, 1956). During the night, incandescent ejecta thrown out of the fissure were observed by the frightened campesinos. By the next day, the accumulated ejecta formed a mound about 35 m high—thus was born a new Mexican volcano called *Parícutin* (Mooser, 1958b). The eruption then continued for more than 9 years, and the new volcano ultimately grew to nearly 460 m in height (above original ground level), before ceasing all eruptive activity on 4 March 1952. Although the volcano has remained quiet for decades, the temperature in 1985 at one of the fumaroles at Parícutin measured 473° C (McClelland and others, 1989).

Parícutin's activity and aftermath have spurred numerous studies covering diverse topics, including eruptive processes and products, erosion and revegetation, and socio-economic and human impact of the eruption (e.g., Rees, 1979; Nolan, 1979). Thus, it is fitting and timely that the Universidad Nacional Autónoma de México (UNAM) has organized the multi-disciplinary *Reunión Internacional Conmemorativa: 50º Aniversario del Volcán Parícutin* (18-20 February 1993, Uruapan, Michoacán) to highlight what has been learned about the Parícutin eruption and its impact. A field excursion to the volcano is planned for 20 February 1993, precisely 50 years after the initial eruptive outbreak. The videotape contained in this report is to be premiered at this commemorative international meeting, presenting scenes of Parícutin eruptive activity, as well as of people observing it, heretofore not seen publicly.

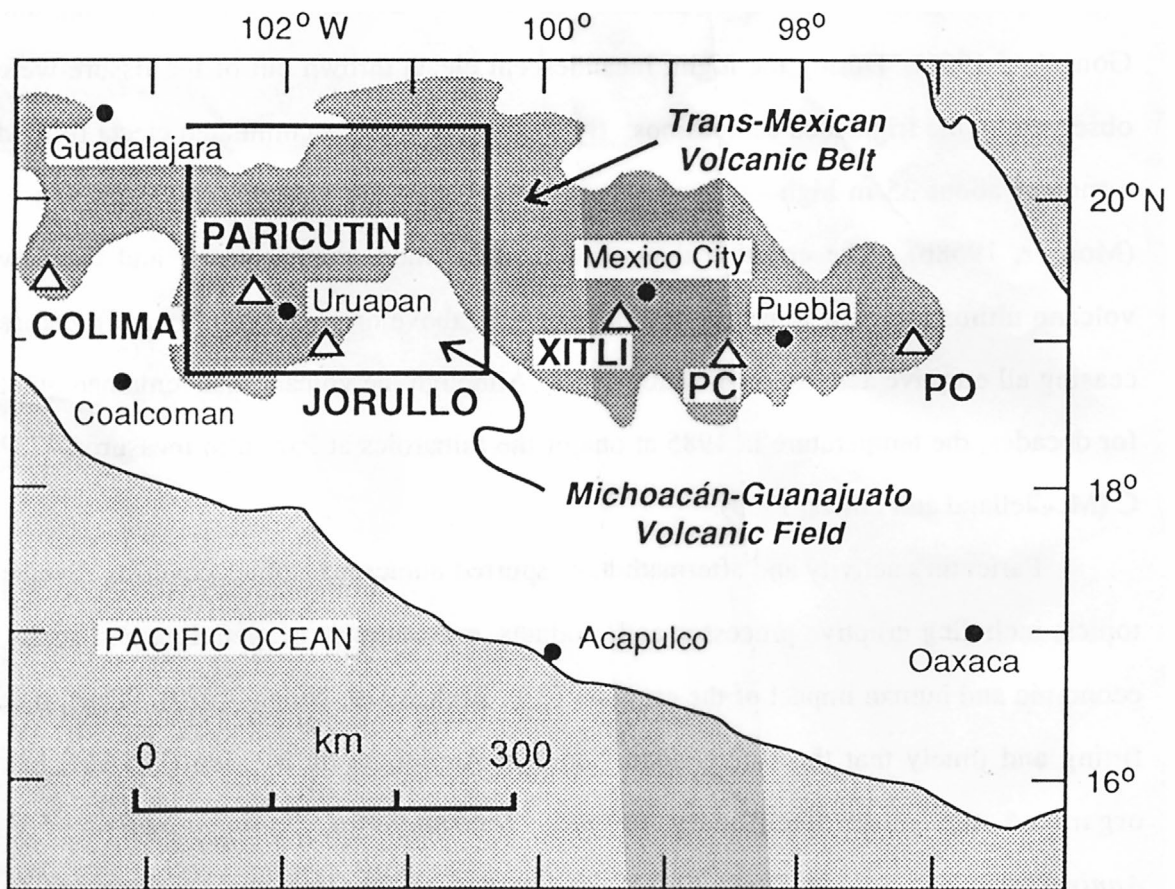


Figure 1. Index map showing part of the Trans-Mexican Volcanic Belt (stippled) and the locations of Parícutin and Jorullo Volcanoes within the Michoacán-Guanajuato Volcanic Field (outlined by rectangle) of Hasenaka and Carmichael (1985). Some other active volcanoes also are indicated by triangles (PC = Popocatepetl, PO = Pico de Orizaba), and selected population centers by solid circles. (Modified from Yokoyama and De la Cruz-Reyna, 1990, Fig. 1).

## INTRODUCTION

The 1943-52 eruption of Parícutin added the newest, cinder-lava cone to the volcanic landscape of a region (Fig. 1) termed the "Michoacán-Guanajuato Volcanic Field" (MGVF) by Hasenaka and Carmichael (1985). About 100 km southeast of Parícutin is Jorullo Volcano, which was born in 1759 and continued eruptive activity until 1774 (Ordóñez, 1906; Segerstrom, 1950; Mooser, 1958a; Bullard, 1976; Luhr and Carmichael, 1985). The MGVF region, which contains more than 1,000 Quaternary volcanic centers (~ 90 % cinder cones), forms a unique part of the Trans-Mexican Volcanic Belt (TMVB) that lacks large active composite volcanoes, such as Colima, Popocatepetl, and Pico de Orizaba (also called Citlaltépetl). Parícutin, Jorullo, and the other cones of the MGVF are considered to be "monogenetic" volcanoes, defined as those formed by a single eruptive cycle; in contrast, the large-volume composite volcanoes of the TMVB—such as Volcán Colima, historically the most active in Mexico—are considered "polygenetic," that is, constructed by more than one eruptive cycle. It is believed that, in general, the cones in the MGVF are "active for only a short period of time, perhaps a few months to twenty years, and rarely become active again." (Hasenaka and Carmichael, 1985, p. 107).

The Parícutin eruption afforded an unprecedented opportunity to study the development of a monogenetic volcano, the first such opportunity since the emergence of modern volcanology in the 20th century. During the eruption, Parícutin's life cycle—birth, growth, and demise—was intensively studied by many scientists of the U.S. Geological Survey (USGS), working closely with U.S. and Mexican colleagues; see Heath and Tabacchi (1968, p. 27-34) for a listing of studies involving USGS participation. Periodic reports on Parícutin's activity were published in geoscience journals, most notably the Transactions of the American Geophysical Union (see Heath and Tabacchi, 1968). Detailed studies of the early years of Parícutin activity, as well as a study of other volcanoes in region, were summarized in four comprehensive papers

comprising USGS Bulletin 965 (USGS, 1956). Since 1950, many additional investigations have been made of various aspects of the eruption, including a retrospective modern analysis of Parícutin's precursory seismicity (Yokoyama and De la Cruz-Reyna, 1990). Collectively, these studies are germane to an improved understanding not only of Parícutin's origin and evolution in particular, but also of monogenetic volcanism in general.

The purpose of this report is to present in videotape format recently "re-discovered" movies—previously unknown to the general scientific community—of Parícutin's activity during the period 1945-52, to add to the body of knowledge about the first well-documented example of an eruption of a monogenetic volcanic cone in historical time. Specifically, this report, which provides background information about Parícutin and the movies, complements a companion report (Open-File Report 93-197-B) that presents the videotape only. These two reports should be used together.

## **ACQUISITION AND HANDLING OF THE MOVIES**

The movie footage presented herein was shot by Carl Fries, Jr., who at the time was a member of the USGS working in Mexico. In February 1943, Carl and several other USGS members, upon learning of the eruption, rushed to the Parícutin site as soon as possible. Dr. William Foshag, the leader of the USGS field party, was first to arrive, about one week after the initial outbreak. All of us took many still photographs during the ensuing activity, but by 1945 Carl was making systematic observations of the eruption and taking color 16-mm movies. The footage he shot during the periods 1945-49 and 1951-52 filled two 800-ft reels and one 100-ft reel.

These movies of Parícutin remained in Carl's personal possession until his death in 1965, at which time his movies and other personal effects were sent to a brother (William) living in Oshkosh, Wisconsin. After William's passing in 1991, his widow,

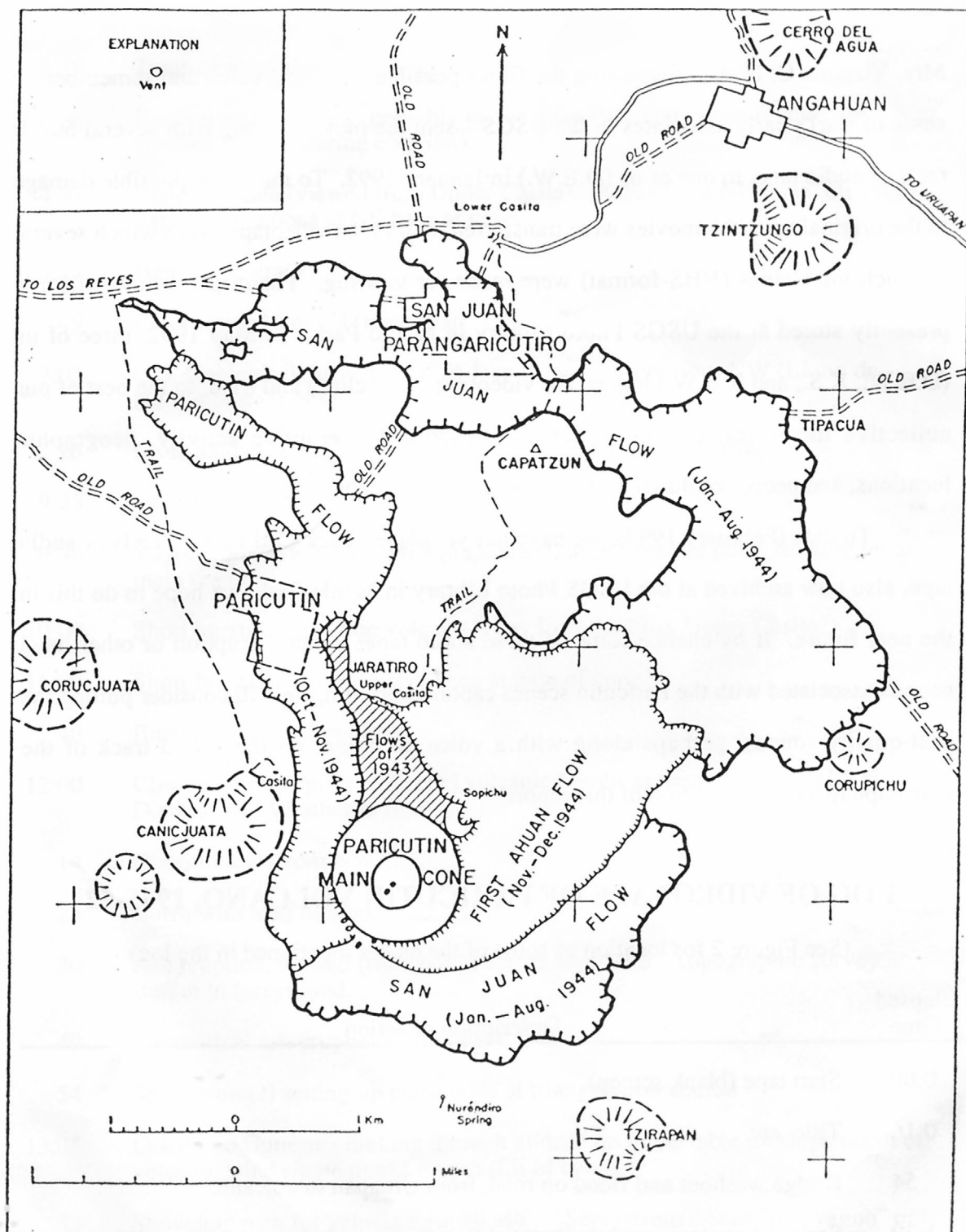


Figure 2. Map showing area covered by lavas of Parícutin volcano to end of 1944; grid ticks correspond to 2000-m intervals. Some of the place names mentioned in the log of the videotape are indicated in this figure. (Modified from Wilcox, 1954, Fig. 96).



Mrs. Virginia C. Fries—suspecting the film's possible historical value and remembering some of Carl's early associates in the USGS—sent the movies, along with several 600-ft reels of audio tape, to one of us (D.E.W.) in January 1992. To minimize possible damage to the original film, the movies were transferred to 3/4 inch videotape, from which several 1/2-inch videotapes (VHS-format) were made for viewing. The original movie film is presently stored at the USGS Photo Library in Menlo Park. In May 1992, three of us (D.E.W., K.S., and R.E.W.) logged the videotape (see below) and tried, to the best of our collective memories, to reconstruct and describe the eruptive activity, geographic locations, and people captured on film nearly 50 years ago.

To date (February 1993), we have not yet played back Carl Fries' 7 reels of audio tape, also now archived at the USGS Photo Library in Menlo Park; we hope to do this in the near future. If by chance some of these audio tapes contain eruption or other local sounds associated with the Parícutin scenes captured on film, we will consider putting the best-quality sounds, perhaps along with a voice narration, on the sound track of the videotape in a revised edition of this report.

## LOG OF VIDEOTAPE OF PARICUTIN VOLCANO, 1945-52

(See Figure 2 for location of some of the places mentioned in the log)

Elapsed Time	Description of action
0:00	Start tape (blank screen).
0:16	Title, etc.
54	Bridge washout and flood on road, from Uruapan to volcano.
1:30	Series of explosive ash outbursts (view from north?).
2:05	Mrs. Merle Foshag sketching volcano from Jarátiro (Upper Casita).
42	Bill Foshag and son, talking in background and, later, walking.
3:04	Repairing washed out bridge.

- 3:19 Treating injured person.
- 28 Festival and livestock, probably in San Juan Parangaricutiro (eventually covered by lava during eruption).
- 4:51 Parícutin cone (viewed from Upper Casita). Note rift on NE flank, steaming. Sapichu lava boca at NE base of cone.
- 5:32 Harvesting grain.
- 49 Cone viewed from N (from Llano Grande?).
- 7:05 U.S. Geological Survey (USGS) Jeep wagon. View from NW (Llano de Huirambosta?) of volcano.
- 26 Jesús Saldaña (?) climbing main cone; standing on crater rim.
- 9:23 Volcano from N (Jarátiro?).
- 9:36 Vapor from lava boca mound (Sapichu??) at NE base of cone, looking up at main crater.
- 10:00 Short bursts of ash from volcano (view from Jarátiro, Upper Casita?).
- 11:00 Short bursts of ash from lava boca at base of cone?
- 40 Bursts (viewed from NE?).
- 12:00 Climbing across piles of ejected volcanic bombs at base of cone. (USGS Director Bill Wrather in front?)
- 14 Distant view (from NW?).
- 25 Burro with load of wood.
- 30 Ash eruption, viewed (from SW?) across lava field. Topographic survey station in foreground.
- 40 Intermittent ash eruptions (viewed from S).
- 54 Segerstrom(?) setting up plane table at triangulation station.
- 13:06 Celedonio Gutiérrez looking through alidade on plane table on slope north of volcano; wind ripple marks on ash (SE of cone).
- 43 Shoveling path for vehicle through ash.... Segerstrom drives "pie wagon" out of arroyo.
- 54 Vapor eruption, then ash and bombs.
- 14:15 Dust raised by bombs falling on flanks of cone (photographer on adjacent lava mound).
- 32 USGS Jeep wagon struggling up slope.



- 14:40 Checker-shirted geologist, Bill Putnam (UCLA), examining ash.  
53 USGS Jeep wagon.
- 16:03 Sampling fresh ash from Lower Casita and from hood of car.  
21 USGS Jeep wagon struggles out of arroyo.  
40 Digging test pit in ash.
- 17:02 Lowering a geophysical instrument (geiger counter?) in hole.  
20 Sunset glow  
26 Front of aa flow (sampling).
- 18:12 Operating pump equipment for sampling gas.  
37 Walking along front of flow; people sitting.
- 19:01 Four persons beside Jeep wagon, hooking hose to gas cylinder.  
26 Filling balloon (for meteorological observations?) with gas from hose, held with parachute cloth.  
52 Filling another balloon.
- 20:07 Putnam turns on valve of gas cylinder.  
47 Collecting water at spring (village of Angahuan?).  
56 Celedonio's wife, Magdalena, and child? Tarascan boy and family.
- 21:32 Collecting water from spring (perhaps Angahuan village water supply).  
59 Explosive burst of ash (viewed from NE?). People of Angahuan village.
- 22:56 Volcano plume in early morning; San Juan church tower at right.
- 23:14 Planting corn?  
53 Poppies in bloom, growing through ash.
- 24:02 Log bridge over gully.  
10 Ash washed off bedrock by flood water at edge of llano.
- 24:32 Low activity at cone, as viewed from Lower Casita.
- 25:02 USGS Jeep wagon descending to Llano Grande.  
17 Carl Fries and Jesús Saldaña setting up plane table for shot up cone.

- 26:04 Early morning ash plume (viewed from Upper Casita?).
- 15 Driving "pie wagon," leaving Llano Grande.
- 21 Parícutin cone (inactive); Sapichu lava vent at left, from NW.
- 29 NW of cone, several persons examining a live tree.
- 41 Walking from Segerstrom's "pie wagon."
- 27:04 Antonio Saldaña (picking fruit?) near lava front.
- 26 Maguey plant growing through ash.
- 35 Nearly dead trees outside of W edge of lava field. Parícutin cone at left with SW boca.
- 45 Panorama (where?).
- 55 Side of gully in ash; person slides down.
- 28:05 Eroded cone (Canicjuata?); dead trees.
- 18 Buried Tarascan house (near Parícutin village?).
- 30 Hot lava front. Encrustations are mostly chlorides.
- 35 Active fumaroles in lava field, and other active fumaroles and encrustations.
- 29:37 NE across lava field; white tower of San Juan cathedral in distance; steam from buried hot lava; from heavy rainstorm, hot lava below?.
- 30:00 Sampling gases and measuring temperatures of fumaroles. (Note yellowish vapor.)
- 12 Looking up flank of cone toward ash plume.
- 55 Moderate ash and steam eruption, from SW rim?
- 31:34 Two persons on rim watching eruption in crater bottom.
- 32:25 Ash and steam eruption, viewed from rim of crater.
- 33:33 Looking down from S rim to main crater to vent of flowing lava.
- 41 Antonio Saldaña (?) coming diagonally down flank of cone, then across "bomb" field at base; bombs falling and rolling down flank of main cone.
- 34:36 Breaking a hot bomb with hammer; more bombs falling on flank of cone.
- 35:18 Strong vapor and bomb eruption, from crater rim. Bombs are red hot.
- 36:54 Direct view of incandescent vents in main crater.

- 37:57 Three persons retreating down flank, from an explosion of bombs.
- 38:25 Panning from hot lava (SW boca?) and then to flow around S and SE base of cone.
- 43 Flowing incandescent lava.
- 39:15 Looking down on active (SW?) lava boca. (Note blue vapors.)
- 34 Strong activity in main crater vent, viewed from rim. (Reddish reflections result of defective color film?)
- 42:46 Persons on rim illuminated by flow from main crater.
- 51 More strong vapor activity from crater.
- 43:08 People retreating down flank, surrounded by falling red hot bombs.
- 27 Light from setting sun reflected off upper part of vapor column
- 49 Looking W at setting sun.
- 44:05 End (blank screen).

## IN MEMORIAM

Two major participants in the studies at Parícutin were our colleagues Carl Fries and Ken Segerstrom, both of whom are no longer alive. In recognition of their scientific contributions to our understanding of Parícutin, and also of the geology of Mexico, brief memorials to them are given below: the one for Fries draws from Schmitter (1965) and Salas (1966), and the one for Segerstrom from a draft by F. Allan Hills (USGS, Denver) for the *Memorials* of the Geological Society of America.

### Carl Fries, Jr. (1910-1965)

Carl was born on 30 September 1910 in Chicago, Illinois, where he lived until 1919. Then his family moved to Mazomanie, Wisconsin, where his primary and secondary education were completed in 1927. He attended the University of Wisconsin (Madison), earning an A.B. in 1937 and an M.A. in 1939 with "Highest Honors." Carl specialized in economic and structural geology and, after graduation, joined Phi Beta Kappa and Sigma Xi. While a student, Carl was a geologic field assistant for the USGS

working in Colorado and Idaho during the summers of 1937 and 1938. The summer of 1939 Carl worked in Texas and Louisiana for the Seismograph Service Corporation.

Upon obtaining his M.A., Carl joined the USGS as a geologist in September 1939. Although he was headquartered in Washington, D.C., he was the USGS tin commodity expert, involving fieldwork in New Mexico and Nevada (1939-41) and later in Mexico (1942-45), beginning what was to become a life-long love for that country. Carl served as the Chief of the Mexican office of the USGS for the next 12 years, conducting many studies in cooperation with Mexican as well as U.S. geologists. Quite naturally, he became enthusiastically involved with the studies at Parícutin Volcano during its active life. His superior knowledge of the Spanish language, spoken and written, made him an invaluable translator and expeditor of all scientific publications generated from Mexican-U.S. cooperative studies during and after World War II.

During the period 1957-59, Carl worked only part time with the USGS, because he wanted to pursue graduate studies at University of Arizona (Tucson), where he obtained a Ph.D. in February 1959. Upon obtaining his doctorate, Carl accepted a research position at the Instituto de Geología, Universidad Nacional Autónoma de México, where he remained until his death. During his tenure at the Instituto, he investigated—with both Mexican and U.S. colleagues—various types of mineral deposits and the regional geology of central Mexico, focusing on its extensive volcanic fields, areas of recent volcanism, and paleotectonics. He was the first in Mexico to establish a laboratory to date volcanic rocks. Many who knew him best were astonished to find how thoroughly he had become a true friend of the Mexican people—not only his professional associates and acquaintances but also the common man in the street, the campesinos in the fields, and the indigenous peoples of Mexico, including the Tarascan Indians in the Parícutin region.

With the death of Carl Fries, Jr. on 11 July 1965, the country of Mexico and its people indeed lost a staunch, loyal, and caring friend. As stated eloquently by Schmitter

(1965, p. 6): "...I have often expressed my personal conviction that 'ambassadors' of the stature of Dr. Fries could surely eliminate much of the friction and unpleasantness which exist among the peoples of this world."

#### Kenneth Segerstrom (1909-1992)

Kenneth Segerstrom was born on 1 August 1909 in Denver, where he lived for much of his life. He attended the local public schools, graduating from Denver's East High School with a superior scholastic record that earned him a full scholarship to the University of Denver. There, he obtained a bachelor's degree with a double major in mathematics and chemistry and a minor in Romance languages. However, having grown up in Denver, he naturally also enjoyed exploring the nearby Colorado Rockies, and his love of the mountains won out over his interest and a possible career in chemistry.

After graduation from college, Ken worked part-time with topographic mapping parties of the USGS and other government agencies. By the outbreak of World War II, he had a permanent position as a topographer with the USGS' Topographic Division, based in Sacramento, California. Like Carl Fries, Ken also was fluent in Spanish. When the opportunity arose, he eagerly joined a cooperative Mexican-U.S. strategic minerals project in Mexico. During his five-year assignment in Mexico, he witnessed and described much of the Parícutin activity, which convinced him to become a geologist.

Upon his return to the U.S. in 1947, Ken began geologic studies, first completing the undergraduate requirements for a geology major at Pomona College (Claremont, California) and then went to Harvard University, where he earned in 1950 a Master's degree, specializing in structural geology and geomorphology. Ken then returned to Mexico—this time as a geologist—for another USGS assignment, working on ore deposits, volcanic rocks, and regional geology in central Mexico. Time permitting, he revisited Parícutin to extend his earlier studies of the erosion of the fresh volcanic deposits.

In 1957, Ken left Mexico to join a USGS mission in Chile. During this six-year assignment, Ken mapped much of the region around Copiapó in the southern part of the Atacama Desert. He published more than 30 maps and papers on his Chilean work and, equally important, his infectious scientific curiosity and zest for geologic fieldwork profoundly influenced a group of enthusiastic, young Chilean geologists who formed the core of the newly established "geological survey" of Chile (Instituto de Investigaciones Geológicas de Chile). Upon his return to Denver in 1963, Ken participated in various USGS mineral-deposit projects in Michigan, Colorado, Montana, and New Mexico. Because of several debilitating illnesses, however, Ken had to give up his beloved fieldwork, and he retired from the USGS in December 1981. He died on 4 October 1992 following years of progressively deteriorating health.

Ken Segerstrom and Carl Fries shared two common traits. Both were keen observers as well as avid and talented photographers, although Ken largely concentrated on still photography. Both men—spending much of their careers in Mexico—became true friends of the Mexican peoples and devotees of the Hispanic lifestyle. Indeed, both were remembered fondly as being more *Latinos* rather than *gringos*.

## ACKNOWLEDGMENTS

Special thanks go to Mrs. Virginia C. Fries (sister-in-law of Carl Fries), her daughters Susan and Joan, and the entire Fries family for generously making available to the world volcanologic community the Parícutin movies and audio tapes that belonged originally to Carl. Michael C. Moore, USGS Photo Library (Menlo Park) kindly assisted with the transfer of movie footage to videotape and tape editing. We also express our appreciation to our colleagues Keith E. Bargar and Duane Champion (USGS, Menlo Park) and to James F. Luhr (Smithsonian Institution, Washington, D.C.) for their constructive reviews of earlier drafts of this report that contributed toward its improvement.



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