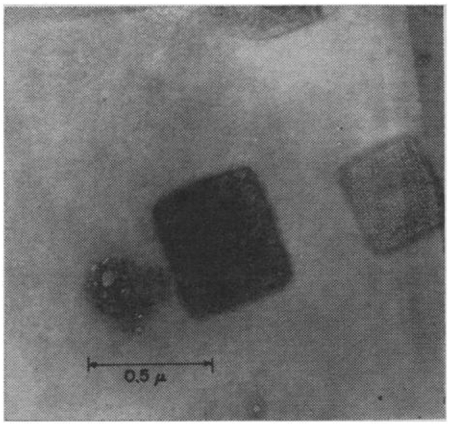

Fig. 2. Unidentified species present in both starting material and shock product. The cell dimension of these cubes is similar to that of the "carbon II" phase reported by Aust and Drickamer (*4*).

during asteroidal collision (*1*) on the other hand, no doubt were of longer duration and might well be expected to result in the formation of subhedral diamond grains. These grains would probably be polycrystalline aggregates,

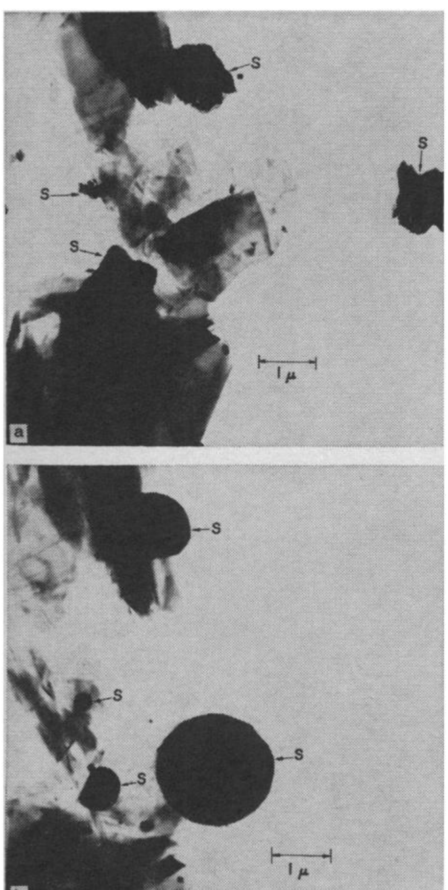

Fig. 3. (*a*) Sulfur (*S*), graphite mixture from Canyon Diablo (75-kv electrons). (*b*) The same area examined with 100-kv electrons. The higher accelerating voltage has sufficiently increased the temperature to melt the sulfur grains.

since the shock-induced conversion of graphite to diamond apparently proceeds by a mechanism other than the orderly diffusion and addition of carbon atoms to diamond nuclei (*1, 2*).

X-ray fluorescence analysis of the interior of the Canyon Diablo nodule indicated the presence of only iron and sulfur. The only carbon phase detected was normal graphite. The cubic phase seen in the starting material and shock product was not observed in the Canyon Diablo nodule.

The sulfur in the Canyon Diablo material apparently exists in two forms; as free rhombic sulfur and as troilite (FeS). Figure 3*a* shows anhedral single crystals of sulfur in a graphite matrix at an electron accelerating voltage of 75 kv. At 100 kv, the normal operating voltage in these studies, the temperature reached was high enough to melt the sulfur (m.p. 113°C), and further aided in its identification (Fig. 3*b*). The troilite in the graphite nodule was identified by both x-ray and electron diffraction. It was present in amounts greater than about 5 percent while the sulfur was present in lesser amounts (about 2 percent).

The coexistence of troilite and elemental sulfur has been observed previously in Type I carbonaceous chondrites (*5*) although in these meteorites there is considerably more sulfur than troilite. Free sulfur has not previously been reported in iron meteorites. It may be that the sulfur was formed by terrestrial weathering of the troilite, the iron thus liberated forming amorphous limonite (*6*). An alternative is that these minerals are preterrestrial. If this was the case it is expected that the S^{32}/S^{34} ratios in the troilite and sulfur may differ.

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6. We thank Prof. Paul Ramdohr for pointing out this possibility.
7. This study was carried out, in part, while M. E. Lipschutz was in the U.S. Army at the Goddard Space Flight Center. We thank Pedro D. Sarmiento of the Goddard Space Flight Center for his valuable assistance, and P. S. DeCarli (Stanford Research Institute) and E. P. Henderson (U.S. National Museum) for providing samples. One of us (M.E.L.) thanks the National Science Foundation for a postdoctoral fellowship at Bern, and the Schweizerischen Nationalsfonds.

13 April 1964

Solar Activity During the First Six Months of the International Years of the Quiet Sun

The first 6 months of the International Years of the Quiet Sun (IQSY) have passed. The solar activity at the start of the IQSY program has been described (*1*) and the present report constitutes a supplement to the earlier report.

In April 1964 the monthly mean relative sunspot number (Zurich) dropped below 10 for the first time in the declining phase of the present sunspot cycle. It was 7.7 in April, 9.4 in May, and 9.3 in June. Values below 5.0, which were characteristic of preceding solar minima, have not occurred (Table 1).

In the first half of 1964 the average latitude of old cycle spots, as observed at the McMath-Hulbert Observatory, dropped to 8.7° in the northern hemisphere and to 6.7° in the southern. All new cycle spots observed prior to 1 July 1964 have been in the northern hemisphere. Their mean latitude during the first six months of 1964 was 30.6°. In the same interval, the number of spotless days per month increased slightly, but it was not as high as 10 for any one month (Fig. 1). The number of sunspot groups per month diminished after March, but the lower total activity was accompanied by more frequent formation of members of the new cycle (Fig. 2).

Eight spot groups of the new cycle were observed at the McMath-Hulbert Observatory during the first 6 months of IQSY. For all of these spot groups the latitudes were $\geq 25°$, and the magnetic polarities were appropriate for the new cycle of activity. In general, the new cycle regions have been well developed and of relatively long duration. According to the four preceding minima, new cycle activity, once established, increases rapidly. If this is a general characteristic of the course of solar activity, it suggests that the minimum between cycles 19 and 20 may be close at hand, or may even be behind us. If this is the case, the residual activity at minimum will have been unusually high.

Since the development and course of new cycle activity may be of special significance in recognizing the probable time of minimum in the current cycle, we have made two additional studies of new cycle phenomena. In Fig. 3 we show, for the present cycle and for the four preceding minima, the number of days in each month in which a new cycle spot was visible on the solar disk. According to this study there were 42 days in the interval August 1963 to June 1964 when new cycle spots were observed on the solar disk. In the four preceding cycles, the number of days with new cycle spots prior to minimum were 3, 0, 27, and 7, respectively.

Table 1. Summary of solar data for January to June 1964.

Characteristic	Month					
	Jan.	Feb.	March	April	May	June
Mean relative sunspot No. (Zurich)	14.6	16.3	14.5	7.7	9.4	9.3
No. of spotless days (Zurich Sunspot No. = 0)	1	9	6	7	4	9
No. of old cycle spots (McMath-Hulbert Observatory)	11	5	12	7	6	4
No. of new cycle spots (McMath-Hulbert Observatory)	0	0	1	2	1	4
Mean measured 2800 Mcy/sec flux (Ottawa)	74.4	76.2	75.5	72.7	69.1	69.0
Mean 2800 Mcy/sec flux adjusted to 1 A.U.	72.0	74.4	74.7	73.2	70.7	71.2

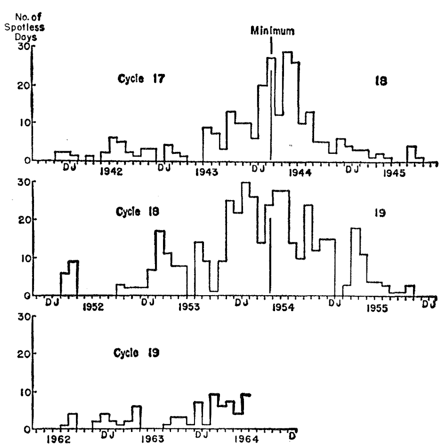

Fig. 1. Number of spotless days per month for the years centered on the two preceding solar minima and for 1962 to June 1964. The time of "minimum" as indicated by the smoothed monthly means of Zurich relative sun spot numbers is shown by a vertical line.

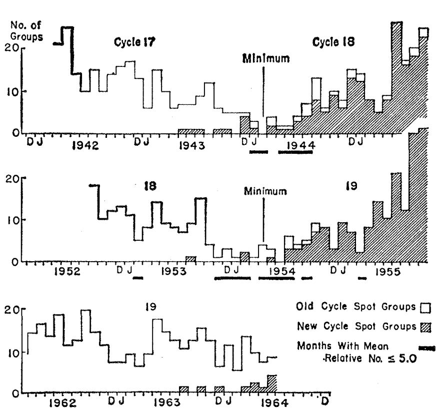

Fig. 2. Number of old-cycle and new-cycle sun spot groups and the months with mean relative Zurich sun spot number $\lesssim 5$ for years centered on two preceding solar minima and for 1962 to June 1964. The time of "minimum" as indicated by the smoothed monthly means of Zurich relative sun spot numbers is shown by a vertical line.

The development of the new cycle also can be seen in the increasing number of high-latitude calcium plages. Spots occur in the midst of plages, but there are many plages without visible spots. The number of days in each month, January 1962 to June 1964, with at least one calcium plage at latitudes $\gtrsim 25°$ is shown in Fig. 4. Minor calcium plages occur at high latitudes throughout the entire solar cycle, but their existence in large numbers at latitudes as great as 25° is characteristic of the ascending branch of the solar cycle. A marked increase in the number of days with plages at high northern latitudes began in June 1963. All of the plages in high southern latitudes have been relatively small and of short duration.

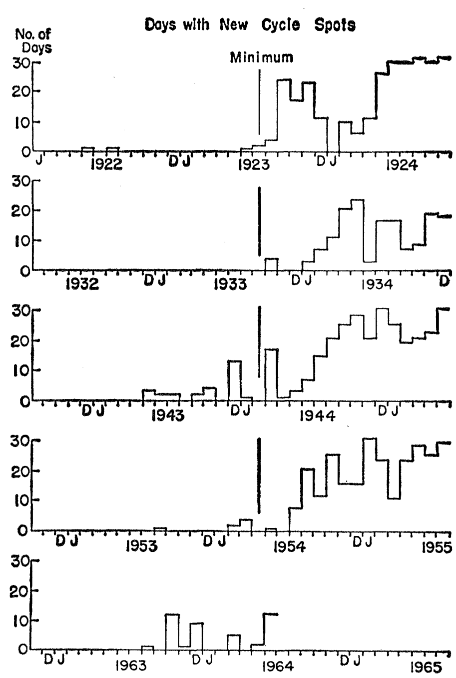

Fig. 3. Number of days in each month with new cycle spot visible on solar disk for the years centered on the four preceding solar minima and for 1962 to June 1964. The time of "minimum" as indicated by the smoothed monthly means of Zurich relative sun spot numbers is shown by a vertical line.

Solar radiation at 2800 Mcy/sec, adjusted for changes in the separation of earth and sun, provides a measure of certain aspects of solar activity. Plots of daily values of 2800 Mcy/sec flux (Ottawa), both measured and corrected, for the first 6 months of IQSY are given in Fig 5.

During the first six months of IQSY there were very few days with corrected values of 2800 Mcy/sec flux below 69.0 just as there were very few days without spots or well defined calcium plages. The relation between daily values of 2800 Mcy/sec flux, adjusted to 1 astronomical unit (A.U.), and calcium plages is shown in Fig. 6. The daily measure of calcium plages here used is the sum of the area of each plage on the visible hemisphere multiplied by its excess intensity in units of the undisturbed disk. This quantity is subject to considerable error and the scatter is large, but it appears to vary in moderately close accord with the 2800 Mcy/sec flux. The values for days with zero sunspot number (Zurich) are circled.

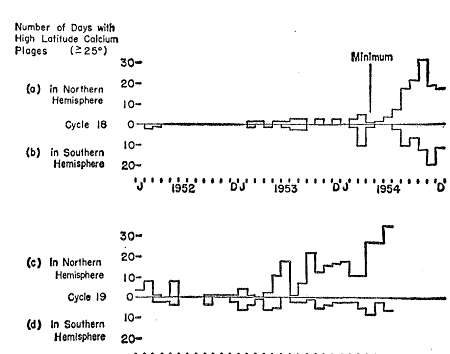

Fig. 4. Number of days per month with high latitude calcium plages on McMath-Hulbert Observatory records for years centered on preceding minimum and for 1962 to June 1964. Smaller plages are included in the data for 1962 to 1964 than have been for the earlier interval.

Waldmeier (*2*) has pointed out that in past minima the polar prominence zone has remained stationary at about 50° latitude prior to the sunspot minimum. During the minimum its heliographic latitude sinks to about 45° before resuming a poleward drift. Observers who have access to detailed prominence data can watch this additional criterion for solar minimum.

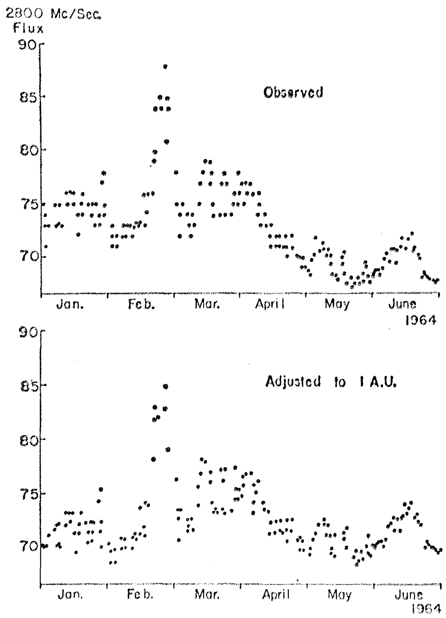

Fig. 5. Daily values of 2800 Mcy/sec solar flux (Ottawa) January to June 1964. New cycle spot visible on solar disk for the surface of the earth in watt/m^2 per cycle of band width per second ($\times 10^{-22}$). The lower chart shows the flux adjusted to the standard distance of 1 A.U.

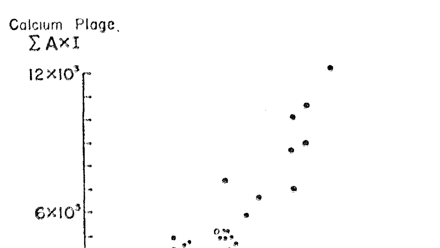

Fig. 6. Relation between daily values of solar radiation at 2800 Mcy/sec adjusted to 1 A.U. (Ottawa) and calcium plages (McMath-Hulbert Observatory). The flux is measured in watts per square meter per cycle of band width per second ($\times 10^{-22}$). The daily calcium plage measurement is the sum of the product for each plage of excess intensity and area in millionths of hemisphere. The open circles identify the days with no visible spots.

In January we suggested (*1*) that the present solar minimum was developing in a manner that resembled circumstances in 1944 more closely than those in 1923, 1933, or 1954. This continues to be true. Unless there is a sudden drop in the development of new cycle activity, the 1964 minimum will occur without long intervals of true solar calm. The exact date of minimum, based on smoothed sunspot means, will be a matter of future statistics. Persons planning IQSY programs designed to study the truly quiet sun should try to take advantage of the brief intervals of solar quiet which are recognized and reported—but all too seldom forecast in advance—by solar astronomers.

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3. Supported in part by contract with the Office of Naval Research.

17 July 1964

Conversion of p,p′ DDT to p,p′ DDD in the Liver of the Rat

Abstract. *Feeding experiments with rats demonstrate that* p,p′ *DDT [1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane] is converted to* p,p′ *DDD [1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane] in the liver.*

Relatively high concentrations of *p,p′* DDD in fish liver oils have recently been reported (*1*). Although some *p,p′* DDT and *p,p′* DDE [1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethylene] were found in these oils, the amounts were significantly smaller than the amount of *p,p′* DDD and, judged by the usual pesticide practices, there appeared to be no immediate explanation for the high *p,p′* DDD concentrations. In more recent work, Kallman and Andrews (*2*) showed by the use of C^{14}-labeled *p,p′* DDT and paper chromatography that yeast can effect a reductive dechlorination of *p,p′* DDT to *p,p′* DDD. The study with yeast was repeated in this laboratory with pure *p,p′* DDT and a gas chromatographic technique. The result supported the evidence for formation of

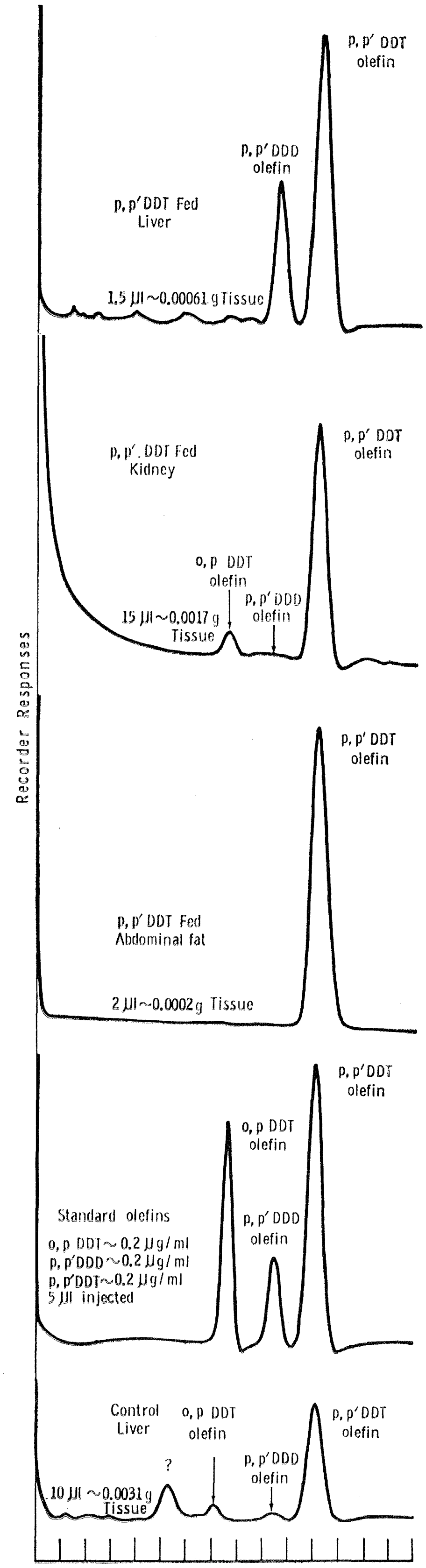

Fig. 1. Representative gas chromatograms of the olefins derived from *p,p′* DDT and *p,p′* DDD in the defatted tissue extracts of rats fed *p,p′* DDT and a control rat.