International Heat Flow Committee[1]

W. H. K. LEE

Institute of Geophysics and Planetary Physics
University of California, Los Angeles

INTRODUCTION

The International Heat Flow Committee was formed within the International Union of Geodesy and Geophysics to promote geothermal research on an international scale. It is now under the chairmanship of Francis Birch of Harvard University. The purpose of this article is to describe its organization and the first meeting held on March 5 and 6, 1964.

THE ORGANIZATION

At the Thirteenth General Assembly of the International Union of Geodesy and Geophysics (IUGG), 1963, the following resolution was approved by the IUGG Bureau:

> Noting the extremely uneven distribution of measurements of the heat flow from the interior of the Earth and the large areas from which there are no measurements, the International Association of Seismology and Physics of the Earth's Interior (IASPEI) recommends that measurements be made wherever the present coverage is inadequate and especially in South America, Asia, Africa north of 10°S, the Antarctic, and the northwest Pacific. Measurements are also desirable on shields, in areas of contrasting tectonic types and in areas of abnormally high seismic absorption or electrical conductivity.

In addition to the above resolution, the following resolution was approved by the IASPEI:

> That the IASPEI should establish a working group on geothermal problems which should arrange comparisons of the techniques of different experimenters, particularly in the measurement of thermal conductivity, organize a symposium at the next General Assembly, and collect and summarize the observational data. The committee should arrange for adequate liaison with the International Association of Volcanology (IAV).

Following the approval of the second resolution, the International Heat Flow Committee was appointed by the Presidents of the IASPEI and IAV as follows: Chairman Francis Birch (USA), Vice Chairman H. A. Lubimova (USSR), Secretary W. H. K. Lee (USA), and Deputy Secretary Gene Simmons (USA). The members include the following: C. J. Banwell (New Zealand), A. E. Beck (Canada), G. Bodvarsson (Iceland), T. Boldizsar (Hungary), E. C. Bullard (Great Britain), Pierre Evrard (Belgium), G. C. Facca (Italy), James Healy (New Zealand), J. C. Jaeger (Australia), A. M. Jessop (Canada), M. G. Langseth (USA), C. Lomnitz (Chile), V. A. Magnitsky (USSR), James McNitt (USA), L. Stegena (Hungary), G. B. Udintsev (USSR), S. Uyeda (Japan), and R. P. Von Herzen (USA). The members ex officio are: G. D. Garland (Secretary, IUGG), J. P. Rothe (Secretary, IASPEI), Francesco Penta (Secretary, IAV), Ilmo Hela (Secretary, IAPO), and Leon Knopoff (Secretary, International Upper Mantle Project).

THE MEETING

The first International Heat Flow Committee Meeting was held at Harvard University on March 5 and 6, 1964. All the officers, including Francis Birch, H. A. Lubimova, W. H. K. Lee, Gene Simmons, and several of the members (A. E. Beck, G. D. Garland, A. M. Jessop, M. G. Langseth, G. B. Udintsev, and R. P. Von Herzen) were present. The following guests also attended: K. E. Bullen, S. P. Clark, W. H. Diment, Paul Grim, P. J. Hart, A. H. Lachenbruch, Henry Pollack, John Reitzel, and Robert Roy.

March 5, Morning Session

Professor Birch opened the morning session by welcoming the members and guests. The following items were discussed:

Symposium. It was decided that the Sym-

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posium on Geothermal Problems shall be held at the time of the next General Assembly of the IUGG (1966), and that the Committee will issue invitations and make all necessary arrangements for the Symposium.

Conductivity standards. The desirability of heat flow workers using a consistent standard for thermal conductivity measurements was stressed. It was decided that no action on the part of the Committee was necessary at present.

Exchange of scientists. The recent Amphitrite Expedition of the Scripps Institution of Oceanography, in which Lubimova and Udintsev of the USSR and Hundman of Canada were guest scientists, was described. It was agreed that these exchanges of scientists in heat flow measurement programs were extremely valuable, and that the Committee should assist, where necessary, in the future.

Promoting research. On the question of promoting heat flow research, the opinion was expressed that an important step, as far as land measurements are concerned, would be to ensure wider use of holes drilled for other purposes. The following resolution was passed:

> Noting the large number of holes being drilled in the Earth for various purposes, the International Heat Flow Committee resolves that, wherever possible, these holes should be preserved for temperature measurements, and cores from these holes should be obtained and collected for thermal conductivity determinations. The Committee should be informed about these available holes, and it will provide technical advice and assistance if requested.

Reporting data. Considerable discussion took place on the reporting of results of heat flow measurements, including the necessity of World Data Centers. It was agreed that workers should use a standard form in reporting measurements to the Committee Secretary. These forms will be sent to all known heat flow workers and will also be available upon request. The Secretary will undertake to publish an annual supplement to the list of measurements which has already been published.

Various opinions were expressed on the need to maintain World Data Centers for geothermal measurements. It was agreed that geothermal data should be included if any of the Upper Mantle measurements are to be collected on a systematic basis. The following resolution was then passed by the International Heat Flow Committee:

> 1. All heat flow workers should give full support to the Committee Secretary in maintaining an up-to-date compilation of heat flow measurements by promptly reporting their data in the standard format sheets provided by the Committee.
> 2. The International Upper Mantle Project Committee should give full attention to the question of establishing World Data Centers to receive geothermal data in the light of evidence transmitted by the Committee Secretary.

It was recommended that, for the present, the compilation of heat flow measurements be included in the data of the Upper Mantle discipline to be received by World Data Centers, and consideration be given to the World Data Centers receiving more detailed readings of temperatures and thermal conductivities. The Committee Secretary will investigate the situation in detail and transmit evidences to proper authorities.

Monograph. The Committee then discussed the contents and level of presentation of the proposed Monograph on Terrestrial Heat Flow, and whether or not the IUGG should be invited to publish it. Agreements on these matters were hard to reach, and it was decided that a working group would hold a meeting the next day to review the question and present detailed recommendations.

March 5, Afternoon Session

The afternoon session was devoted to a discussion of research programs under way, chiefly by representatives of geothermal groups in North America and the USSR. Examples of recent continental measurements showed the necessity for an ample distribution of measurements, since local variations due to water circulation and different heat productivity of rocks can be significant. The discussion of oceanic measurements emphasized the importance of possible instability in the water layer adjacent to the ocean floor, in contrast to earlier ideas on the thermal nature of this layer. It is not yet known whether such instability could account for some of the variations of oceanic heat flows. All active oceanic heat flow groups have agreed to investigate this problem more fully.

March 6, Morning Session

On March 6, the Working Group on the Monograph, consisting of Beck, Garland, Jessop, Langseth, Lee, Lubimova, Udintsev, and Von Herzen, as well as several guests, discussed the proposed Monograph on Terrestrial Heat Flow in detail. It was decided that the purpose of this Monograph is to give an up-to-date account of the subject in order to stimulate interest in heat flow and provide guidance for geophysicists starting this work. It was agreed that the Monograph is to be about 250 pages in length and is to be ready by summer 1964, under the editorship of W. H. K. Lee, and with the following tentative Table of Contents:

1. Introduction (E. C. Bullard).
2. Mathematical Theory of Heat Transfer and Its Application in Geophysics (J. C. Jaeger).
3. Techniques of Heat Flow Measurement on Land (A. E. Beck).
4. Techniques of Heat Flow Measurement at Sea (M. G. Langseth).
5. Heat Transfer through the Ocean Bottom (H. A. Lubimova, R. P. Von Herzen, and G. B. Udintsev).
6. Statistical Results of Heat Flow Measurements (W. H. K. Lee).
7. Geophysical Implications of Heat Flow (G. J. F. MacDonald).
8. Geological Implications of Heat Flow (?).
9. Geothermal Energy and Its Utilization (J. McNitt).
10. A Compilation of Heat Flow Measurements and Bibliographies (W. H. K. Lee).

Realizing that it would be of great value to the international scientific community for this Monograph to be published by the IUGG, the working group resolved that:

> The Monograph on Terrestrial Heat Flow (edited by W. H. K. Lee) be published in the IUGG Monograph Series.