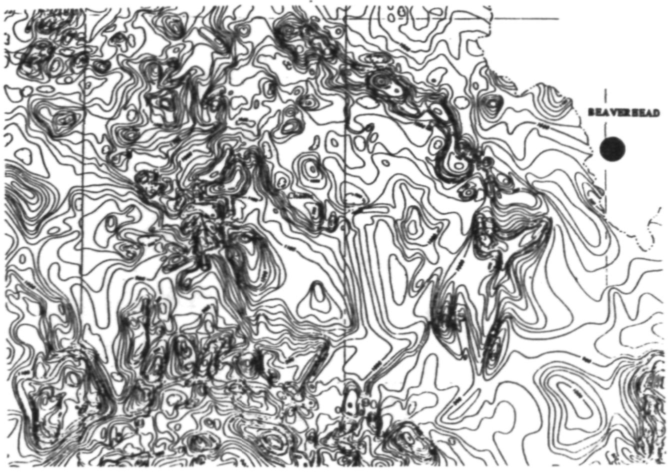

Fig. 4. Eastern segment of Aeromagnetic Map of Idaho [5].

1. The Lemhi Arch (Fig. 1) is a major structural uplift that occurred in late Proterozoic–early Paleozoic time in East Central Idaho and caused the erosion of at least 4 km of sedimentary cover [3]. This may be directly related to the impact.

2. Of the many thrust sheets comprising the Cordilleran belt, the Cabin plate that carries the shocked rocks is unique in that it alone intersected the crystalline basement [2]. It also now marks the apex of the Southwest Montana Recess in the Sevier front [4] (Figs. 2 and 3). The basement uplift remaining from the impact may have constituted a mechanical obstacle to the advancing thrust sheets in Cretaceous time, causing the recess. Perhaps a piece from the western edge of this uplift was sliced off and transported by the Cabin thrust.

3. What could be interpreted as a roughly circular aeromagnetic anomaly ~70 km in diameter can be discerned in the state aeromagnetic map [5] centered about 20 km southeast of Challis, Idaho, in the Lost River range (Fig. 4). It is in approximately the right place, and ignoring the possibility that the anomalies have diverse causes and the circular pattern is coincidental, it may mark what remains of the buried central uplift structure!

The relevance of these speculations in the search for the source of the Beaverhead shocked rocks will be explored this summer and reported at the meeting.

References: [1] Ruppel E. T. and Lopez D. A. (1988) *U.S. Geol. Surv. Prof. Paper 180*, 122. [2] Skipp B. (1988) *Interaction of the Rocky Mountain Foreland and the Cordilleran Thrust Belt* (C. J. Schmidt and W. J. Perry, eds.), 237–266, GSA Mem. 171. [3] Ruppel E. T. (1986) *Paleotectonics and Sedimentation in the Rocky Mountain Region, United States* (J. A. Peterson, ed.), 119–130, A.A.P.G. Mem. 41. [4] Perry W. J. et al. (1989) *Geol. Resources of Montana* (D. E. French and R. F. Crabb, eds.), Montana Geol. Soc. 1989 Field Conf. Guidebook. [5] U.S. Geological Survey (1978) *Aeromagnetic Map of Idaho.*

REPORT ON THE INTERNATIONAL CAMBODIAN CRATER EXPEDITION—1992. J. Hartung[1], C. Koeberl[2], P. Lee[3], Kuhn Pagnacith[4], and Touch Sambath[4], [1]600 East Fifth Street, Des Moines IA 50309, USA, [2]Institute of Geochemistry, University of Vienna, A-1010 Vienna, Austria, [3]404 Space Sciences Building, Cornell University, Ithaca NY 14853, USA, [4]Department of Geology and Mines, Ministry of Industry, Phnom Penh, Cambodia.

It has been proposed that Tonle Sap, a lake in Cambodia, 100 km long and 30 km wide, marks the location of an elongate basin formed by the oblique impact of a comet or asteroid [1]. The impact is considered to have produced melted ejecta found now as tektites over much of southeast Asia and Australia. The location of the lake, its approximate age, its size, and the orientation of its long axis (toward Australia) are consistent with this hypothesis.

After learning about the hypothesis, five individuals volunteered to participate in an expedition to Cambodia: Jack Hartung, Christian Koeberl, Charles Harper, Burkhard Dressler, and Pascal Lee. We agreed that a proper expedition could not be undertaken without a local host or "contact." After a year without progress Hartung decided to arrange travel to Phnom Penh, Cambodia, in January 1992. The primary objective of this trip was simply to identify a local contact. A secondary objective was to collect a variety of representative rock samples. In spite of the uncertainty related to getting into the field in Cambodia, Lee and Koeberl also decided to make the trip. Early in December 1991, John McAuliff, Director of the U.S.-Indochina Reconciliation Project, informed us that he had arranged for us to be received in Phnom Penh by officials of the Ministry of Industry. Although still uncertain regarding their status, Hartung and Lee arrived in Phnom Penh on January 5, 1992, and were greeted by Kuhn Pagnacith and Touch Sambath, who did all that was possible to make the expedition scientifically profitable and personally satisfying. Because we were not from Cambodia, travel into the countryside had to be approved by officials of the

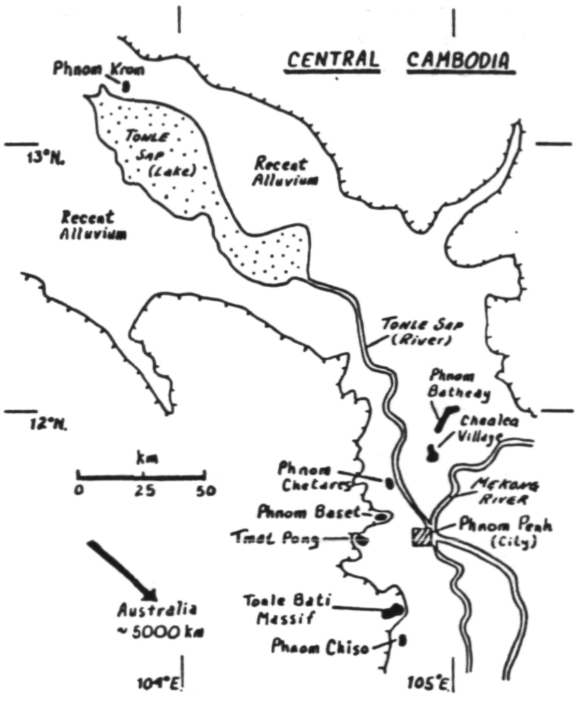

Fig. 1. Map of Central Cambodia, modified from [3].

TABLE 1. Locations of sites where samples were collected and a brief description of the materials collected.

Site Name	Location	Rocks Reported
Phnom Krom (Quarry) (8 samples)	10 km SSW of Siem Reap (Angkor Wat)	Compact cinerites, ferrugenous scoria, pink rhyolitic lavas, dark cinerous sandstones, and various volcanic conglomerates
Phnom Baset (Quarry) (2 samples)	22 km WNW of Phnom Penh	Granite, fine-grained, leucocratic, white quartz vein
Phnom Chetares (1 sample)	30 km NW of Phnom Penh	Jointed polychrome jasperites, subvertical schists
Chealea Village Group (7 samples)	38 km N of Phnom Penh	Devitrified pyromeride, rhyolite, white fluidal rhyolite, rhyolitic breccias, siliceous dark dacite
Phnom Batheay (2 samples)	46 km N of Phnom Penh	Upper Indosinias sandstone, vein of acidic rhyolitic rock
Tmat Pong Group (Quarry) (2 samples)	26 km W of Phnom Penh	Rhyolitic, weathered whitish, sometimes fluidal
Phnom Chiso (Quarry) (3 samples)	45 km S of Phnom Penh	Massive crystalline sandstone, intensely eroded black schist
Tonle Bati Massif (1 sample)	33 km SSW of Phnom Penh	Granite, fine-to-medium grained, pseudo-vortical biotite flames, black slaty schists

Cambodian equivalents of the U.S. Departments of Commerce, Interior, State, and Defense. For support in achieving this "diplomatic" objective we are indebted to Thach Xoval Say, Vice-Director, Dept. of Mines and Geology, Sov Chivkun, Director, Dept. of Geology and Mines, and Ith Praing, Vice Minister, Ministry of Industry. We were restricted from visiting sites that were "off limits" due either to unknown locations of land mines or known locations of military bases.

Our scientific objectives were to find impact or shock metamorphosed rocks unambiguously related to the Tonle Sap basin, to collect samples of rocks that may represent those melted to produce Australasian tektites, and to learn as much as possible about Cambodian geology. Using 1:200,000-scale geologic maps with fairly detailed descriptions of the rock units shown [2], we selected a number of acceptable "phnoms" (hills that rise abruptly out of the surrounding plain) that may contain rocks affected by the postulated Tonle Sap impact. A map of central Cambodia is shown in Fig. 1, and the locations of sites where samples were collected are indicated. A list of those sites, together with a description of the rocks reported to be present at each site [2], is given in Table 1. No obviously shock-metamorphosed or suevite-like rocks were observed. Recent alluvium surrounding Tonle Sap is judged to be lake sediment deposited when the lake surface was at a higher elevation.

Acknowledgment: Support provided by the Barringer Crater Company is gratefully acknowledged.

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THE DISTRIBUTION AND MODES OF OCCURRENCE OF IMPACT MELT AT LUNAR CRATERS.

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Introduction: Numerous studies of the returned lunar samples [1–4] as well as geologic and remote-sensing investigations [5,6] have emphasized the importance of impact melts on the surface of the Moon. Information concerning the distribution and relative volumes is important for (1) an improved understanding of cratering processes, (2) kinetic energy estimates and energy partitioning studies, (3) the proper interpretation of melt-bearing lunar samples,and (4) comparative planetology studies. The identification of major flows of fluidized material associated with impact craters on the surface of Venus has increased interest in impact melt flows on the other terrestrial planets. For a number of years, we have been investigating the distribution, modes of occurrence, and relative and absolute amounts of impact melt associated with lunar craters as well as the manner in which melt volumes vary as a function of crater size, morphology, and target characteristics. The purpose of this paper is to present the results of this effort.

Method: Impact melt deposits were identified using the criteria established by Howard and Wilshire [5] and Hawke and Head [6–8]. Qualitative estimates were made and trends were established utilizing a population of over 100 fresh impact craters that was characterized in a previous paper [6], plus additional lunar craters for which adequate Lunar Orbiter and Apollo photography exists. Quantitative determinations of impact melt volumes were made for those craters for which high-quality topographic data are available from Lunar Topographic Orthophotomaps.