1990A&AS...85..691F

ASTRONOMY & ASTROPHYSICS
SUPPLEMENT SERIES

Astron. Astrophys. Suppl. Ser. **85**, 691-803 (1990)

A radio continuum survey of the Galactic Plane at 11 cm wavelength. III. The area $76° \leq l \leq 240°$, $-5° \leq b \leq 5°$

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Received February 12, accepted February 23, 1990

Abstract. — The third section of the Effelsberg 11 cm radio continuum survey of the Galactic Plane covers the range $76° \leq l \leq 240°$, $|b| \leq 5°$. We present contour maps at an angular resolution of 43 and a sensitivity of 50 mK T_B (or about 20 mJy/beam area).

Key words : Galactic radio emission — radio continuum survey.

1. Introduction.

We have used the Effelsberg 100-m telescope to map the Galactic Plane in the latitude range $|b| \leq 5°$ at a wavelength of 11 cm. The first and second section of this survey (Reich *et al.*, 1984 (Paper I) ; Reich *et al.*, 1990 (Paper II)) cover the longitude range of the Galactic Plane : $357\overset{\circ}{.}4 \leq l \leq 76°$. For this area large scale emission data have been added from surveys carried out with smaller telescopes. The third section of the survey is presented in this paper. It covers the area : $76° \leq l \leq 240°$. The Effelsberg 100-m telescope has been used before to map a part of this region ($l \leq 162°$, $|b| < 4°$) at a wavelength of 21 cm with lower angular resolution (Kallas and Reich, 1980 ; Reich *et al.* ; 1990). Higher resolution 6 cm data of the Cygnus X region have been published by Wendker (1984). Flux densities of small diameter sources from this survey section are included in a list of 6483 sources from the complete 11 cm survey (Fürst *et al.*, 1990 (Paper IV)).

2. Observations.

Details of the receiver and the antenna characteristics have been already described in Paper I and summarized in Paper II. At 2695 MHz the HPBW of the Effelsberg 100-m telescope is about $4\overset{'}{.}3$ and the ratio T_B/S is 2.51 ± 0.05 [K/Jy]. We used a cooled FET receiver ($T_{sys} = 60$ K), but added a few observations carried out before 1981 with an uncooled parametric amplifier ($T_{sys} \simeq 115$ K) as listed in section 4.2. The source 3C286 served as main calibrator with an assumed flux density of 10.4 Jy.

The method of observations was to scan in Galactic latitude and longitude with a speed of 2°/min and a scan separation of 2′ as described in Paper II. The typical scan length was between 3° and $3\overset{\circ}{.}4$, but for some fields it was between 2° and 4° to avoid strong emission complexes at the map boundaries. The Cygnus X region $76° \leq l \leq 84°$, $-3° \leq b \leq 5°$ was observed by 8° long scans in Galactic latitude and longitude. These observations have been made during good weather conditions and at sideral times when the scans could be observed at nearly constant elevations to avoid strong ground radiation effects. Neighbouring fields have always $0\overset{\circ}{.}1$ of overlap. All fields were mapped at least twice. The r.m.s. noise measured from small low emission regions varied between 14 mK T_B and 21 mK T_B, which is close to the expected values (see Paper I). However, some small areas show higher noise likely due to some influence of bad weather or low level interference.

3. Reduction.

The different stages of data reduction have been described in Paper I and Paper II. Briefly : In the first step calibrated maps were computed and two data points at the ends of each scan were used for a linear baseline adjustment. All maps were edited interactively to remove or correct distorted data points. Baseline distortions were removed by the method of unsharp masking (Sofue and Reich, 1979). All edited data were combined into two maps containing all data observed either in longitude or latitude direction. From these maps the final map was computed as described in Paper II. The edge areas of neighbouring final maps were compared and the maps were adjusted by adding twisted planes to achieve a common relative baselevel. Except for the Cygnus X region large scale emission exceeding an extent of 3° is partly lost. This large scale component will be added when the 2.72 GHz survey carried out with the Stock-

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ert 25-m telescope of Bonn University will be available for this region.

4. Results.

The results of the survey are shown in the form of contour maps in figure 1 to figure 110. The figures show contours of main beam brightness temperatures.

4.1 THE CONTOUR MAPS. — Figure 1 to figure 110 show the 11 cm emission in Galactic coordinates with a 1° grid of equatorial coordinates (Epoch 1950.0) superposed at the following contour intervals :

−0.25K to 0. K in 50 mK steps, dashed

0. K to 0.6 K in 50 mK steps, labelled every 0.2 ,K

0.6 K to 1.5 K in 100 mK steps, labelled at 1 K and 1.5 K

1.5 K to 3.5 K in 200 mK steps, labelled at 2.5 K and 3.5 K

3.5 K to 6 K in 500 mK steps, labelled at 6 K

6 K to 10 K in 1 K steps, labelled at 10 K

10 K to 30 K in 2 K steps, labelled at 20 K and 30 K

30 K to 80 K in 5 K steps, labelled every 10 K

The area of each figure and the contour levels are the same as for figure 1 to figure 52 of Paper II. Contours above 80 K have been omitted. The only source which exceeds a temperature of 80 K is CAS A (Fig. 23). Arrows on contour lines always point towards relative temperature minima.

4.2 COMMENTS TO INDIVIDUAL FIGURES. — Figure 2 : Weak sidelobe effects from Cyg A, which is located outside of our map, are visible between $l = 76°$ and $l = 77°$ for latitudes $b > 4\overset{\circ}{.}8$.

Figure 19 to figure 22 : The section from $l = 105°$ to $l = 108°$ has been observed in 1979 and 1980 with the parametric amplifier (Kallas, 1983). We have added one more coverage with the FET receiver to obtain the same sensitivity as for the other regions.

Figure 23 and figure 25 : Strong sidelobe effects are visible around CAS A (peak temperature about 204 K) up to a distance of about $1\overset{\circ}{.}5$. Scanning effects are visible between $l = 111°$ and $l = 112°$ for $b < -4\overset{\circ}{.}3$.

Figure 25 to figure 28 : The area around the three supernova remnants G114.3 + 0.3, G116.5 + 1.1 and CTB 1 has been observed in 1978 with the parametric amplifier by Reich and Braunsfurth (1981). New data have been added except for the area $114° \leq l \leq 117°$, $0° \leq b \leq 1\overset{\circ}{.}6$.

Figure 34 to figure 36 : The area around the supernova remnants G126.2 + 1.6 and G127.1 + 0.5 has been observed by Fürst *et al.* (1984). These data have been added to the independent survey observations.

Figure 38 : Sidelobes are visible around 3C58 at $l = 130\overset{\circ}{.}7$, $b = 3\overset{\circ}{.}1$.

Figure 39 and figure 40 : Observations with the parametric amplifier in 1978 of a large region around the W3/W4/W5 complex have been added to the survey data. However, the area around W3 : $133° \leq l \leq 136°$, $-1° \leq b \leq 3°$ is exclusively from the 1978 observations and shows slightly higher noise.

Figure 43 and figure 44 : The section from $l = 139°$ to $l = 142°$ has been observed with the parametric amplifier (Kallas, 1983). We have added one more coverage with the FET receiver.

Figure 56 and figure 58 : The 11 cm map of HB9 (G160.9 + 2.6) has been previously shown by Reich *et al.* (1983) including linear polarisation data.

Figure 79 to figure 81 : The 11 cm maps of the supernova remnants G179.0 + 2.6 and S147 (G180.0 − 1.7) have been already shown by Fürst and Reich (1986a,b) in a multifrequency study of these sources.

Acknowledgements.

We thank S. Wongsowijoto, A. Schmidt and O. Lochner for their support of the 11 cm receiving system. We acknowledge the encouragement of C.G.T. Haslam to initiate this project. C.G.T. Haslam, E. Kallas, H. E. Mathews and C.J. Salter supported us during the first observation periods. G. Engelin helped us to produce the large number of laser plots. We are grateful to R. Wielebinski for his continuous interest in the 11 cm survey project. We like to thank the Nobeyama Radio Observatory for using their FACOM M380 for some reduction work.

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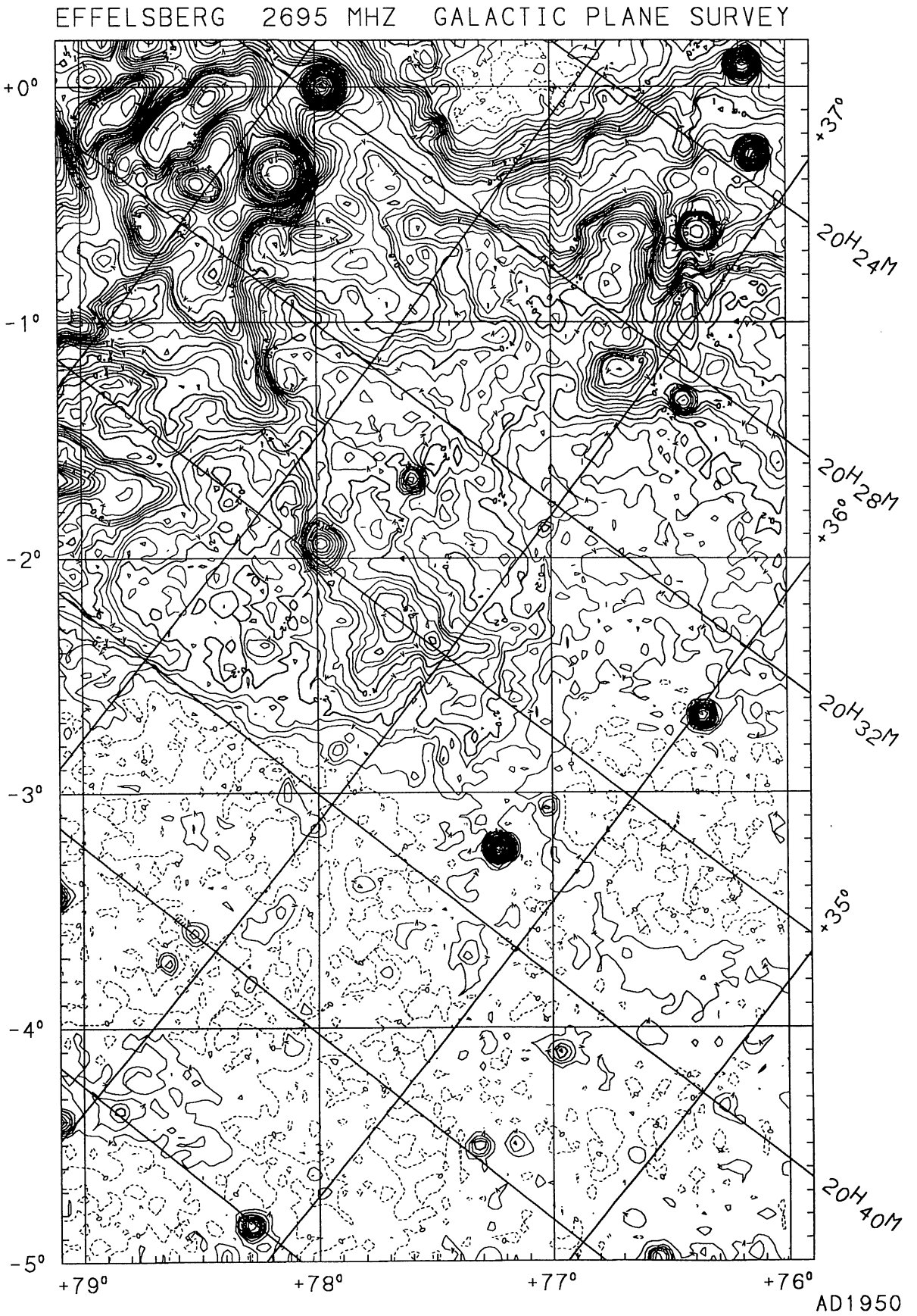

FIGURES 1 – 110. — The atlas of contour maps in Galactic coordinates ordered for increasing longitude. Details of the maps have been described in section 4.1 and comments to individual figures are given in section 4.2. The equatorial grid is shown for Epoch 1950.

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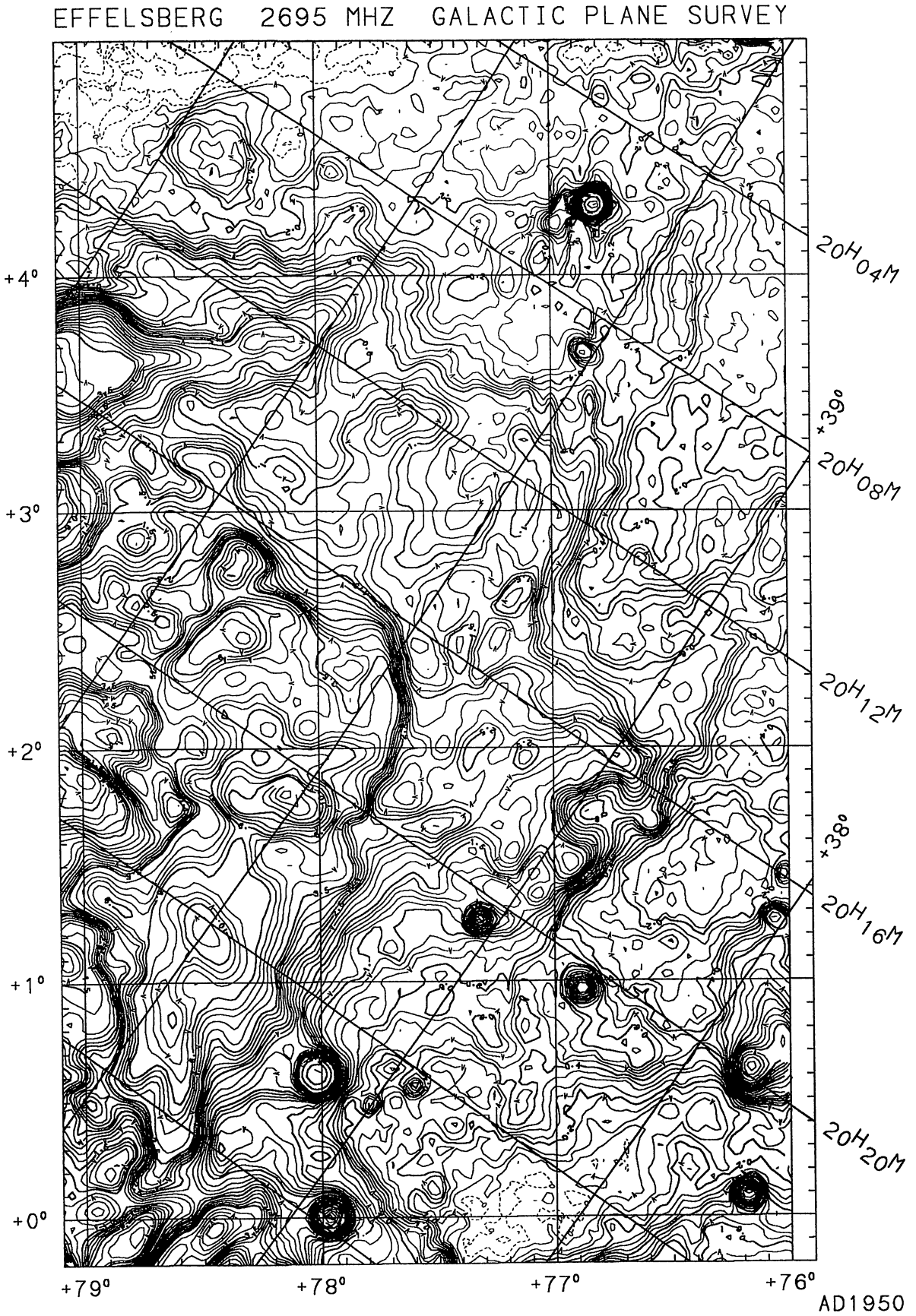

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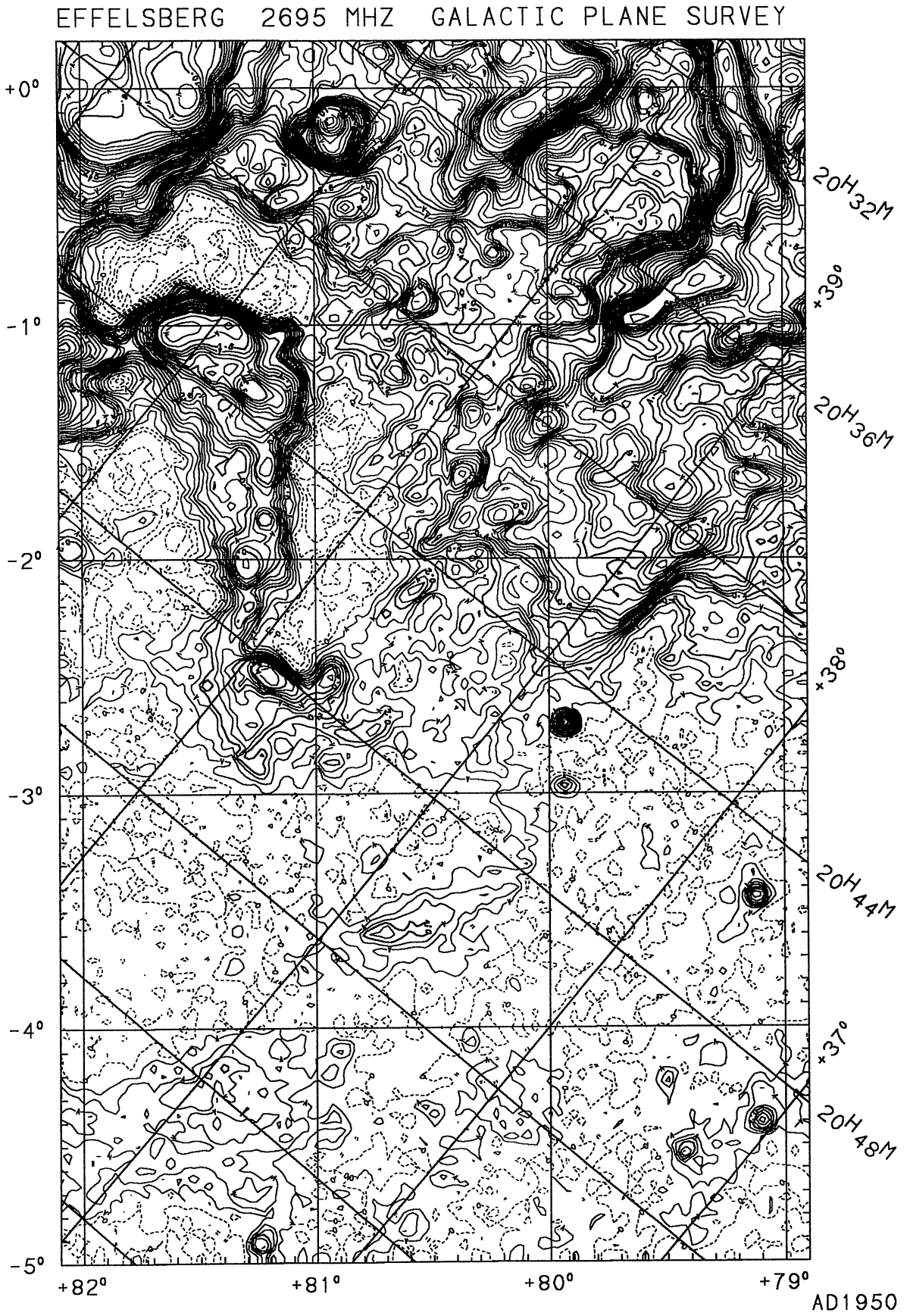

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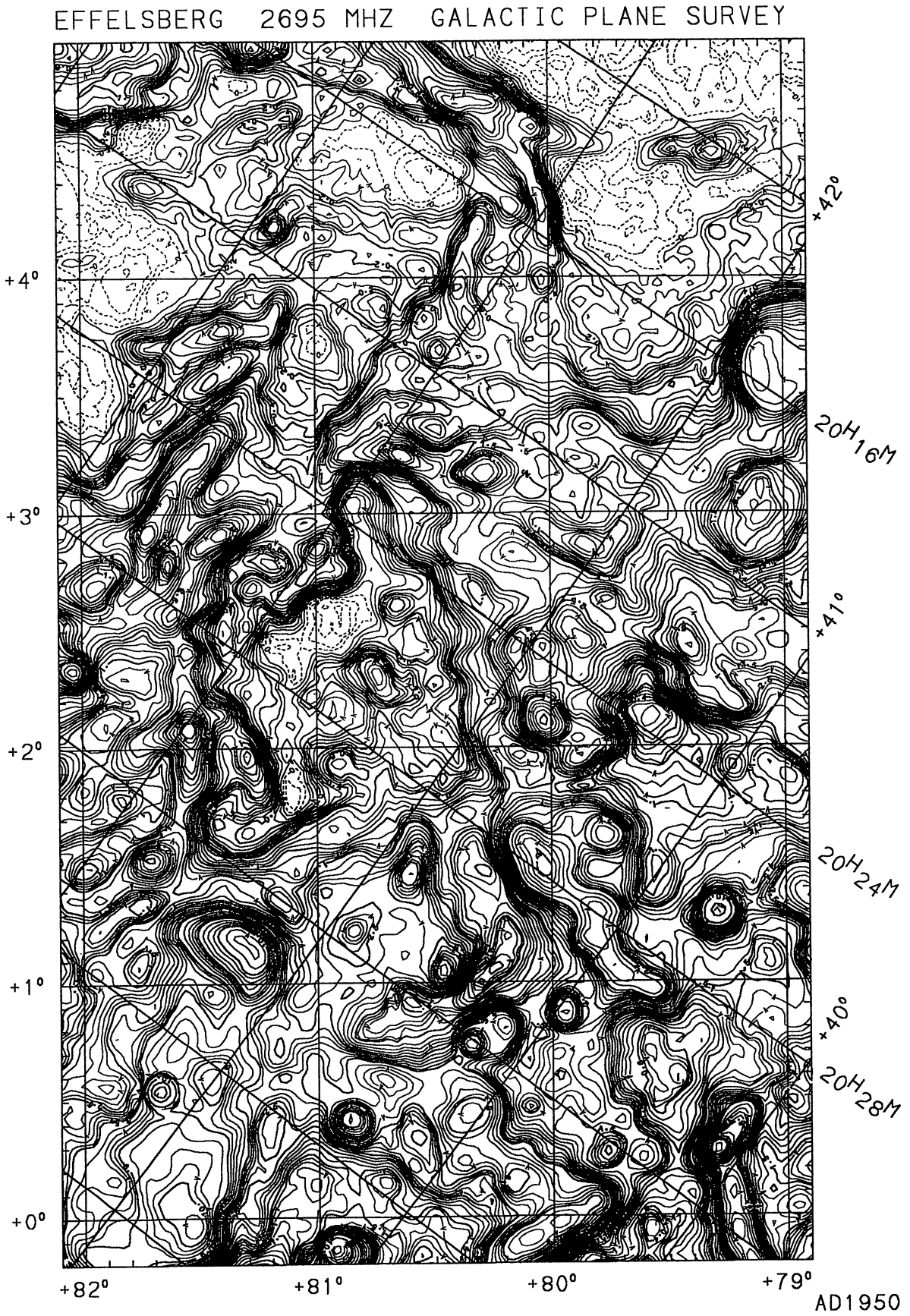

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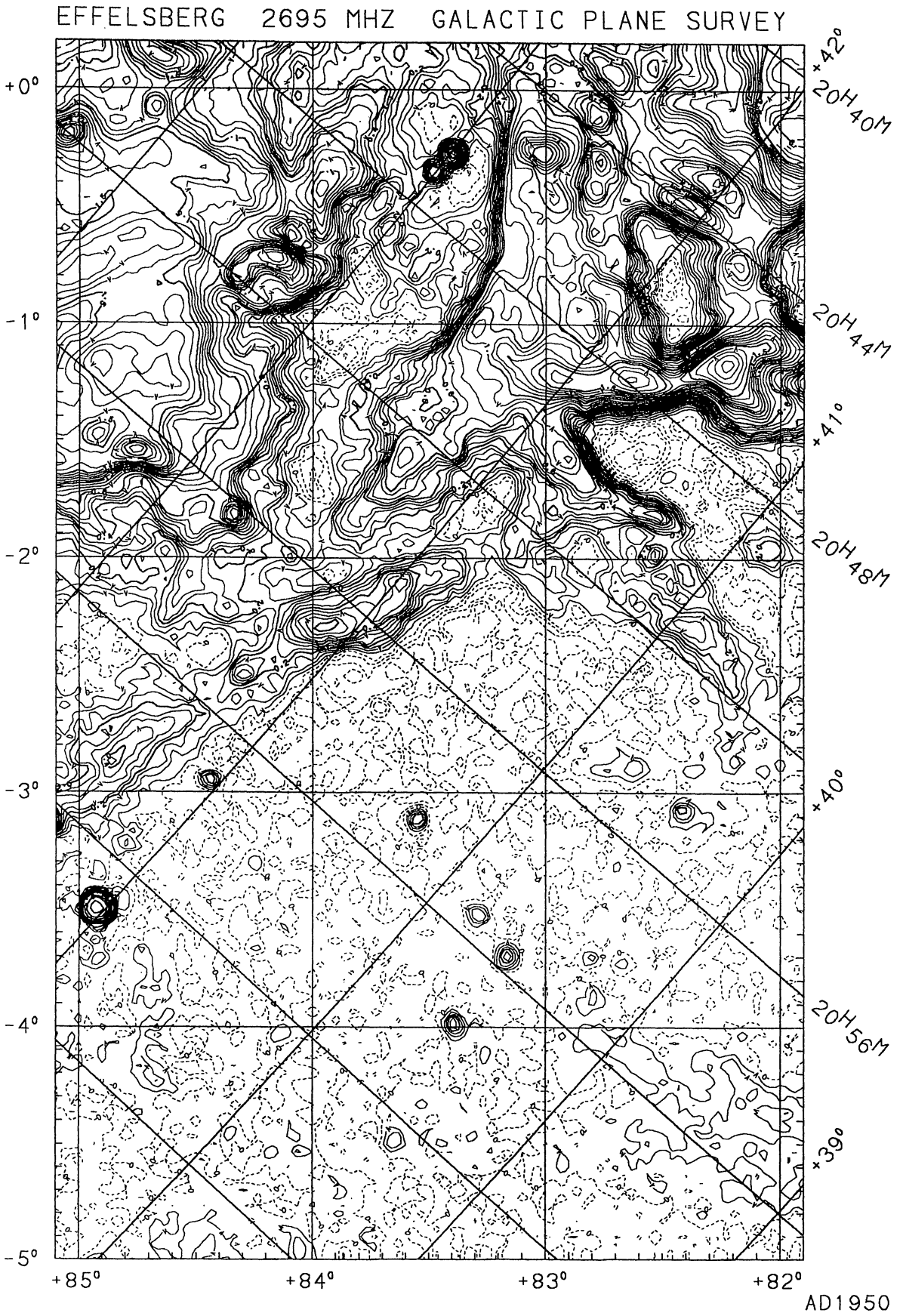

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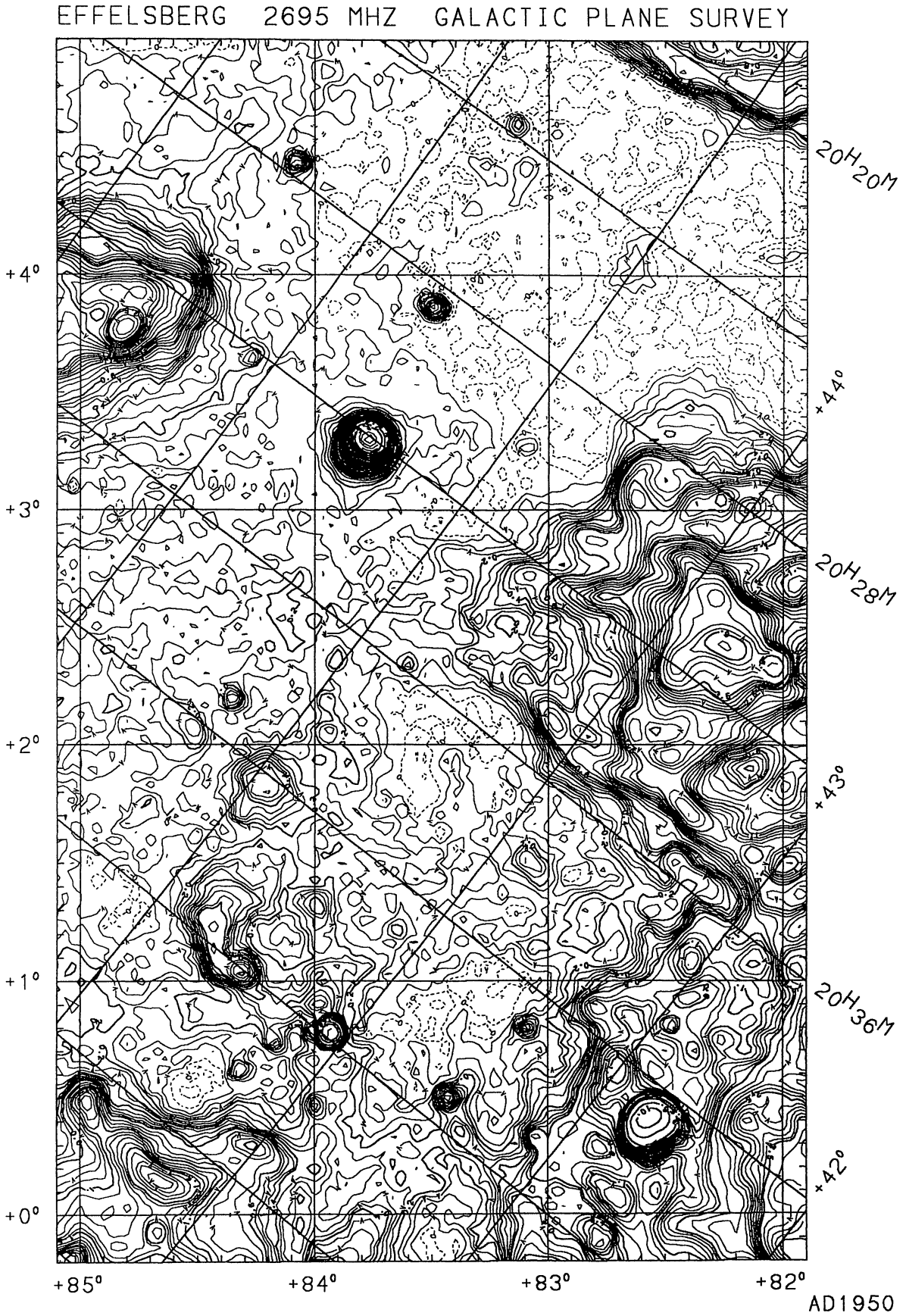

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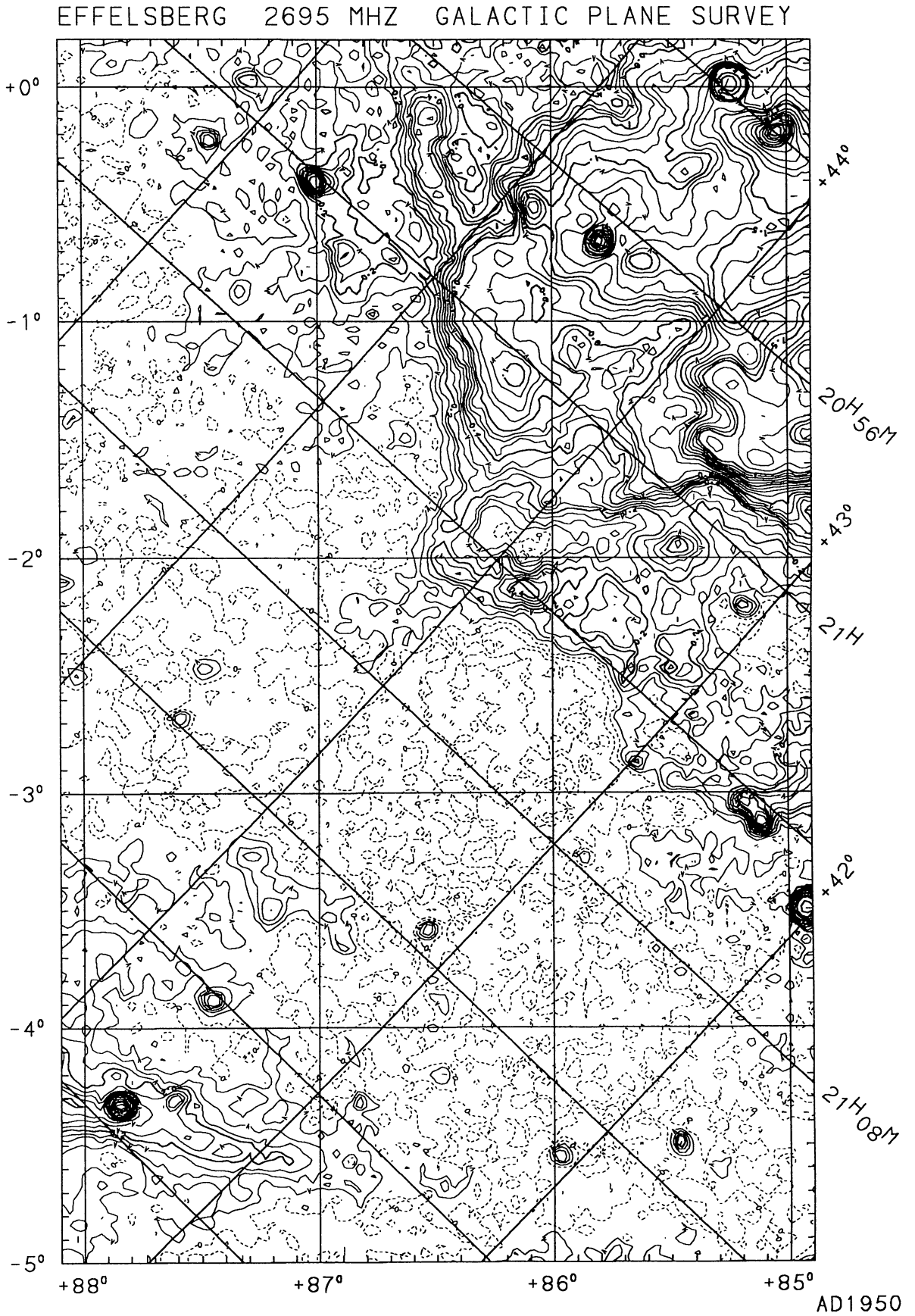

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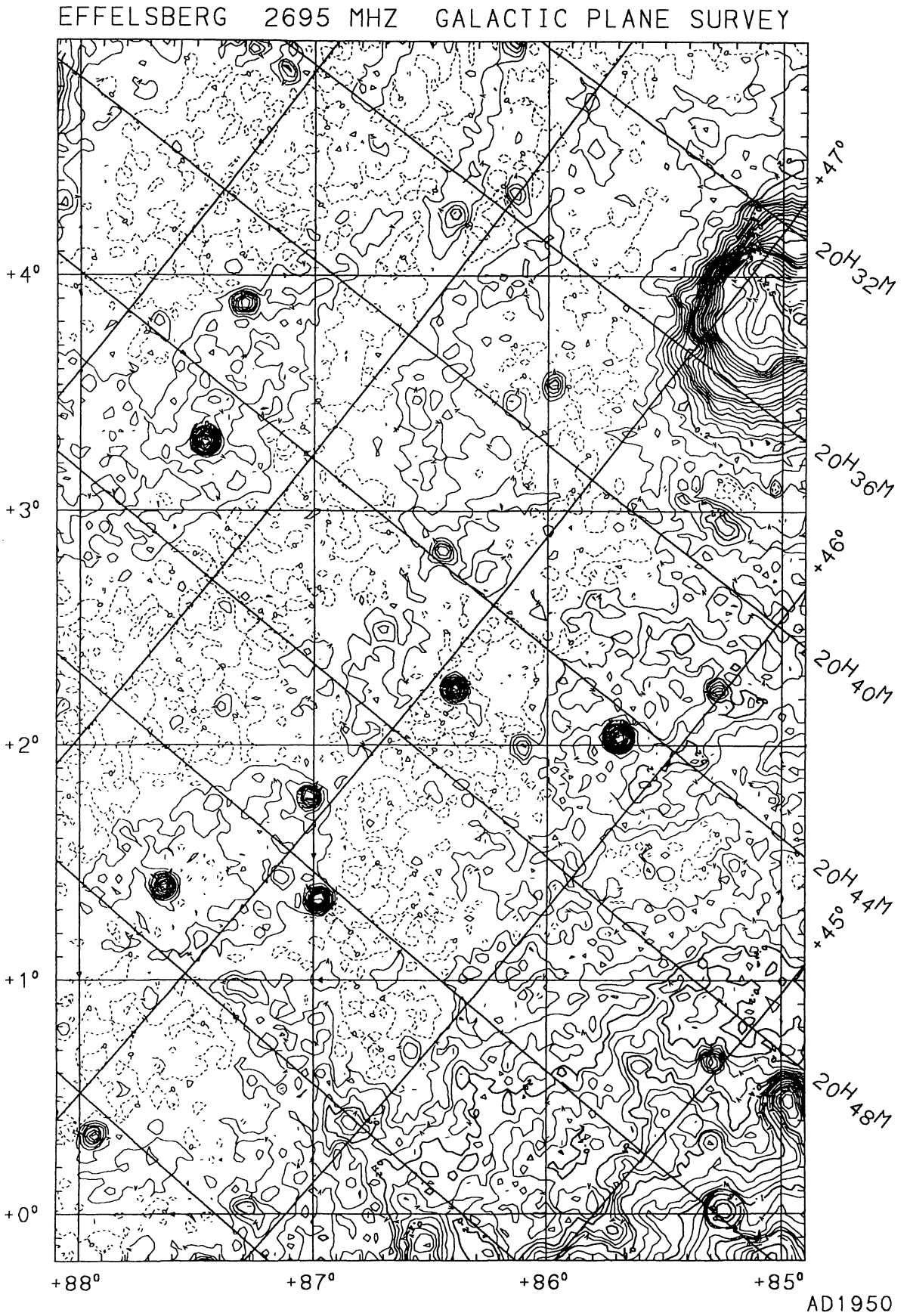

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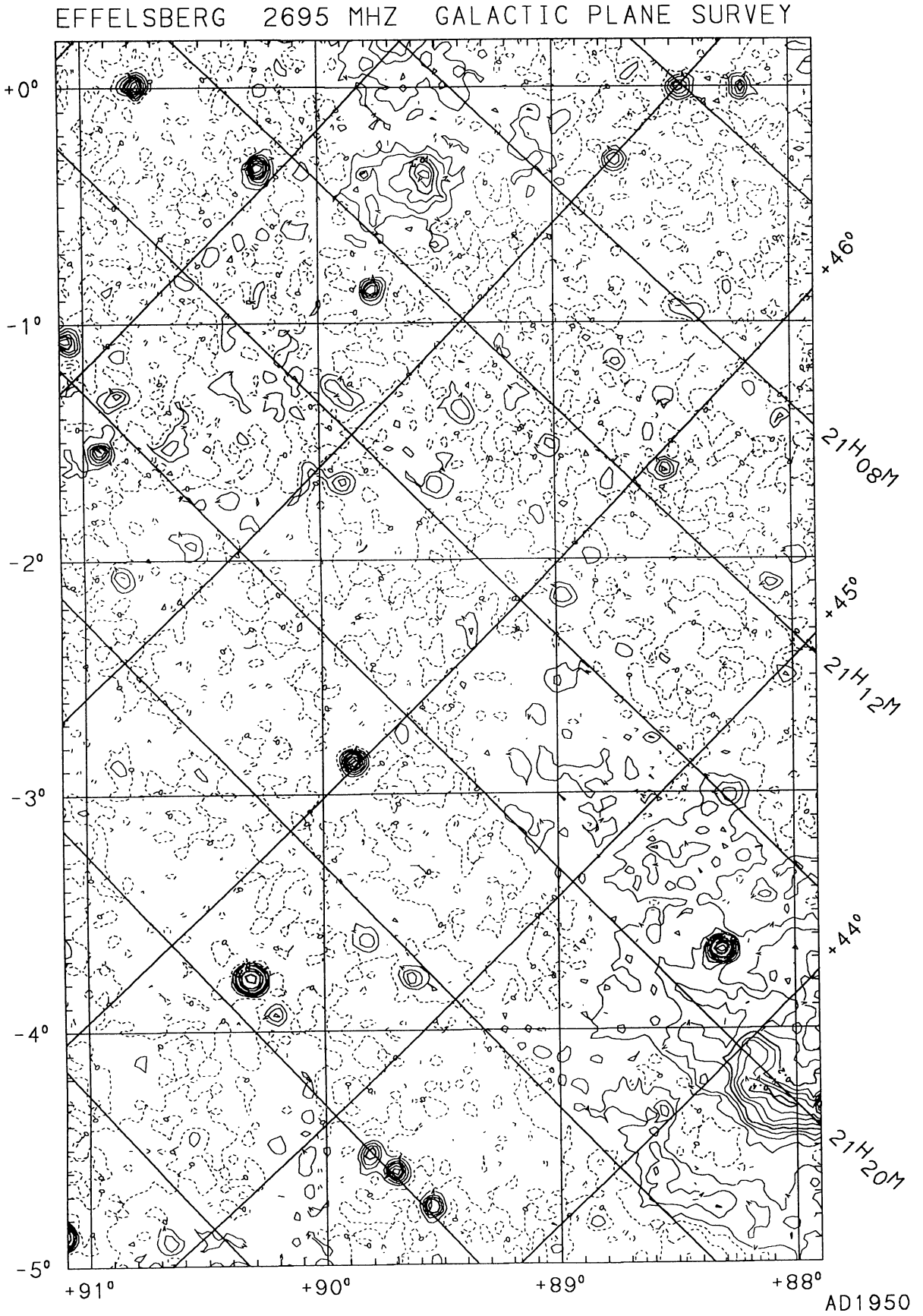

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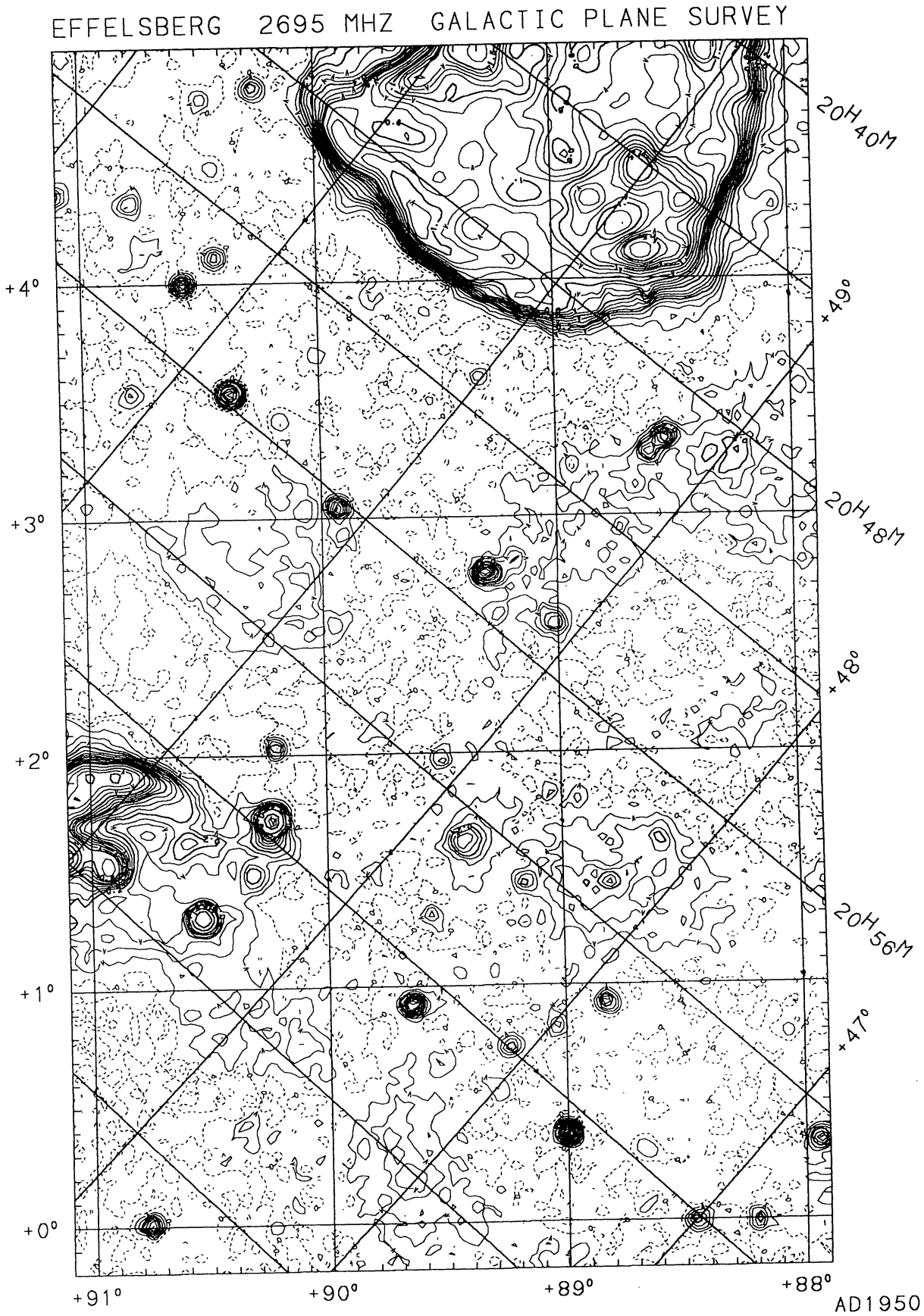

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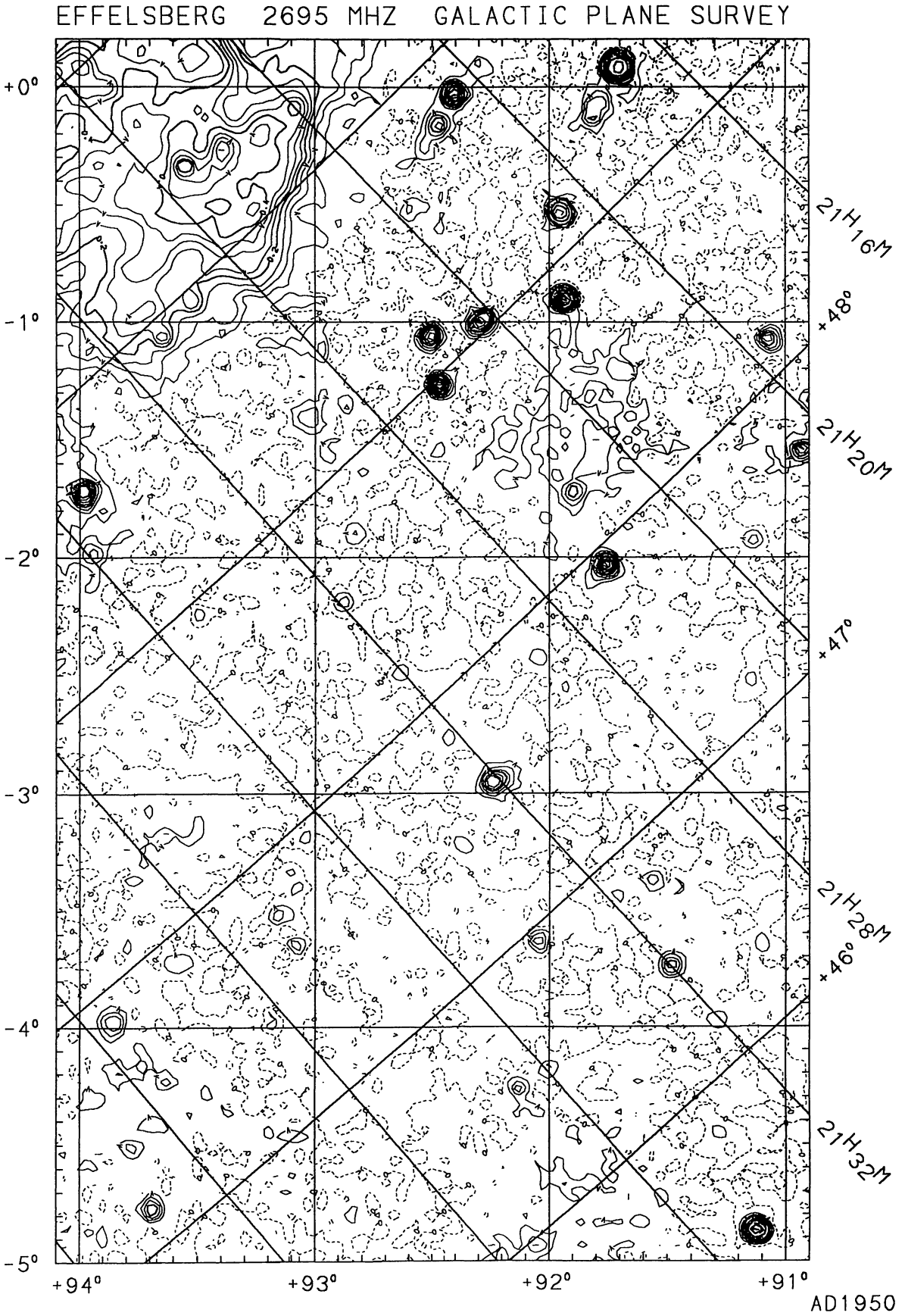

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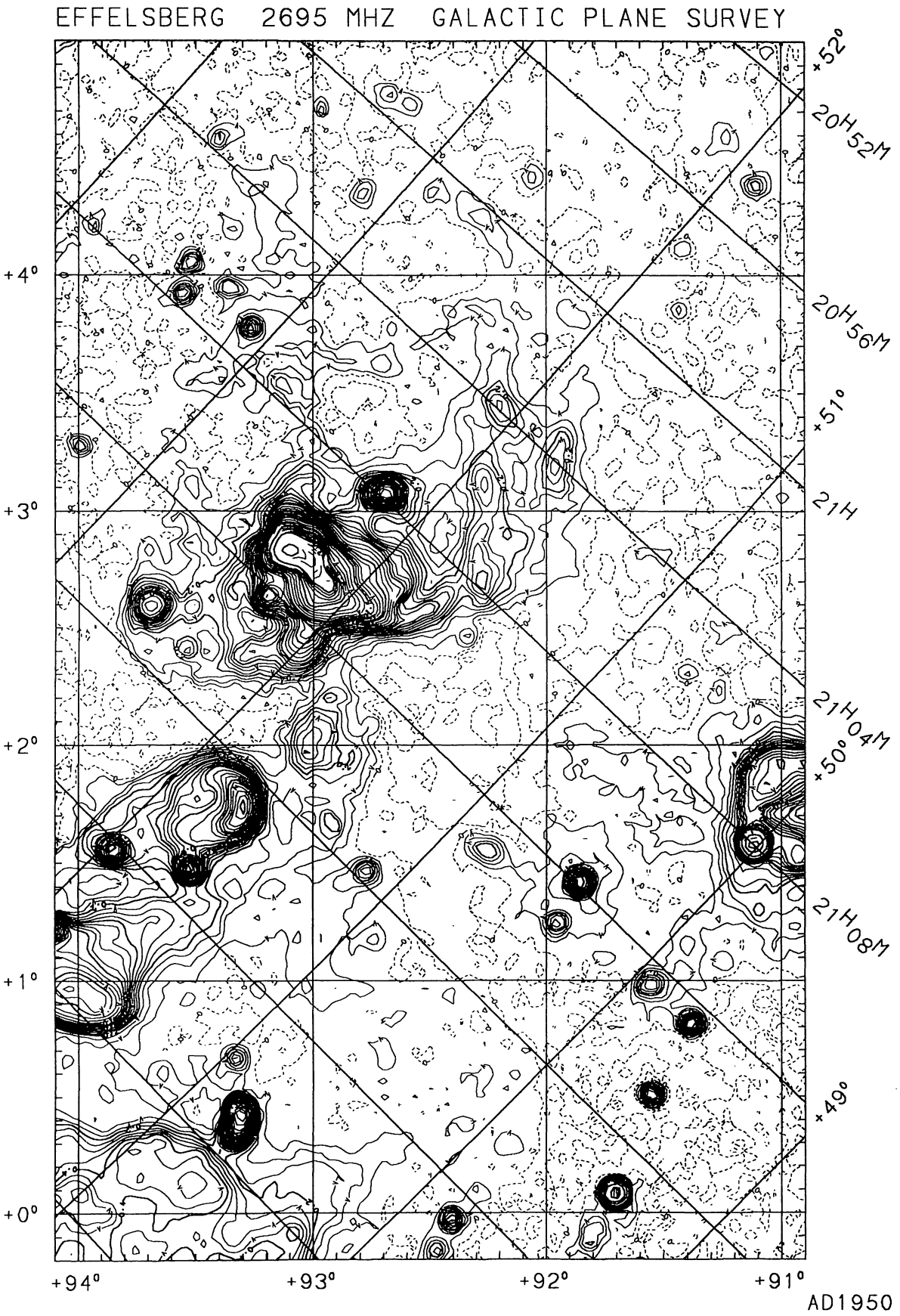

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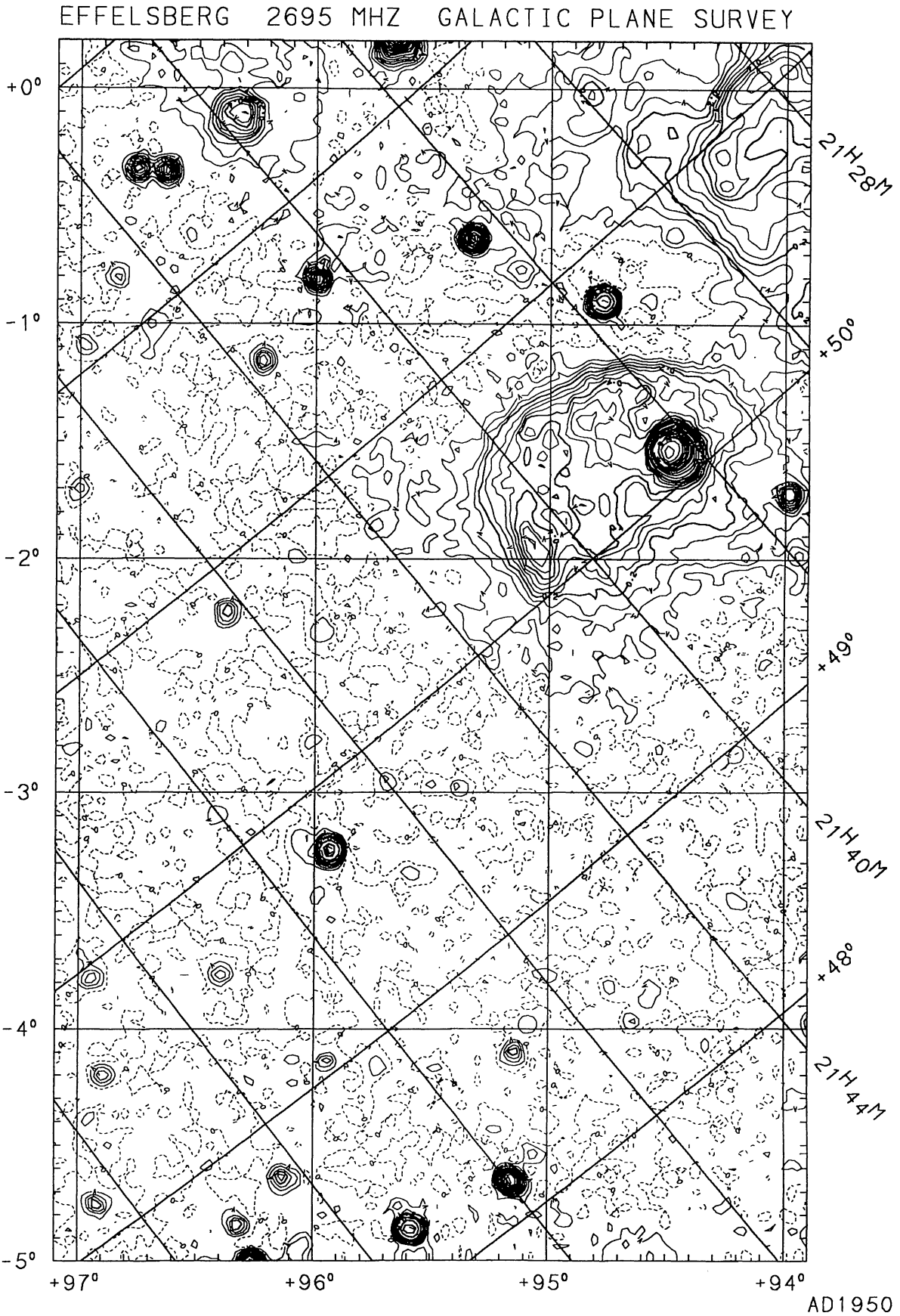

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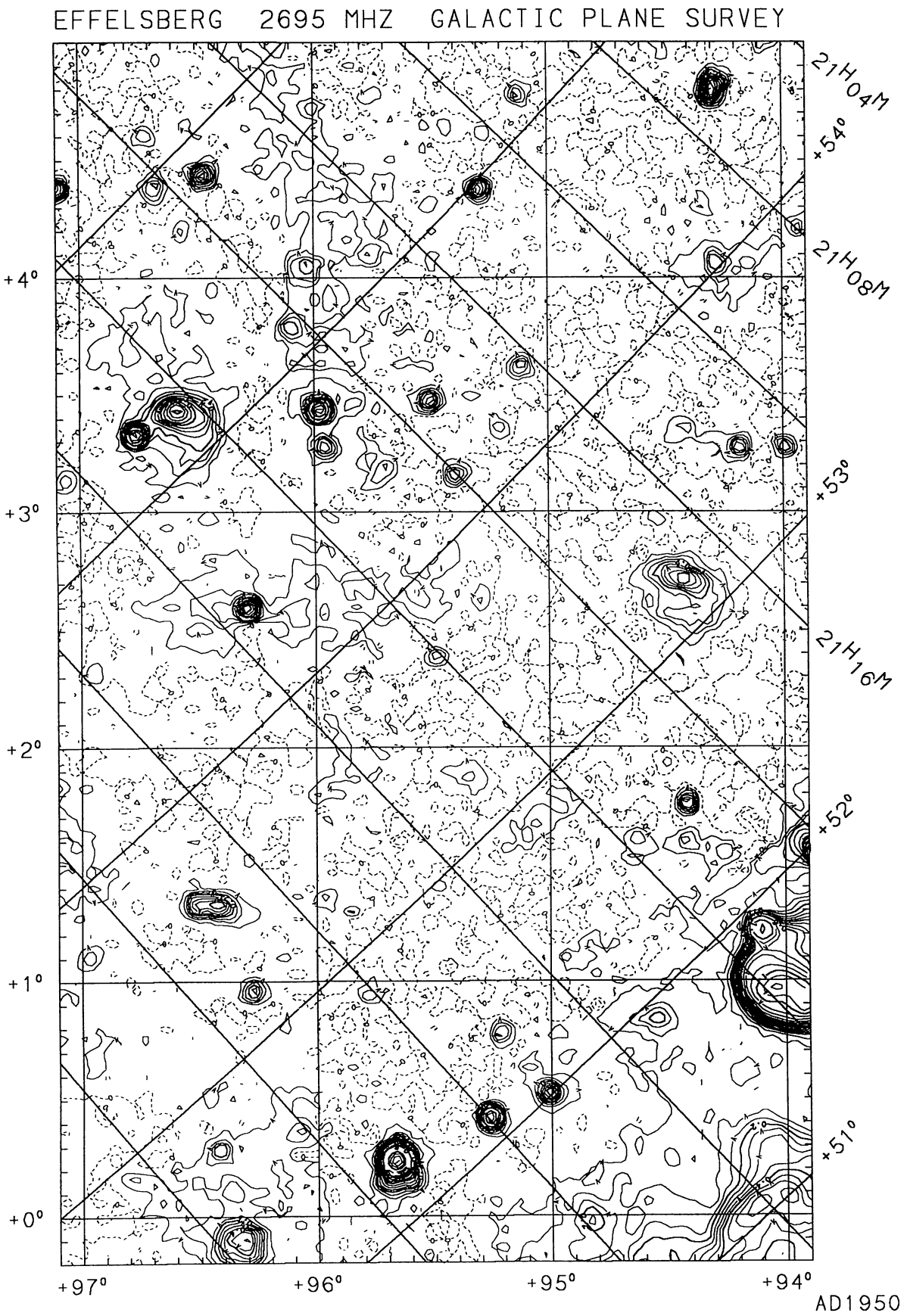

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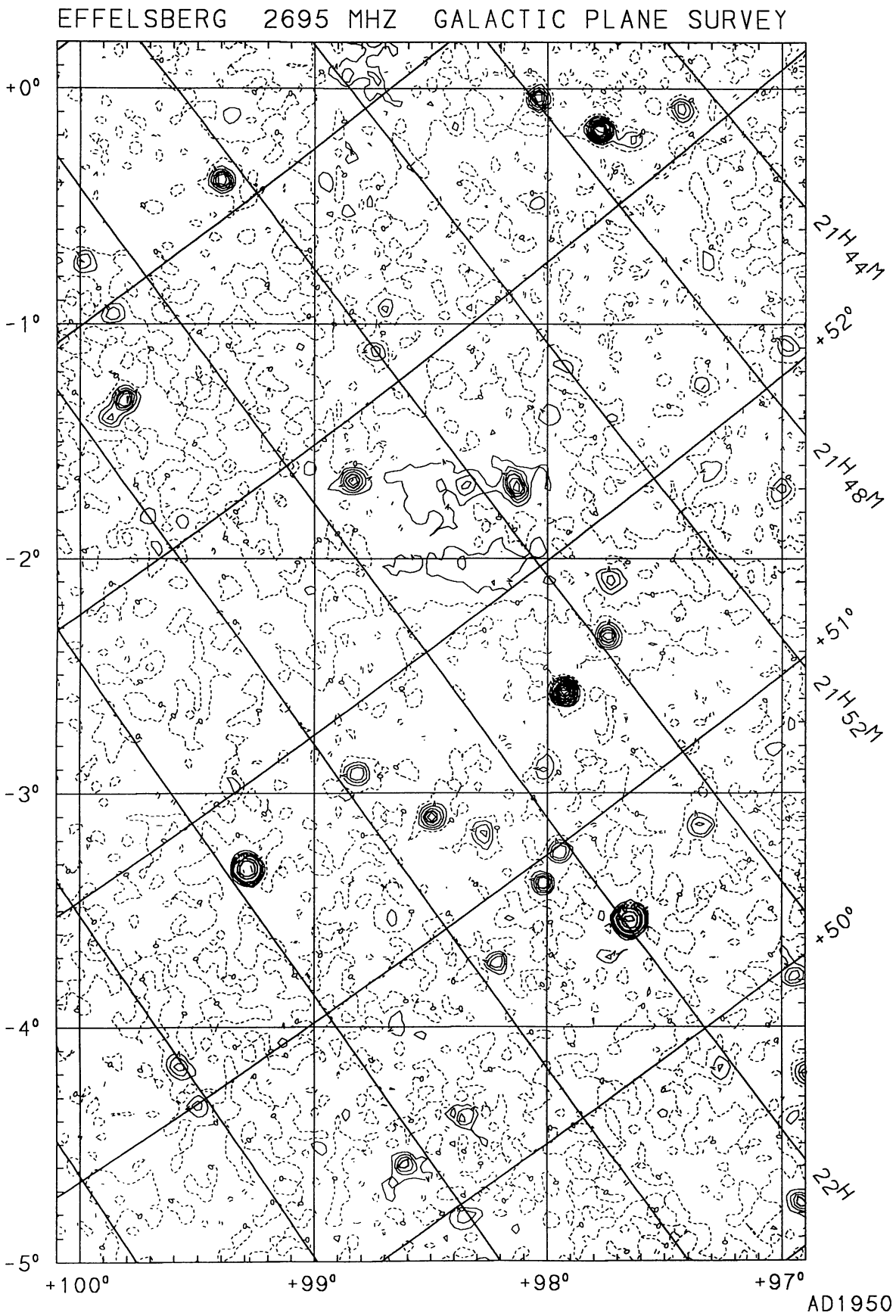

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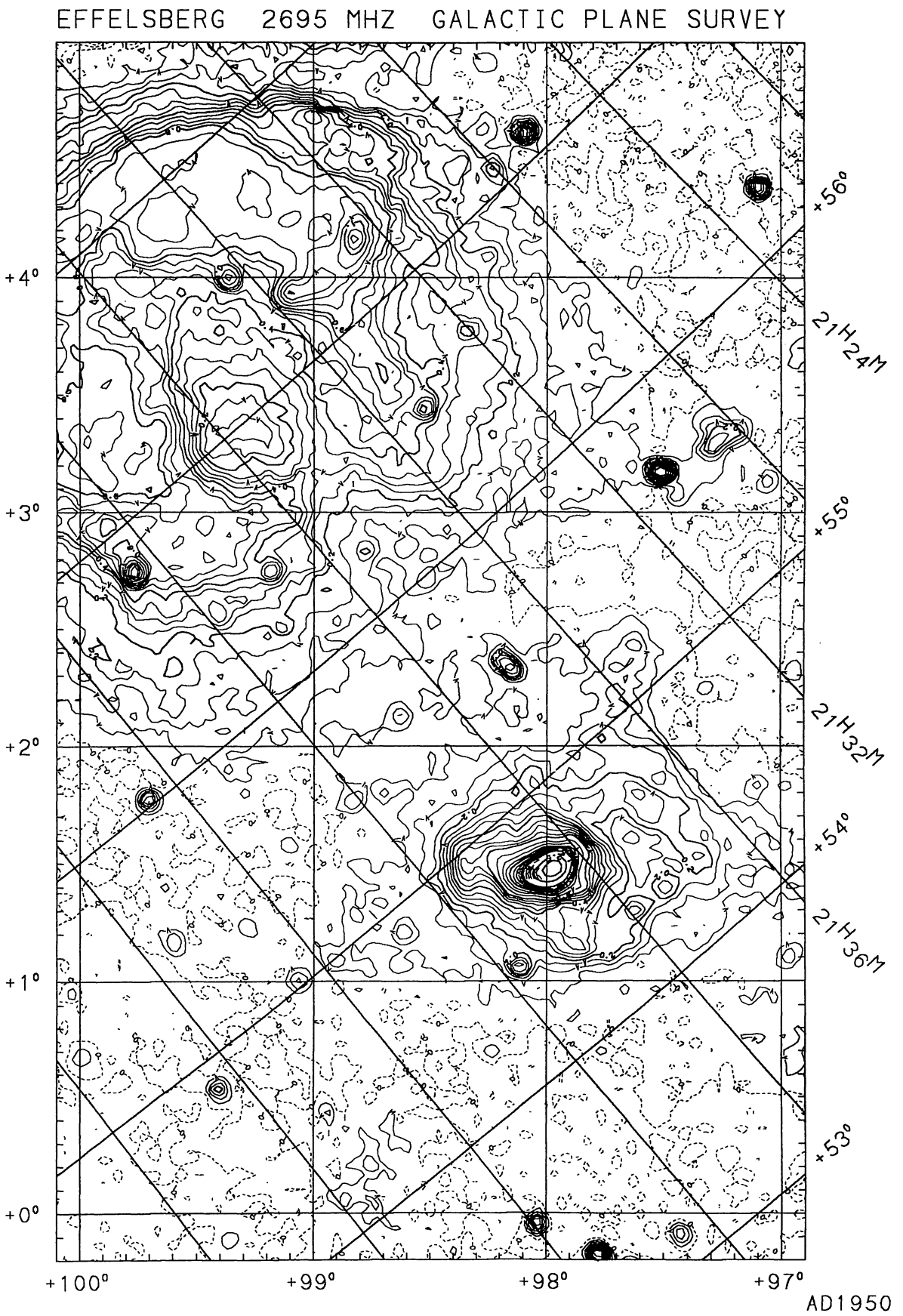

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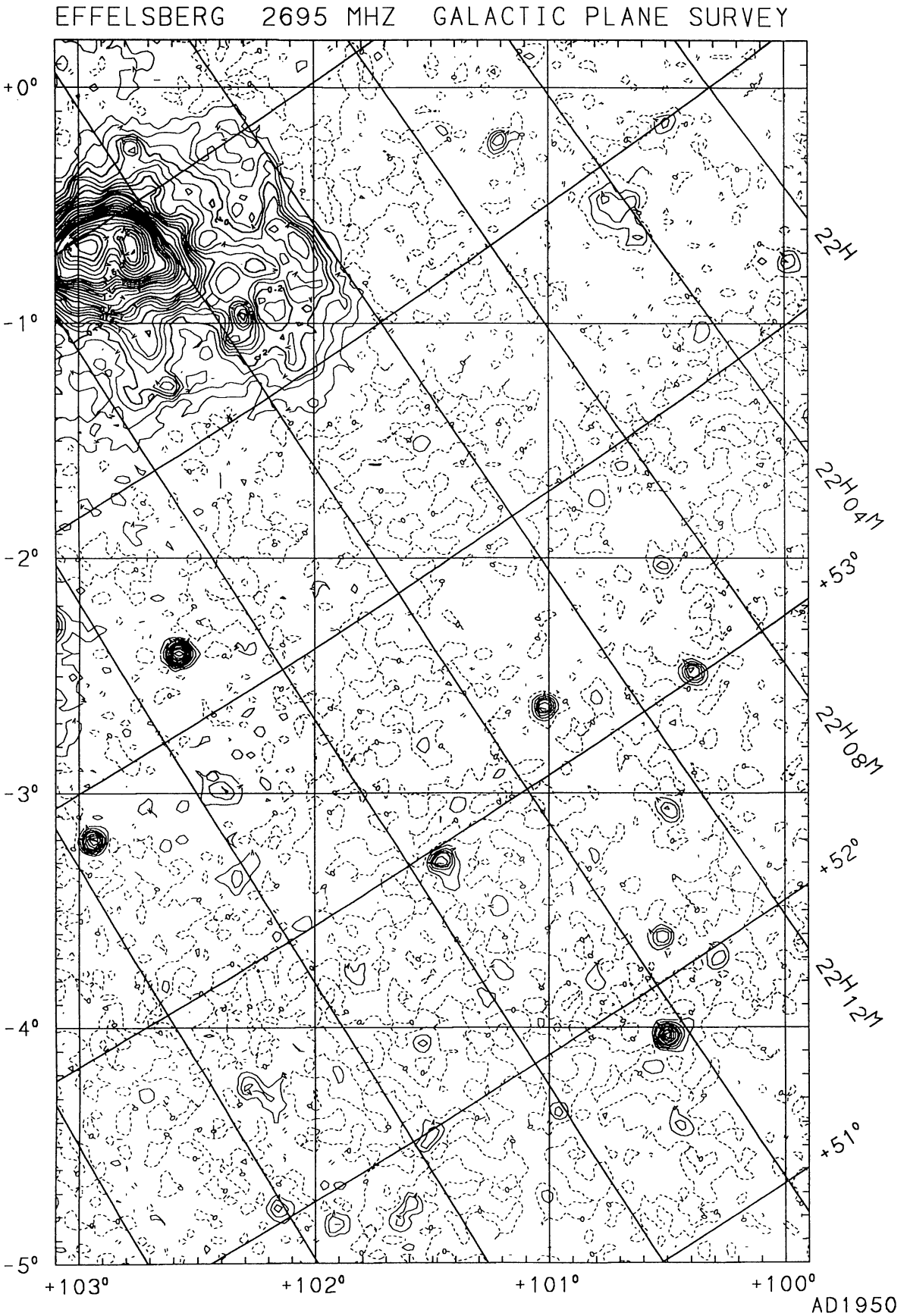

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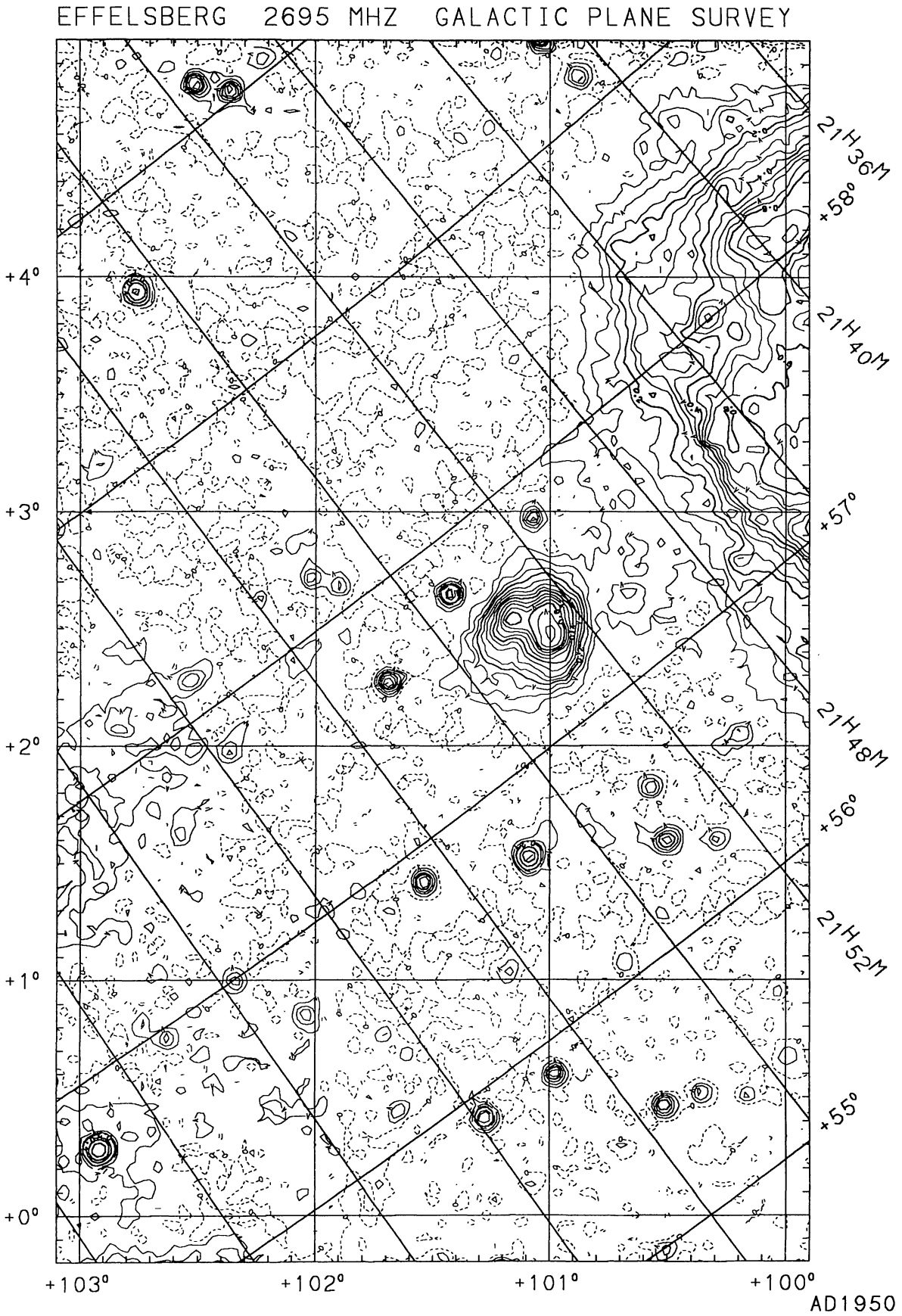

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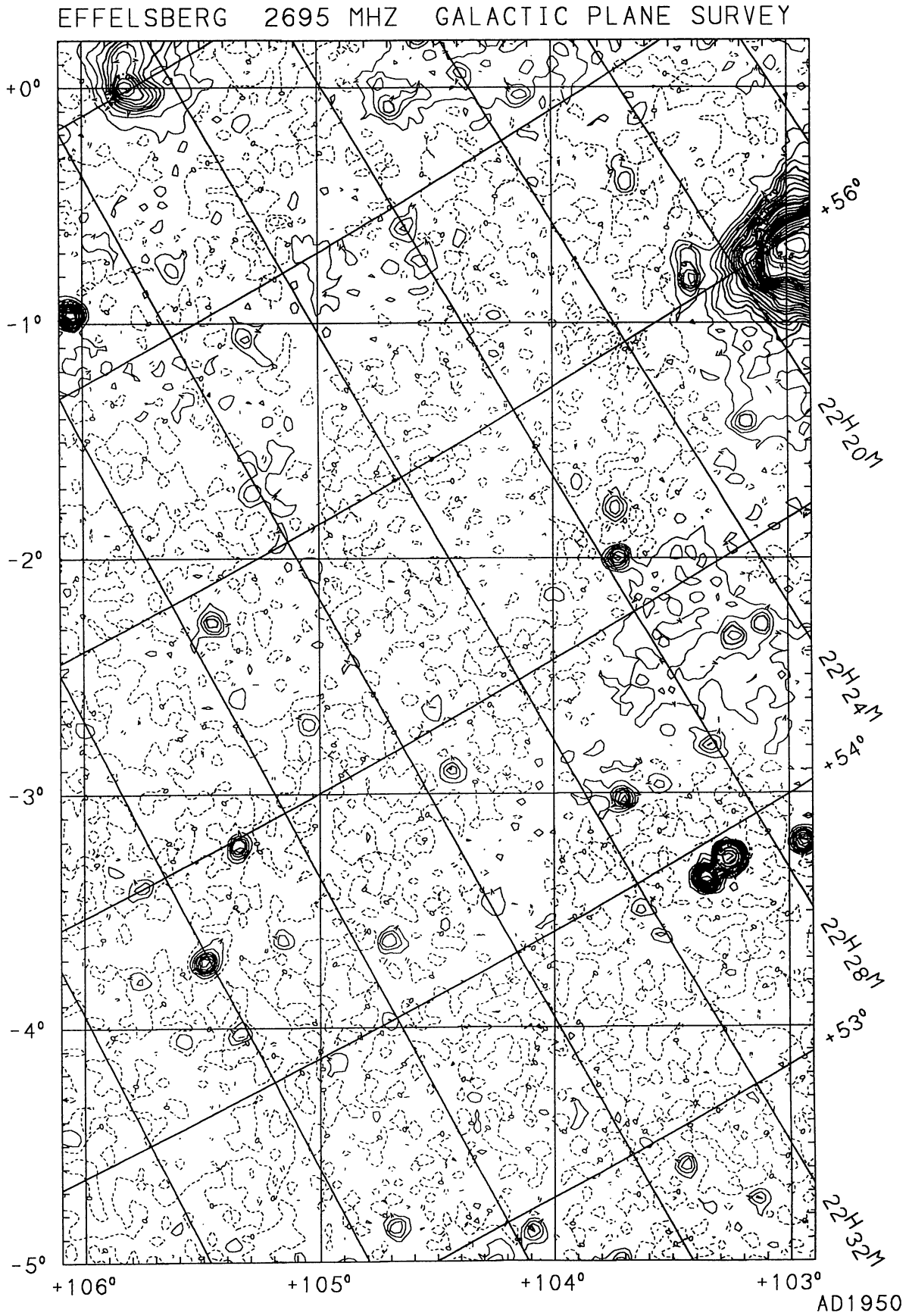

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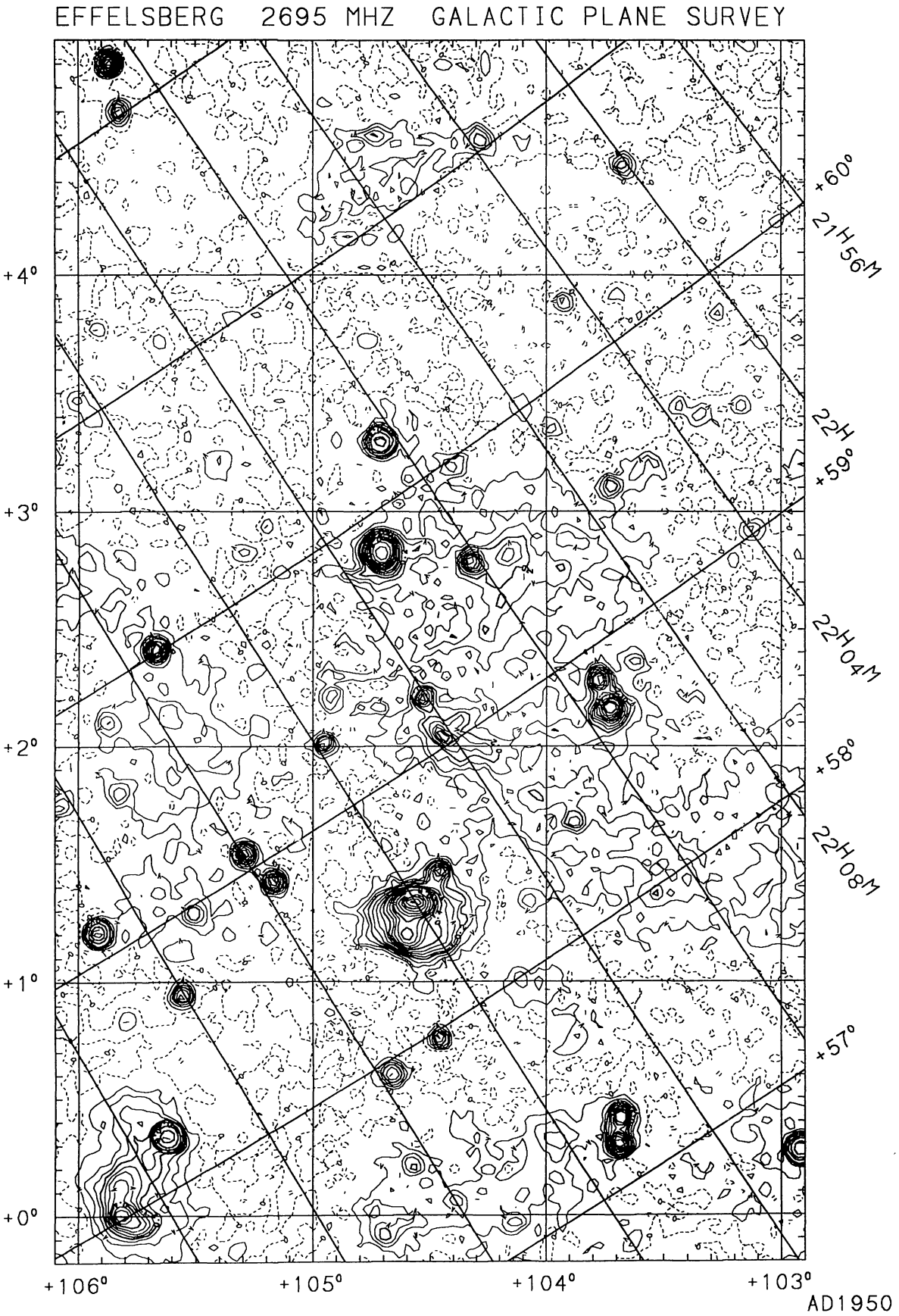

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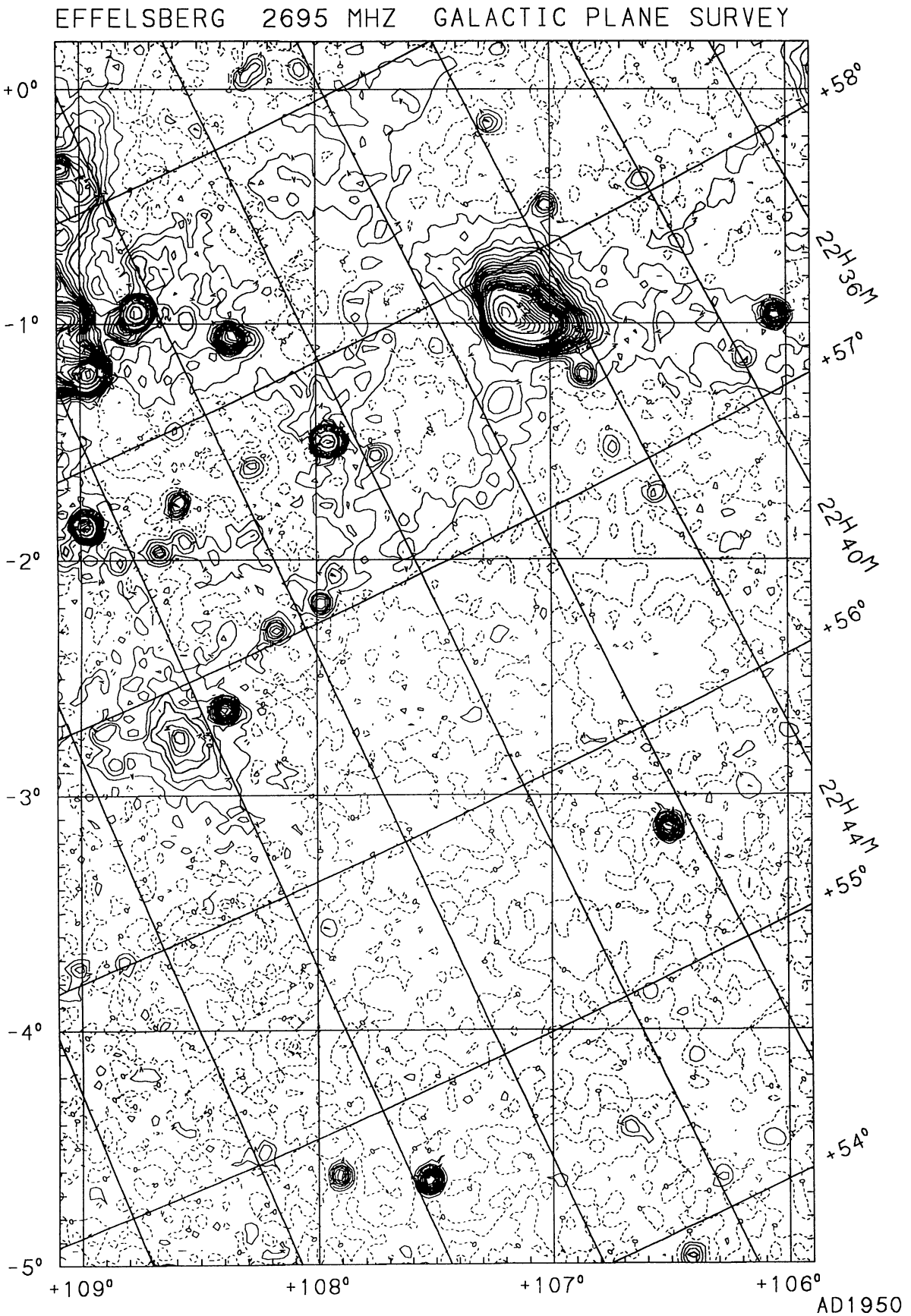

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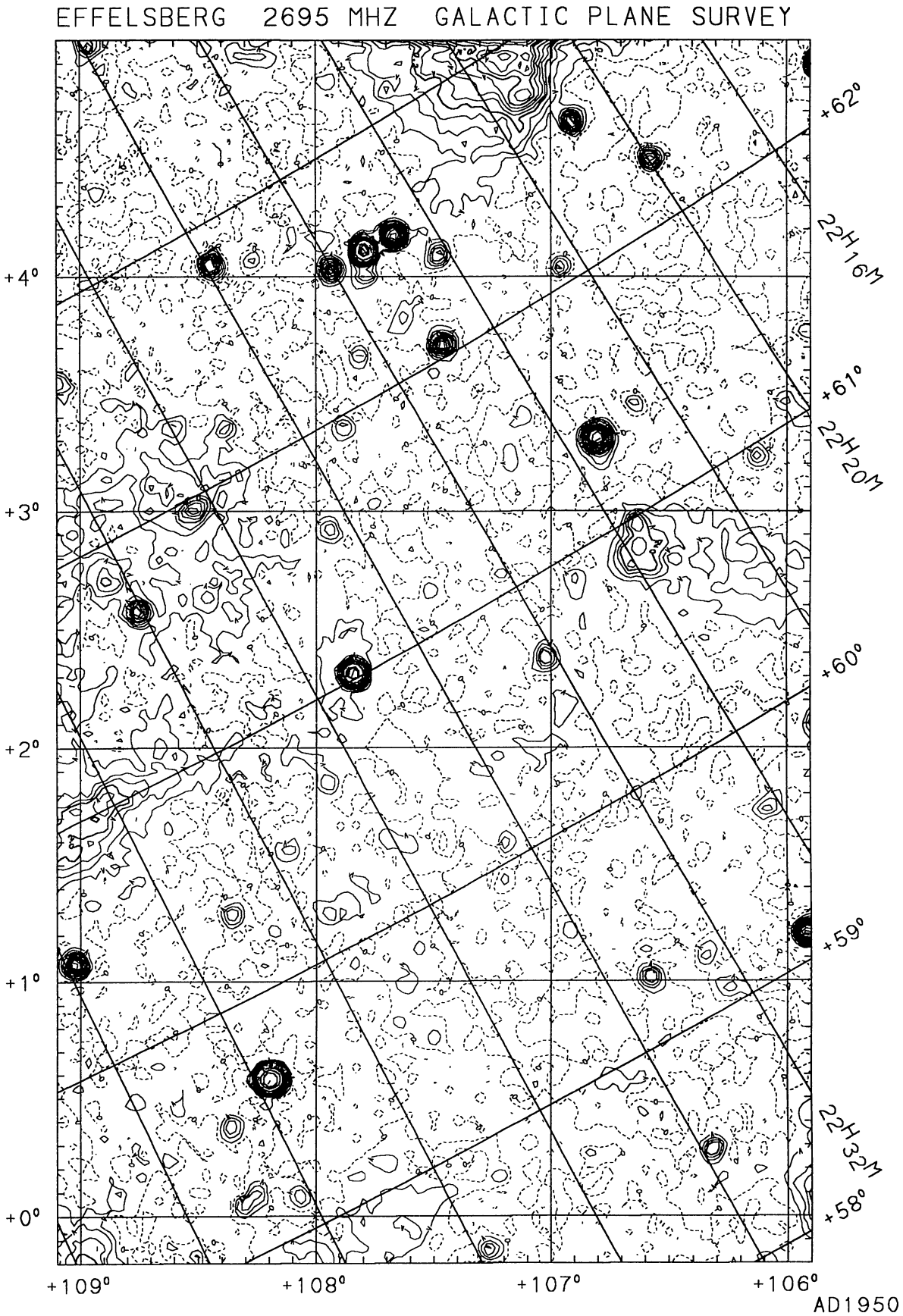

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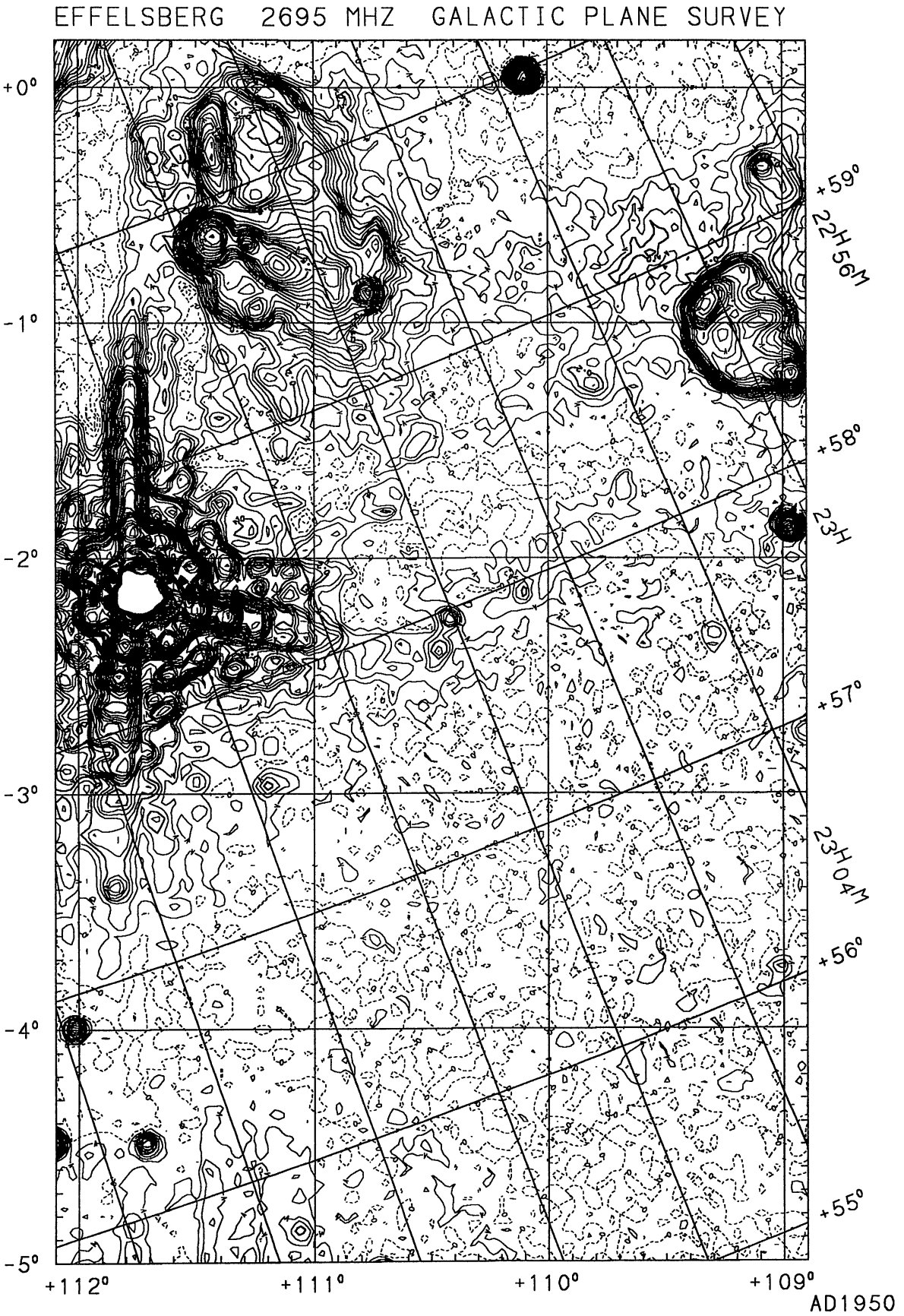

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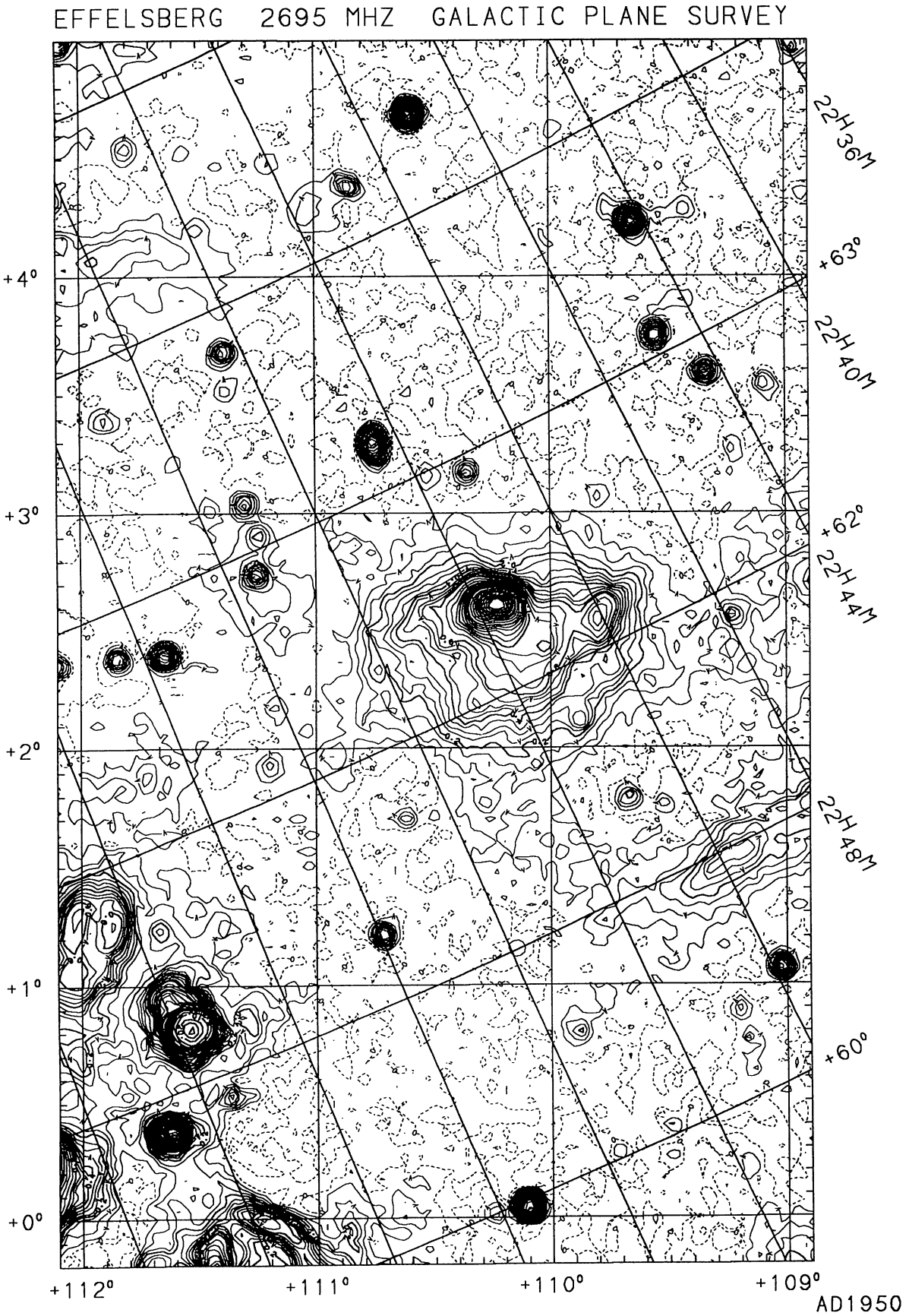

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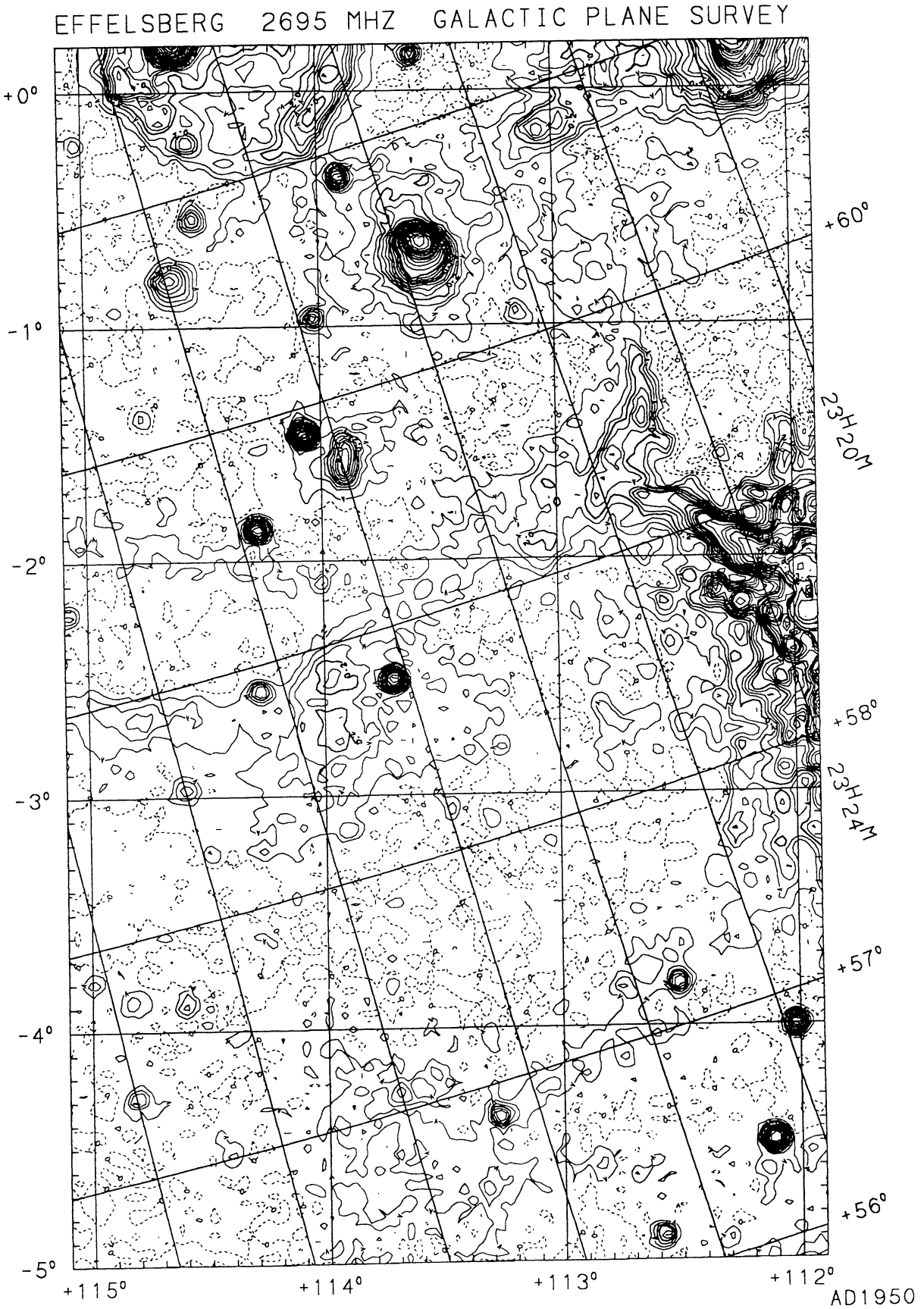

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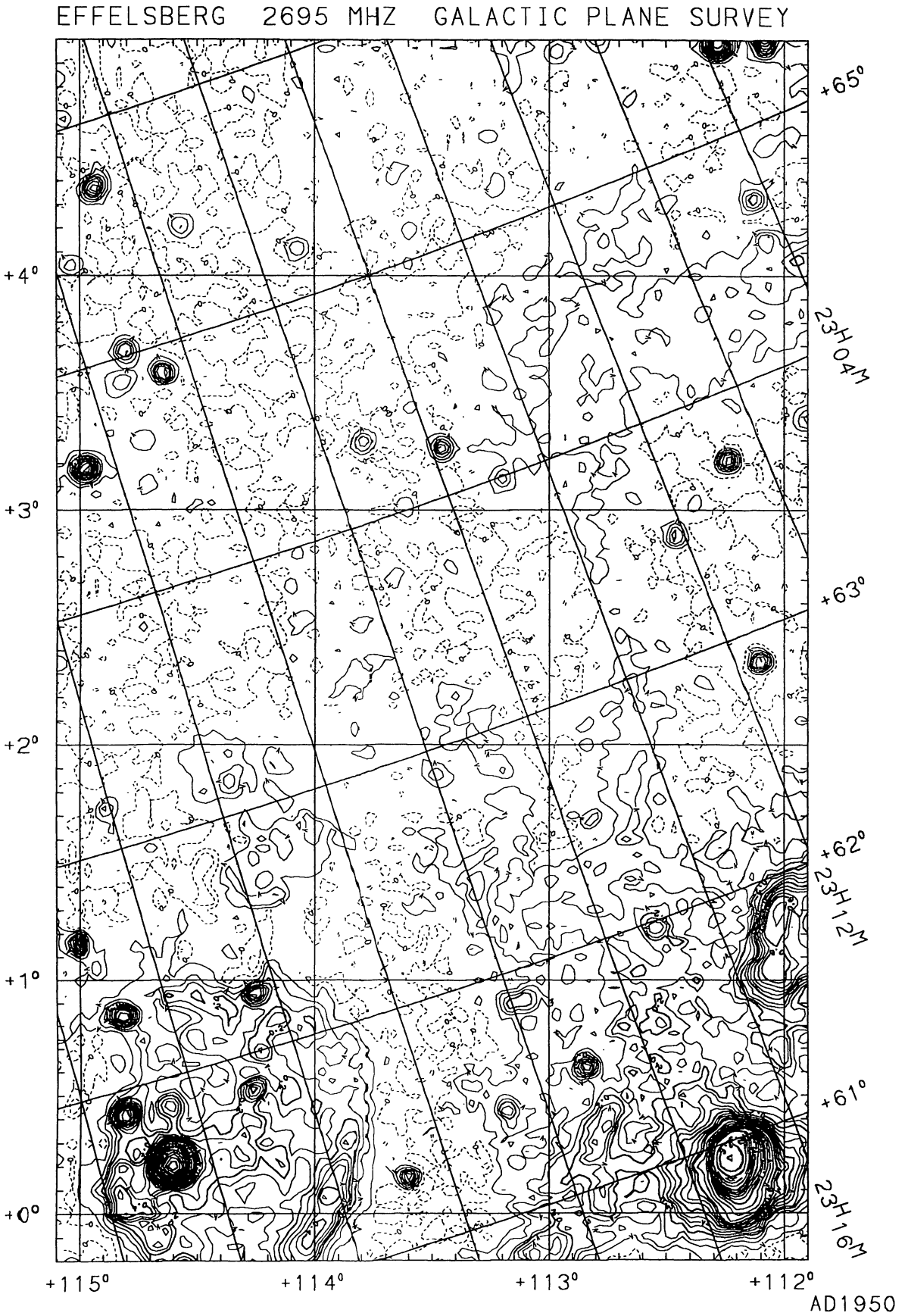

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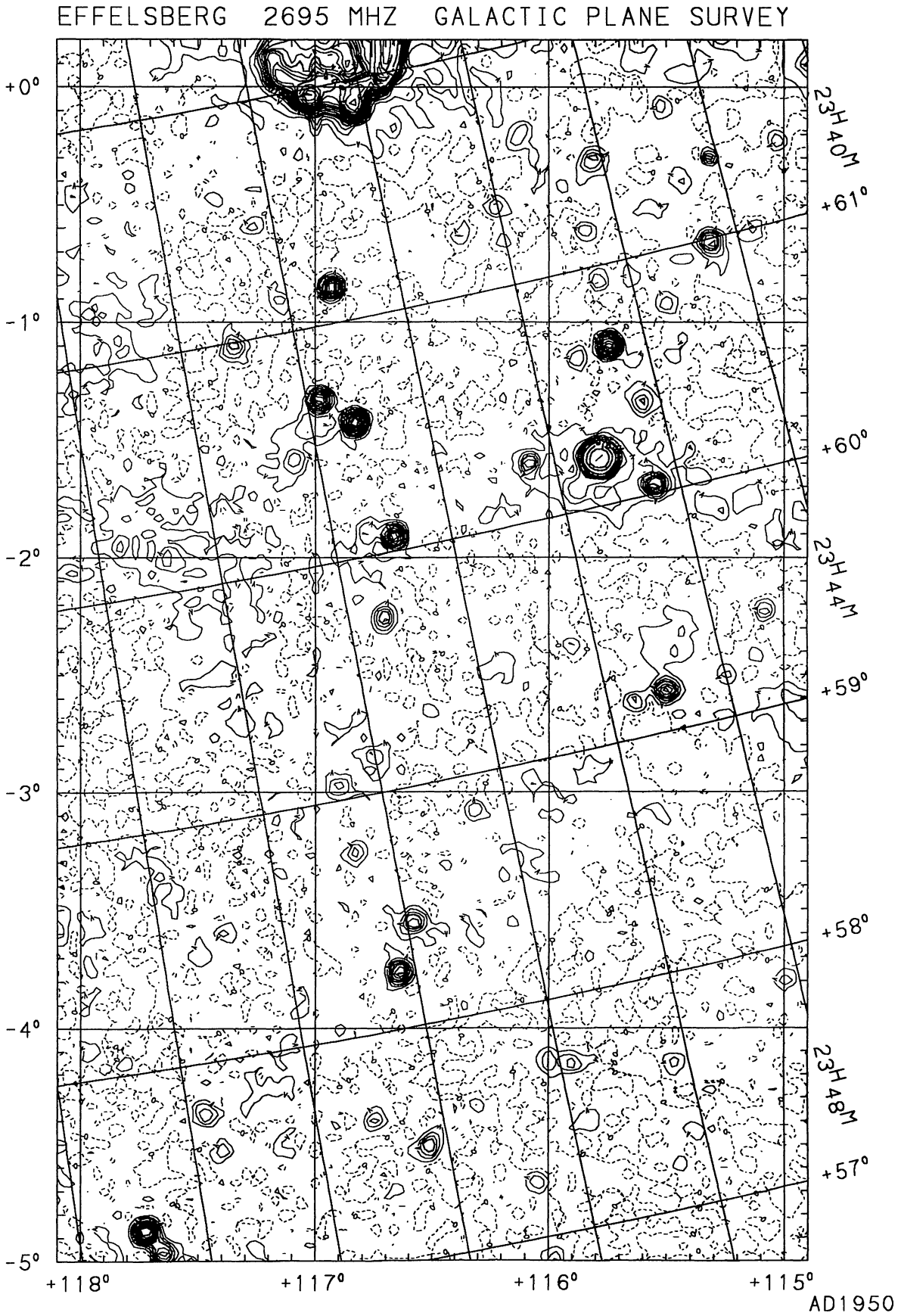

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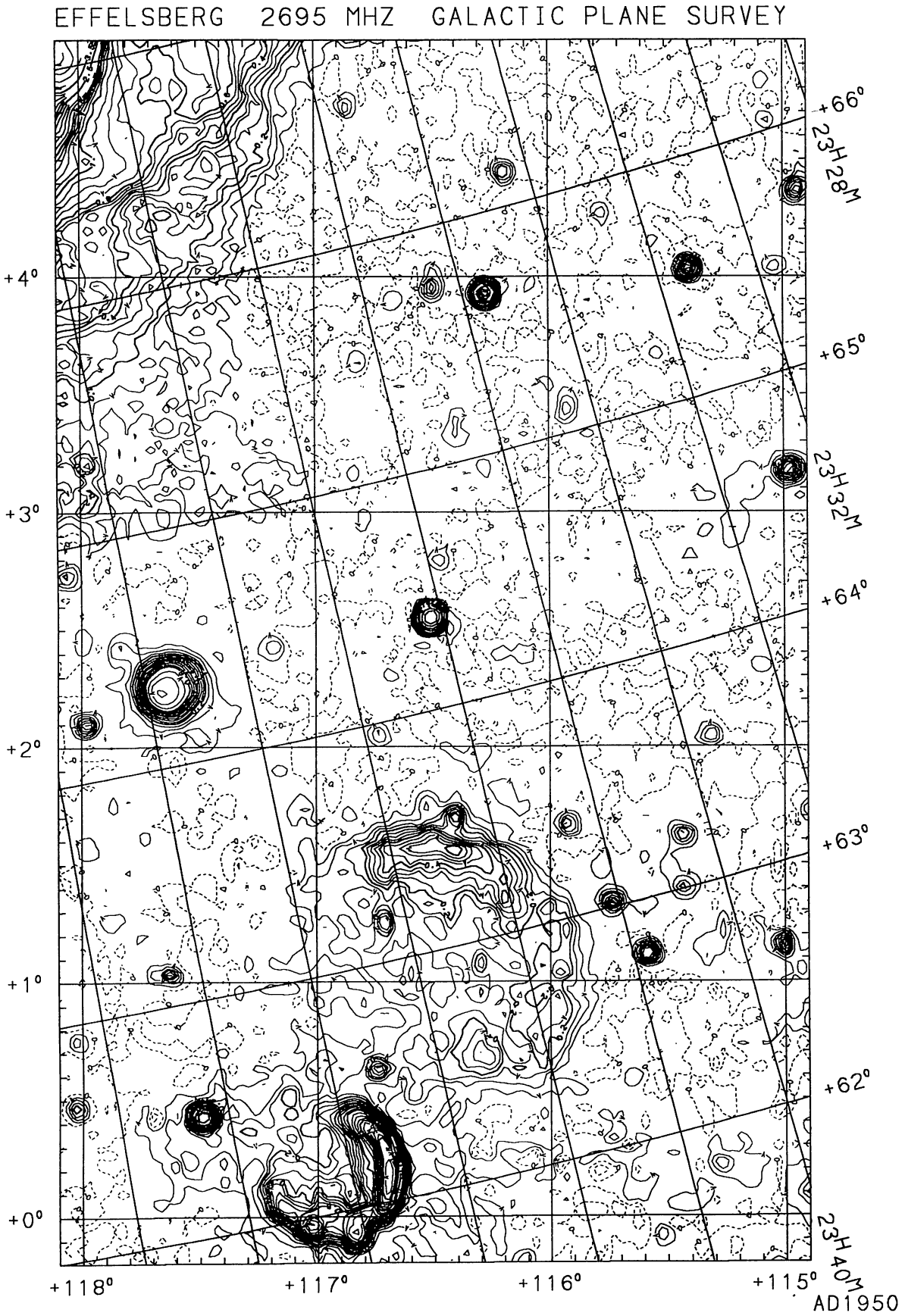

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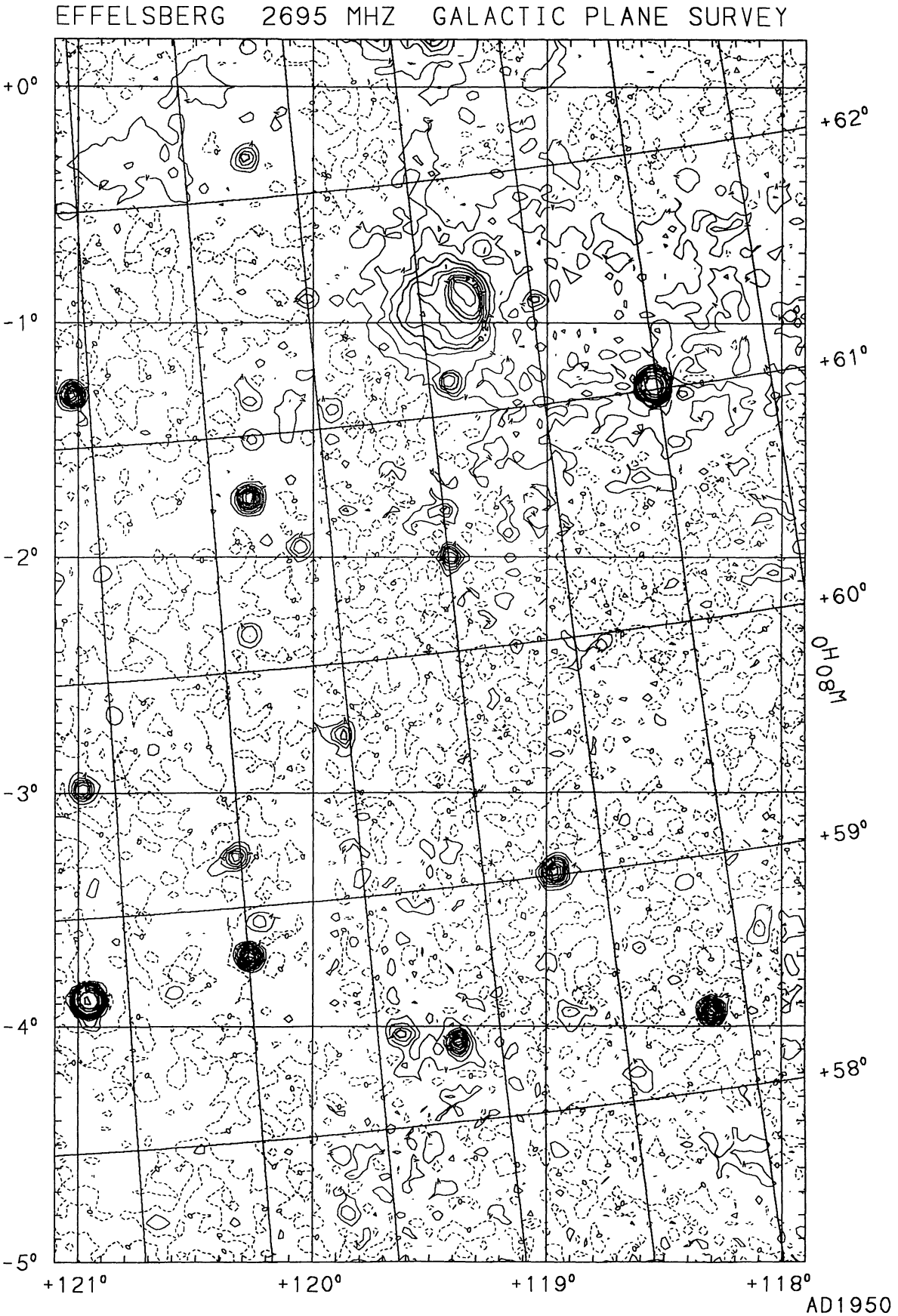

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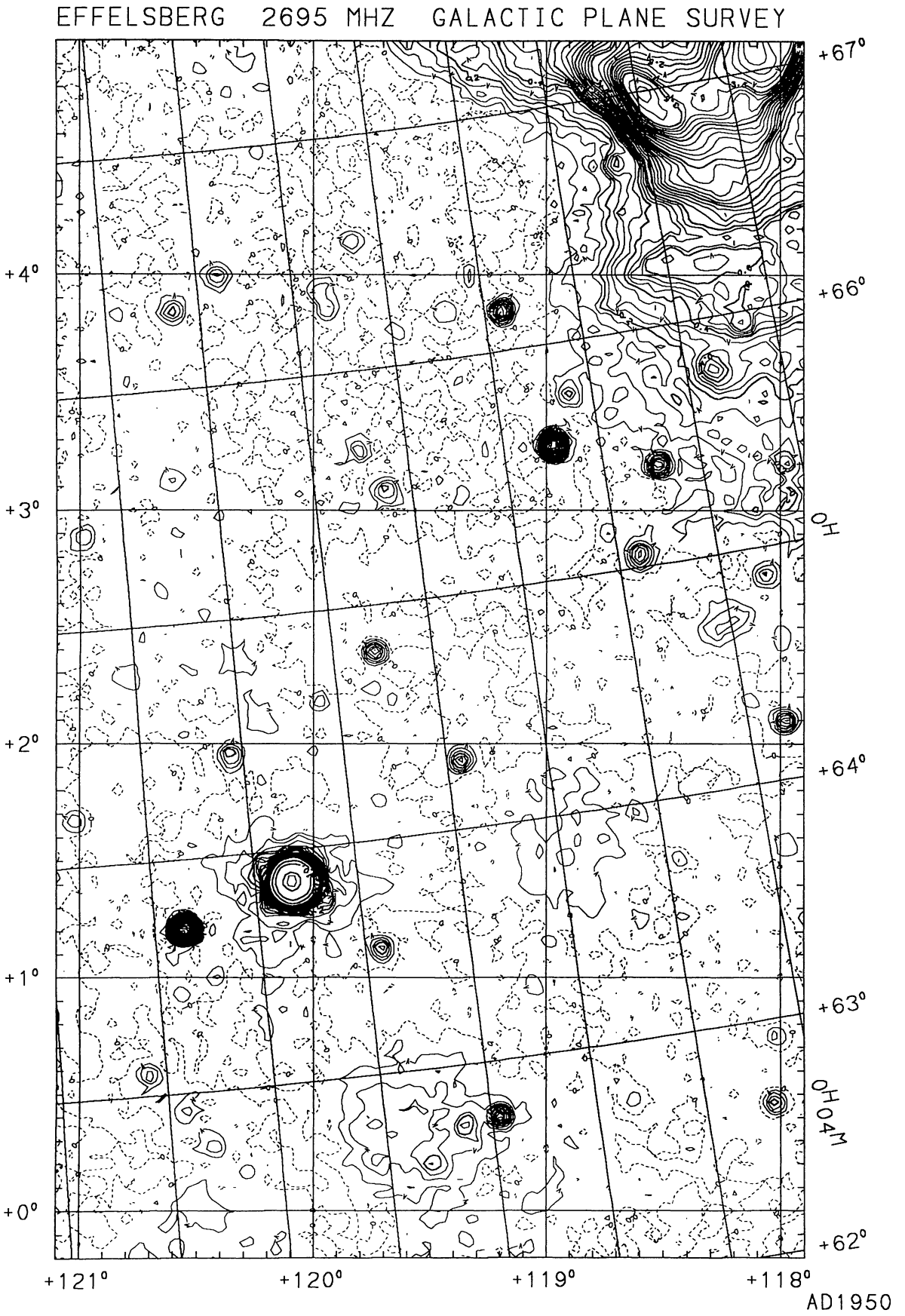

FIGURE 30

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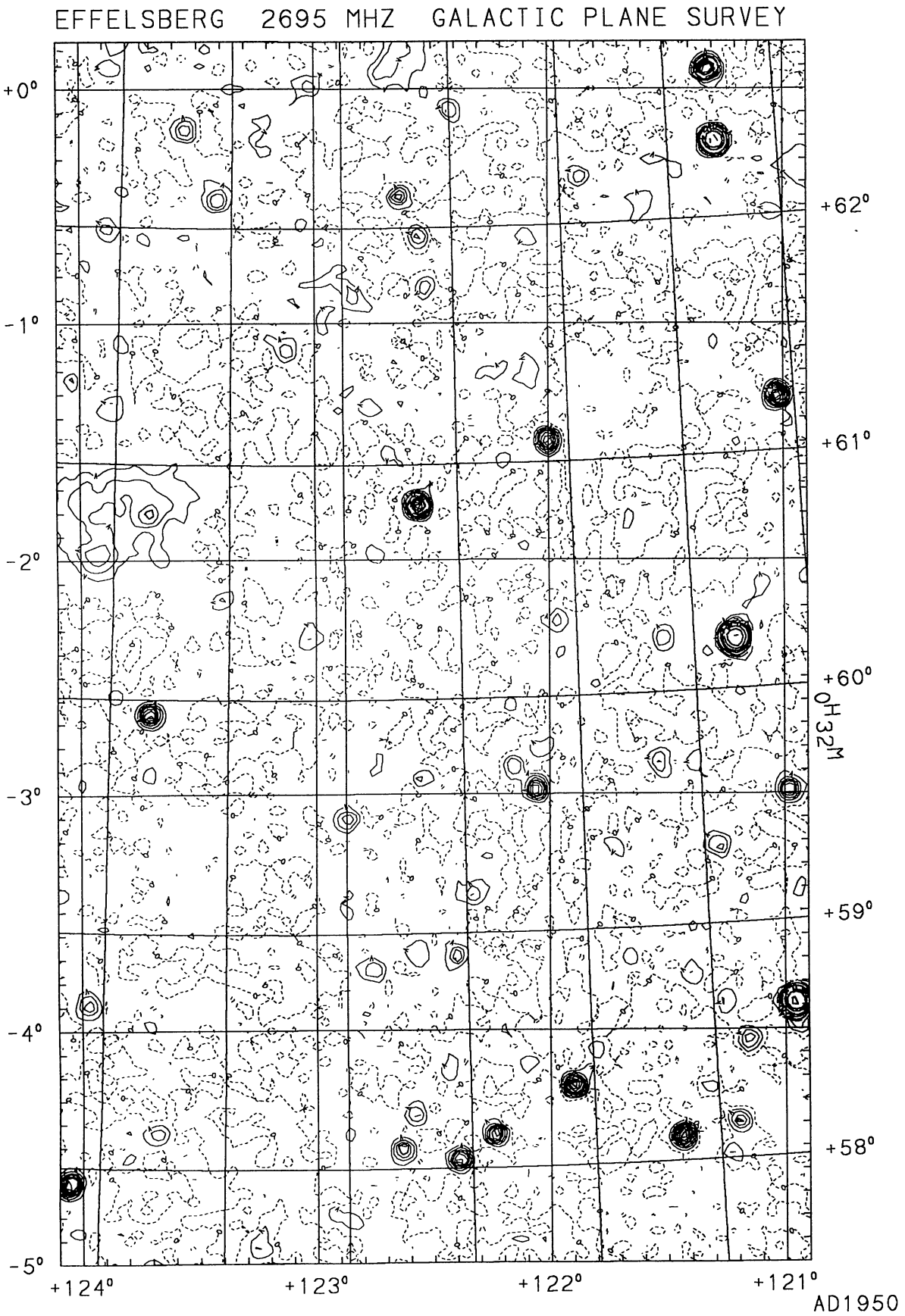

FIGURE 31

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1990A&AS...85..691F

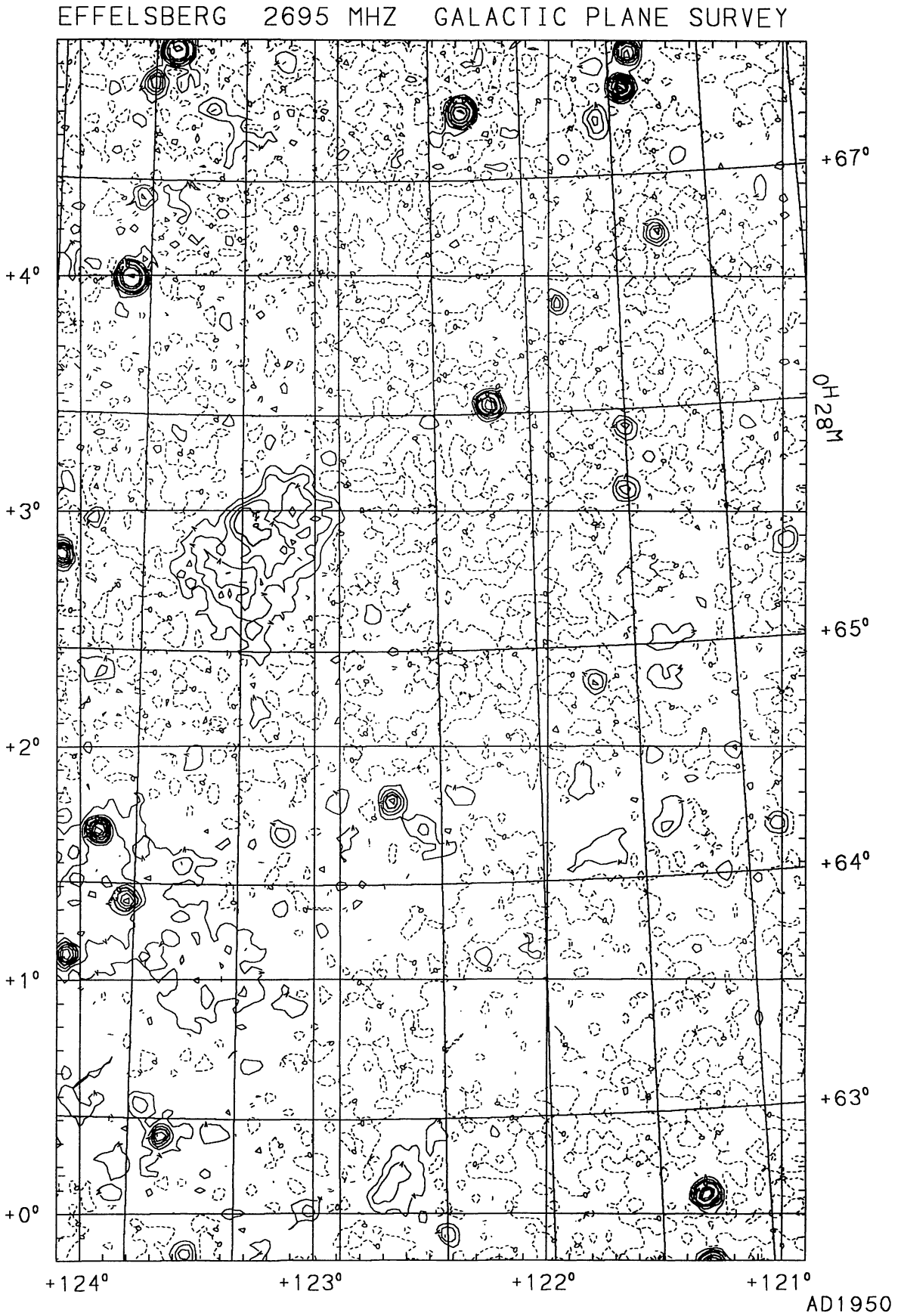

FIGURE 32

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1990A&AS...85..691F

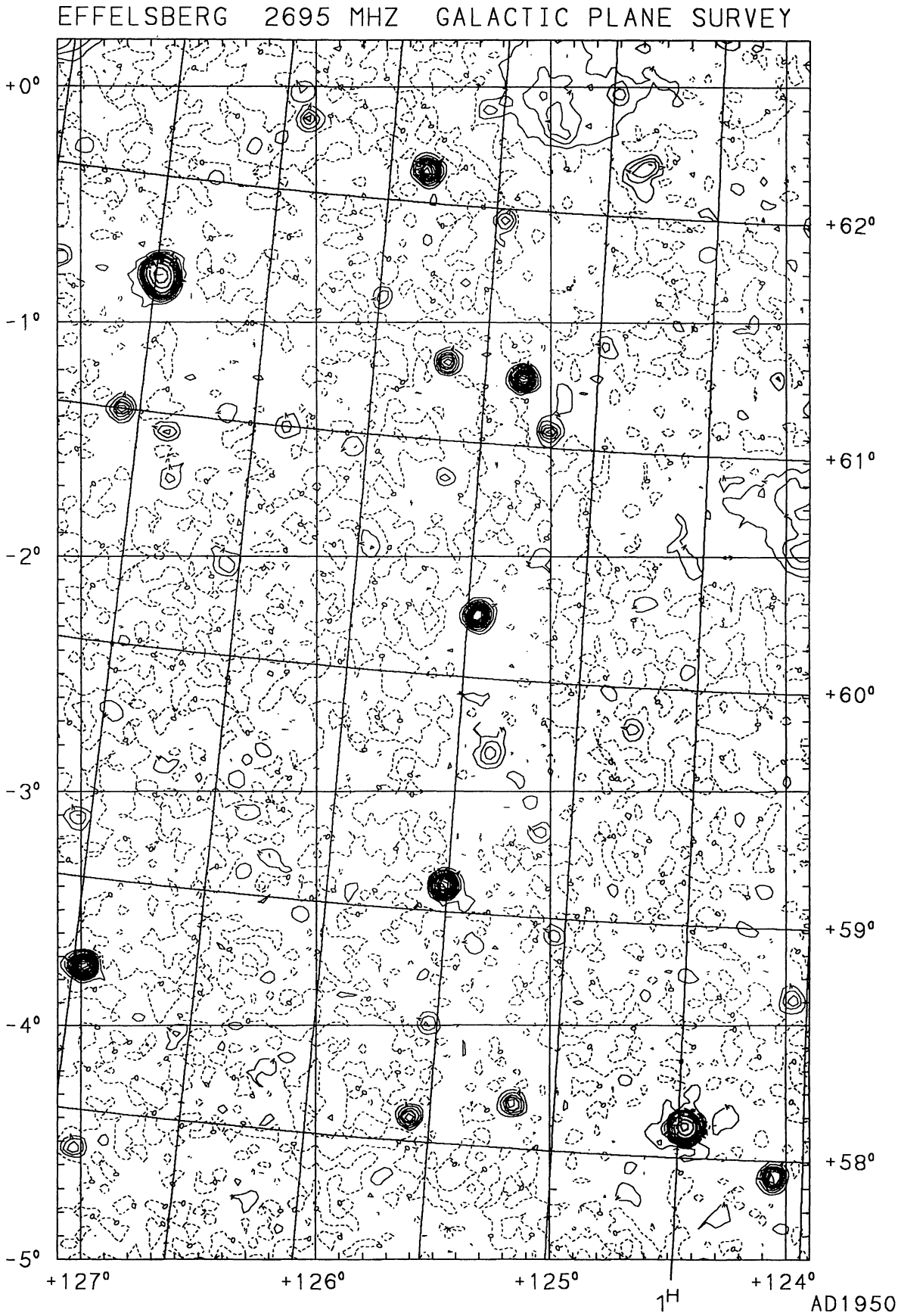

FIGURE 33

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1990A&AS...85..691F

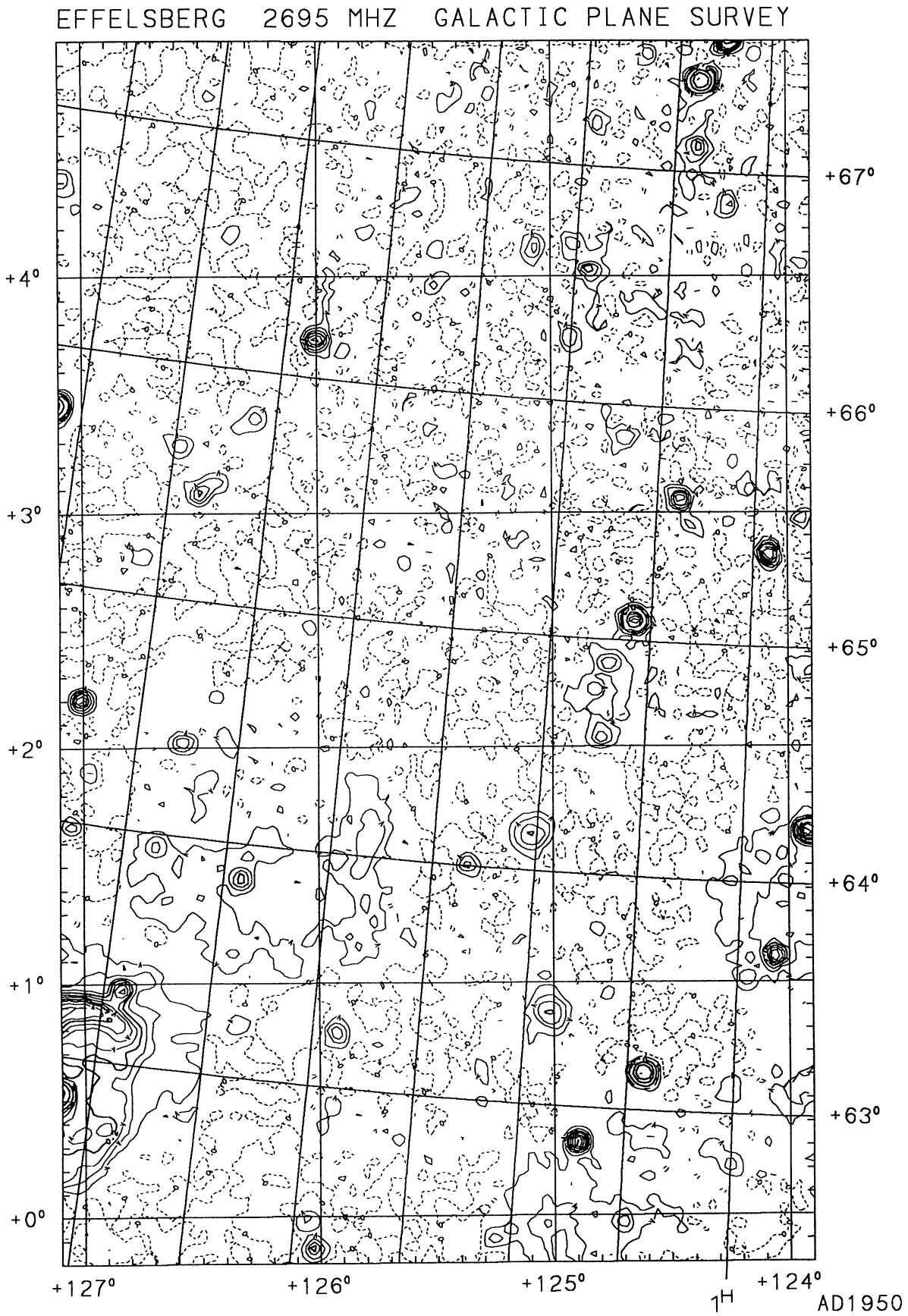

FIGURE 34

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1990A&AS...85..691F

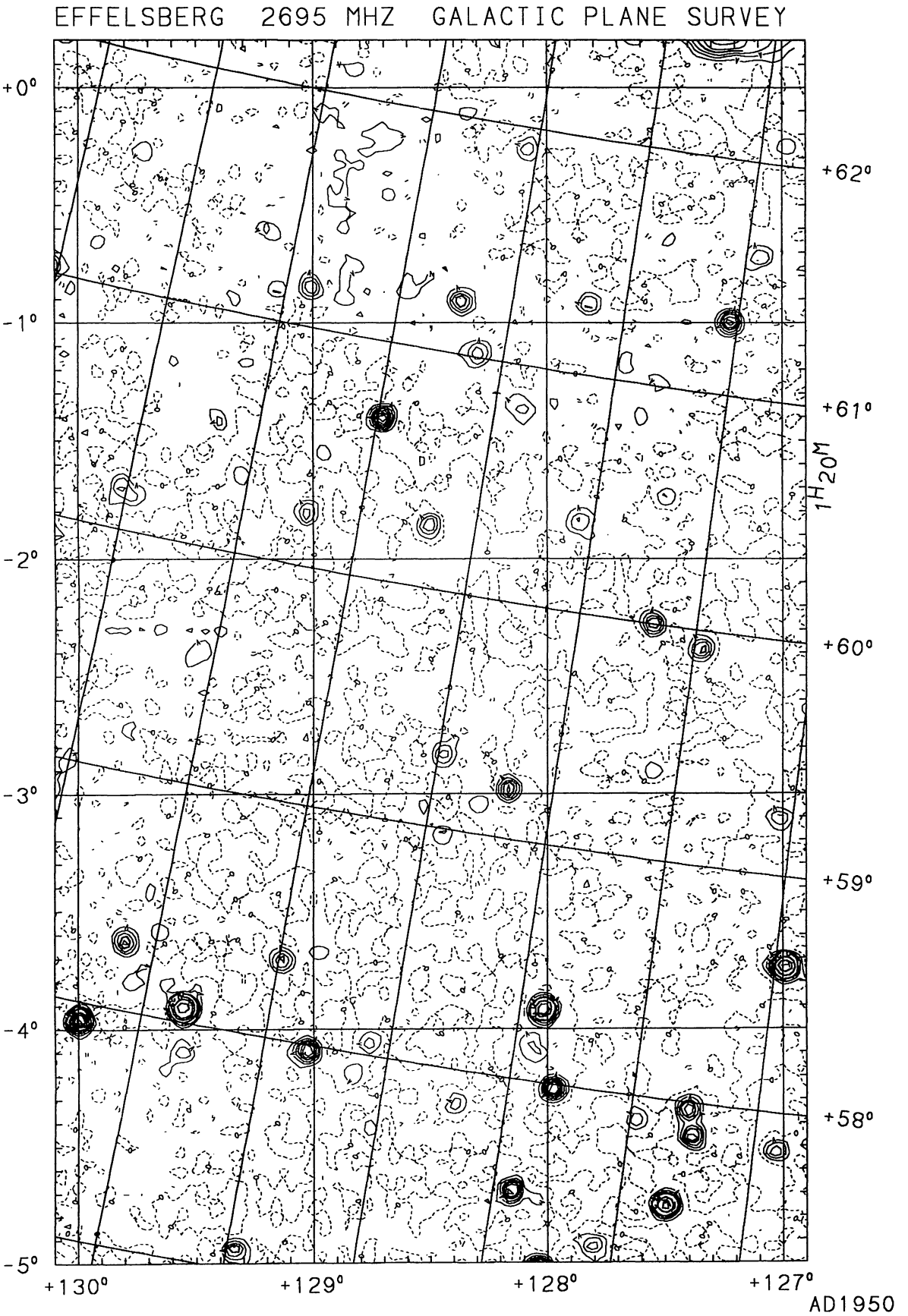

FIGURE 35

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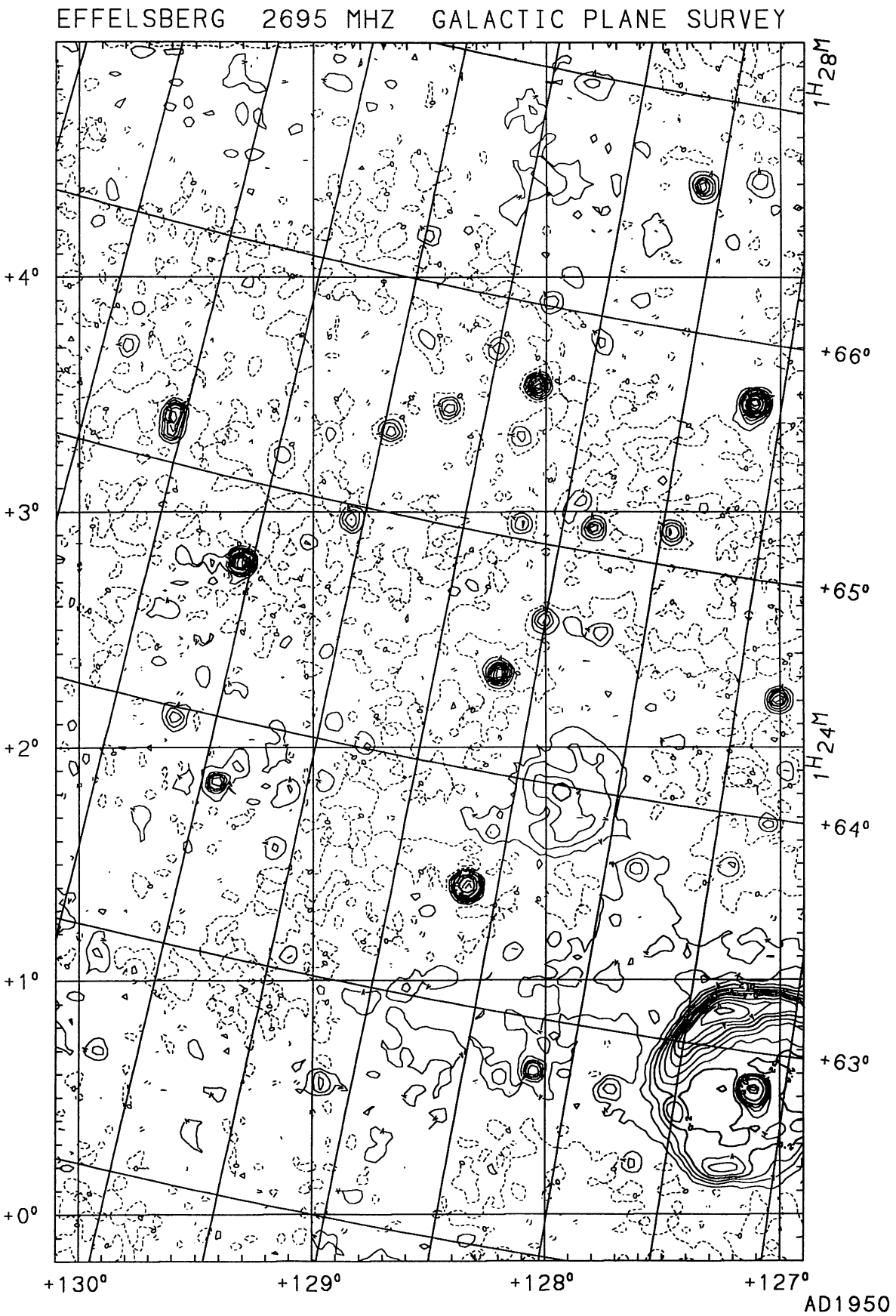
1990A&AS...85..691F



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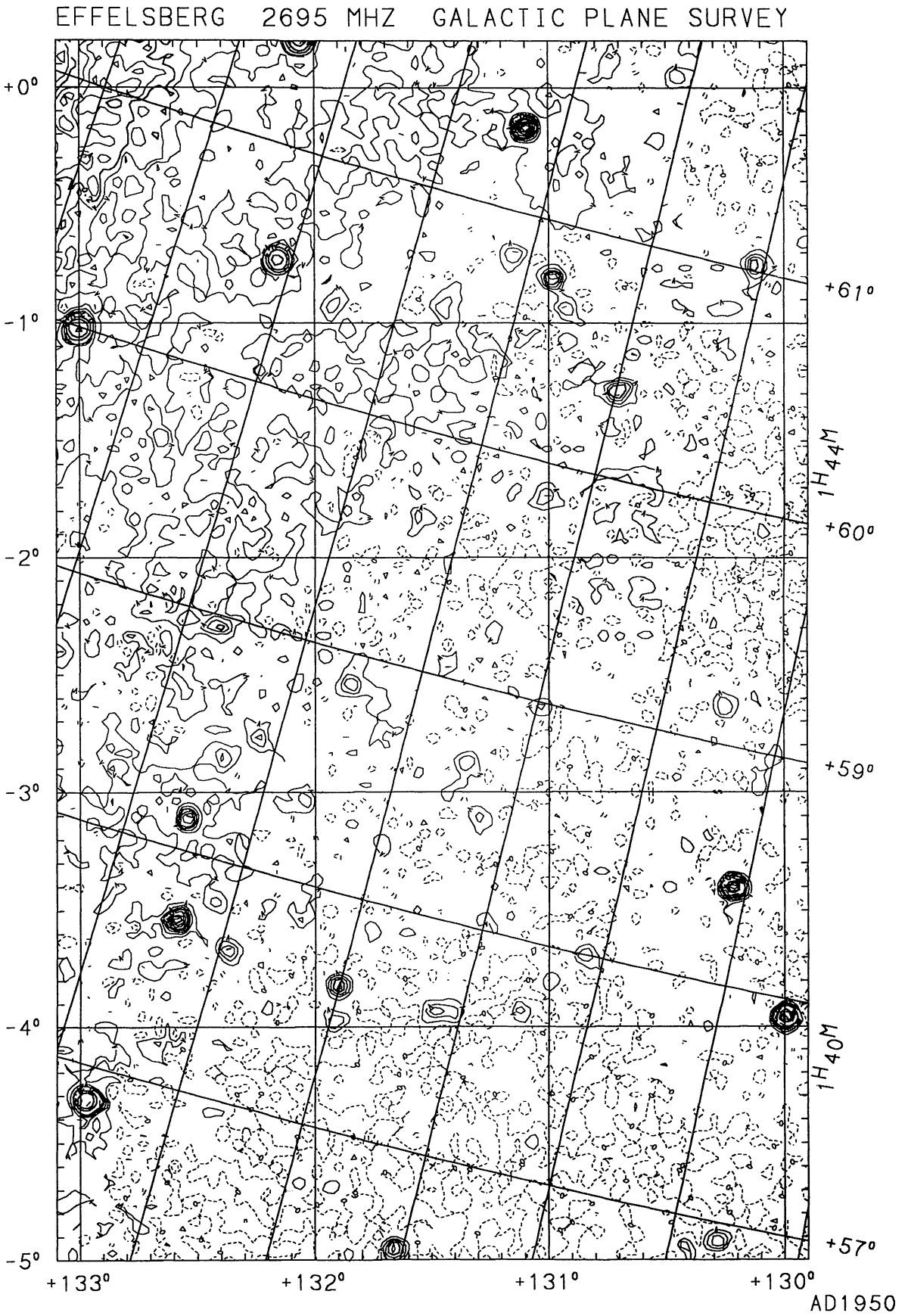

FIGURE 37

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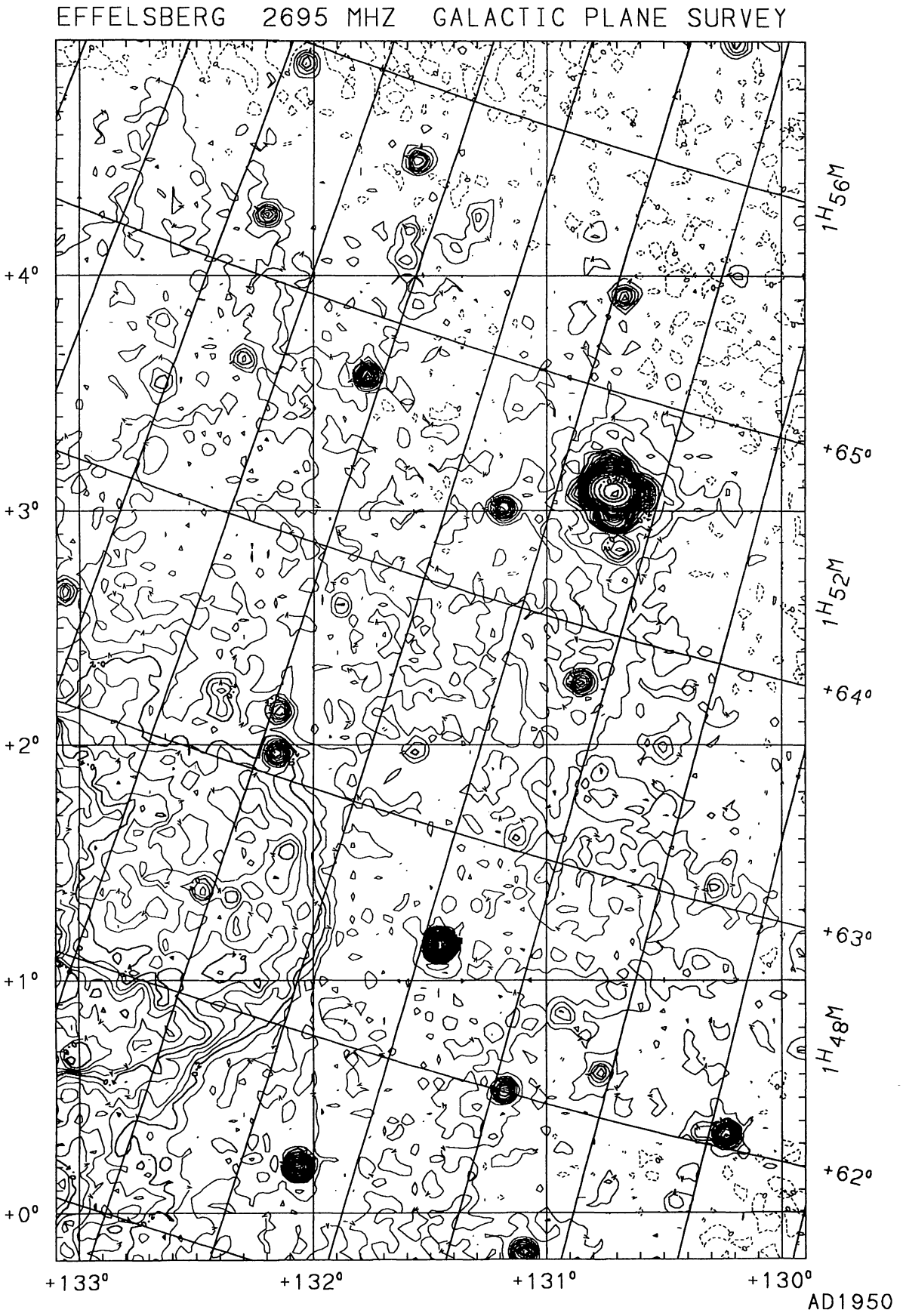
1990A&AS...85..691F



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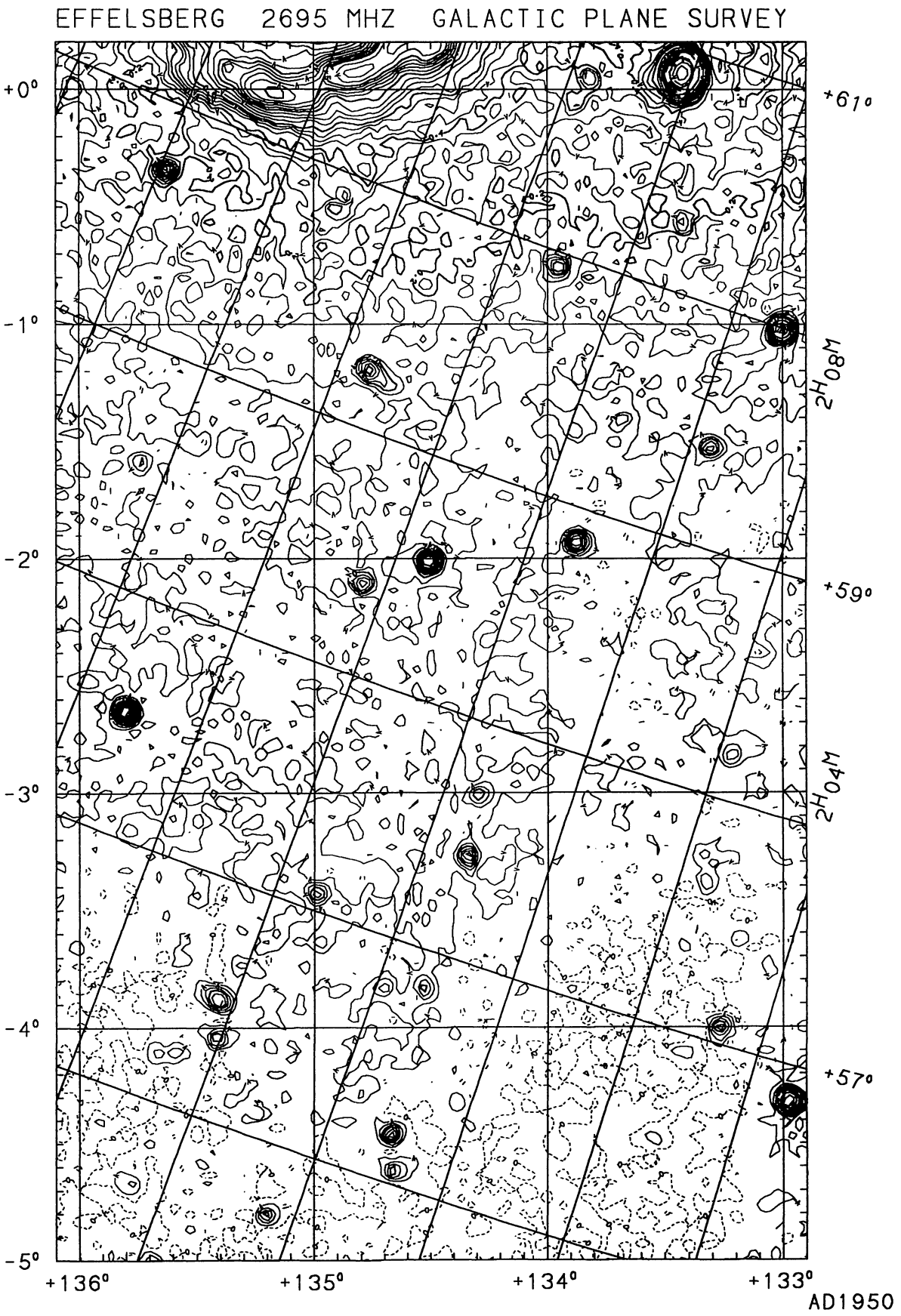

FIGURE 39

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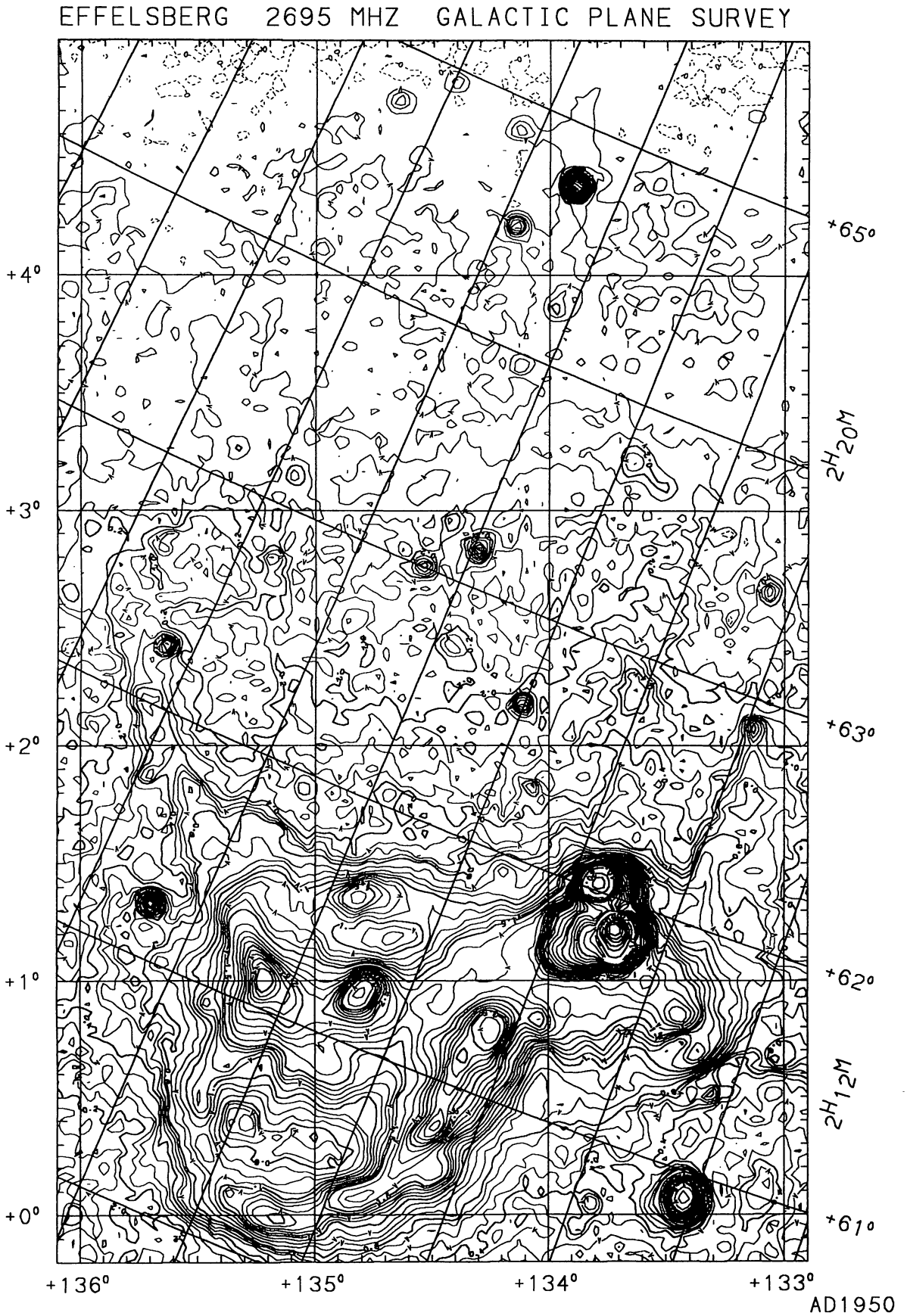

FIGURE 40

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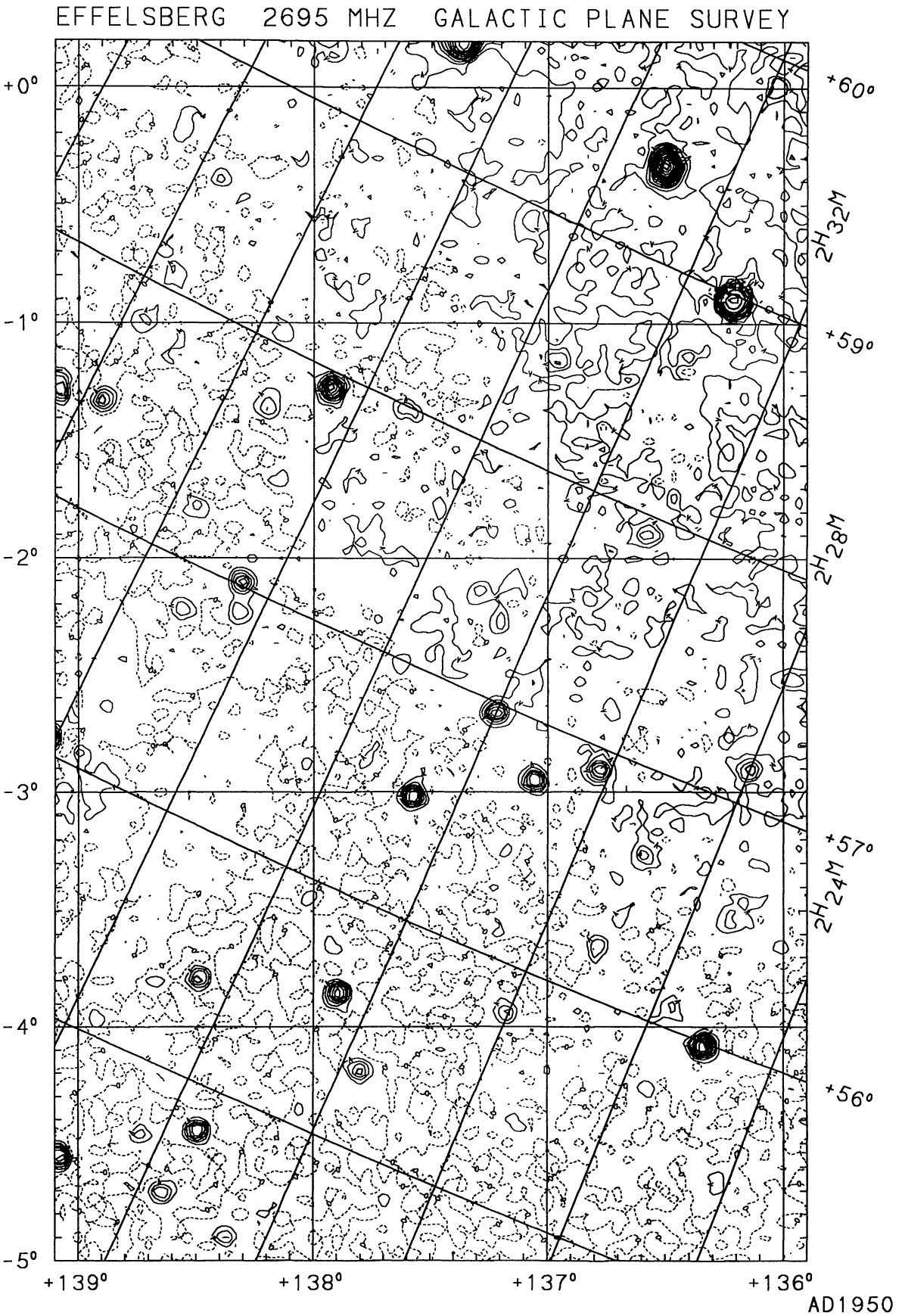
1990A&AS...85..691F



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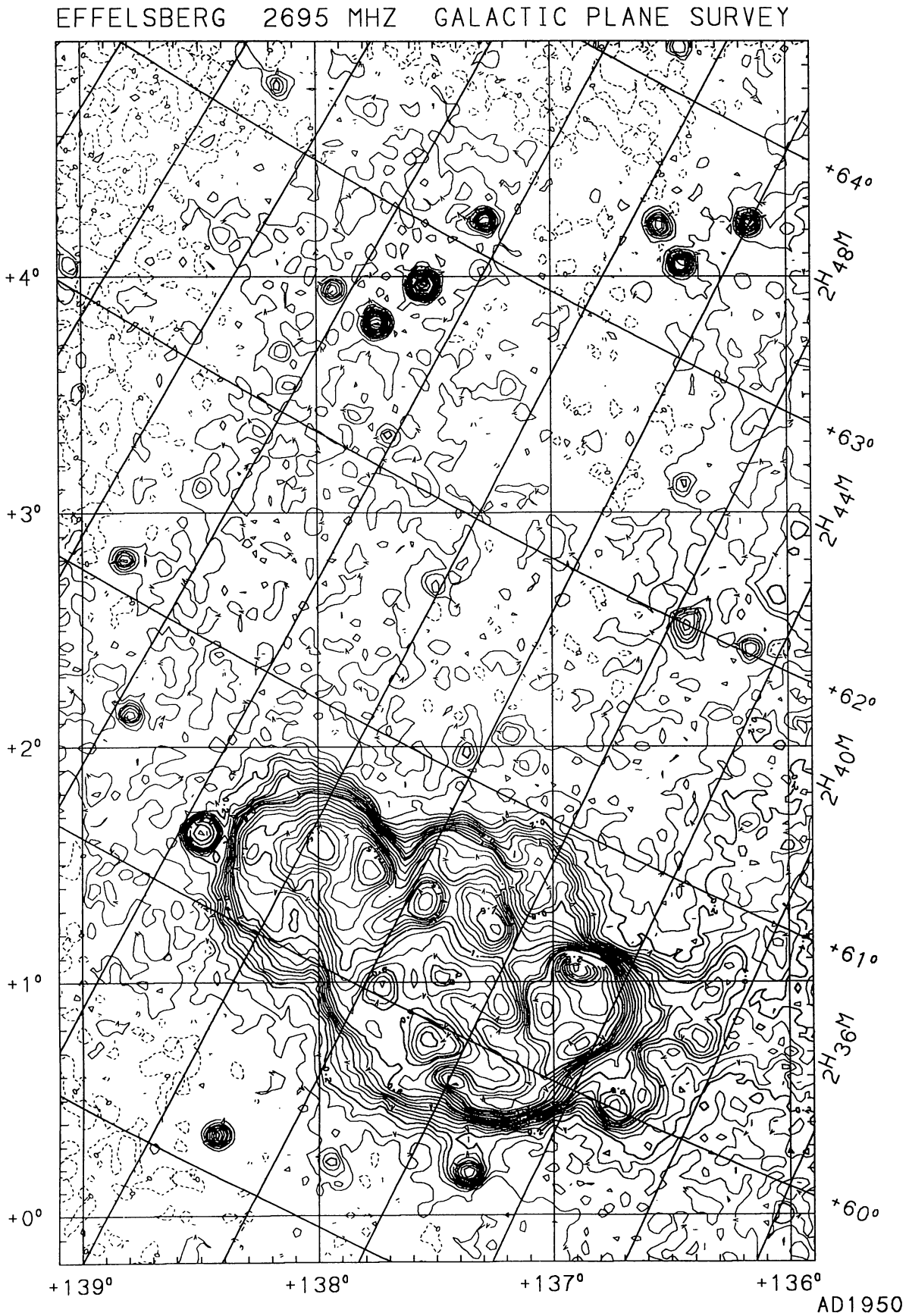

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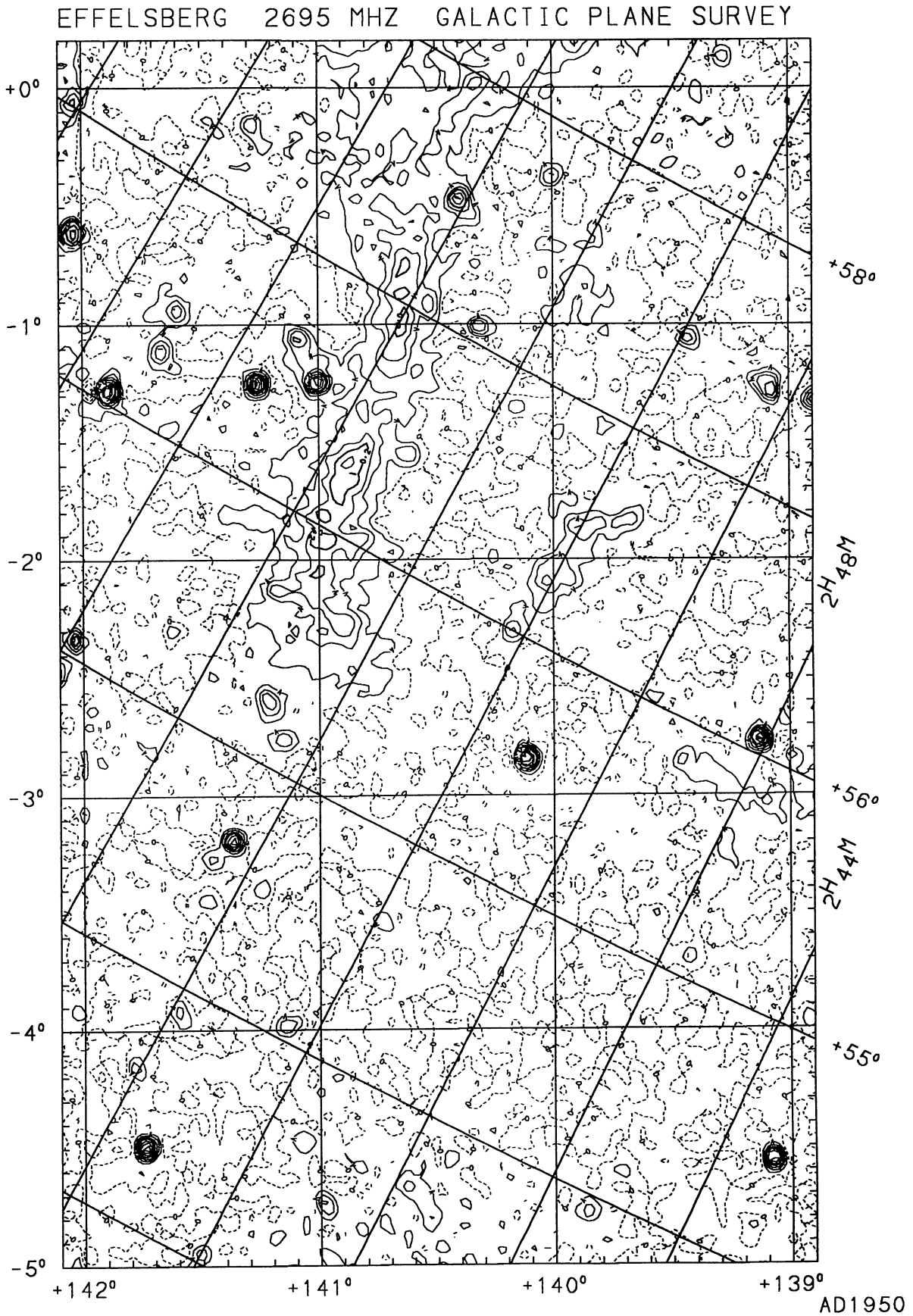

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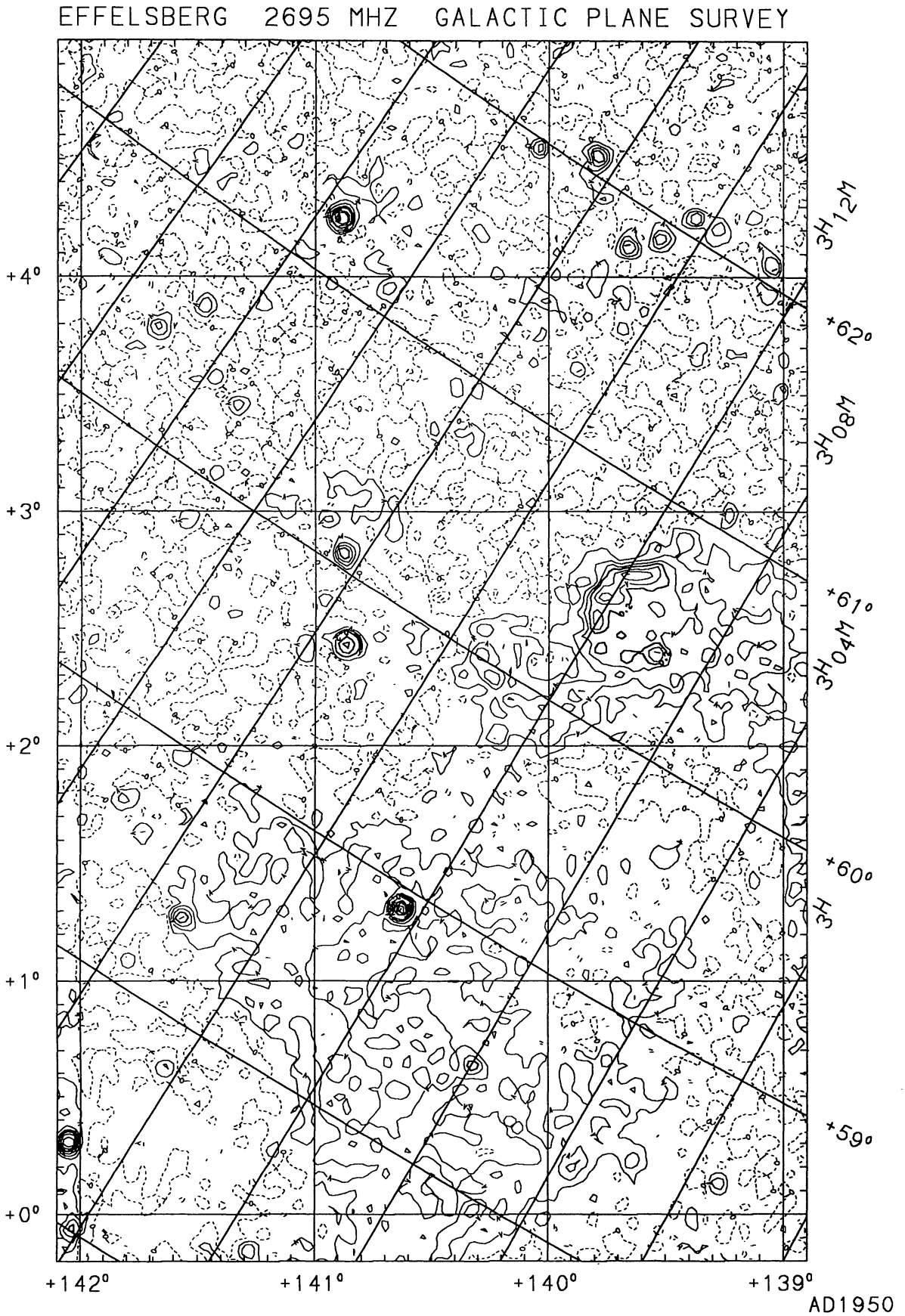
1990A&AS...85..691F



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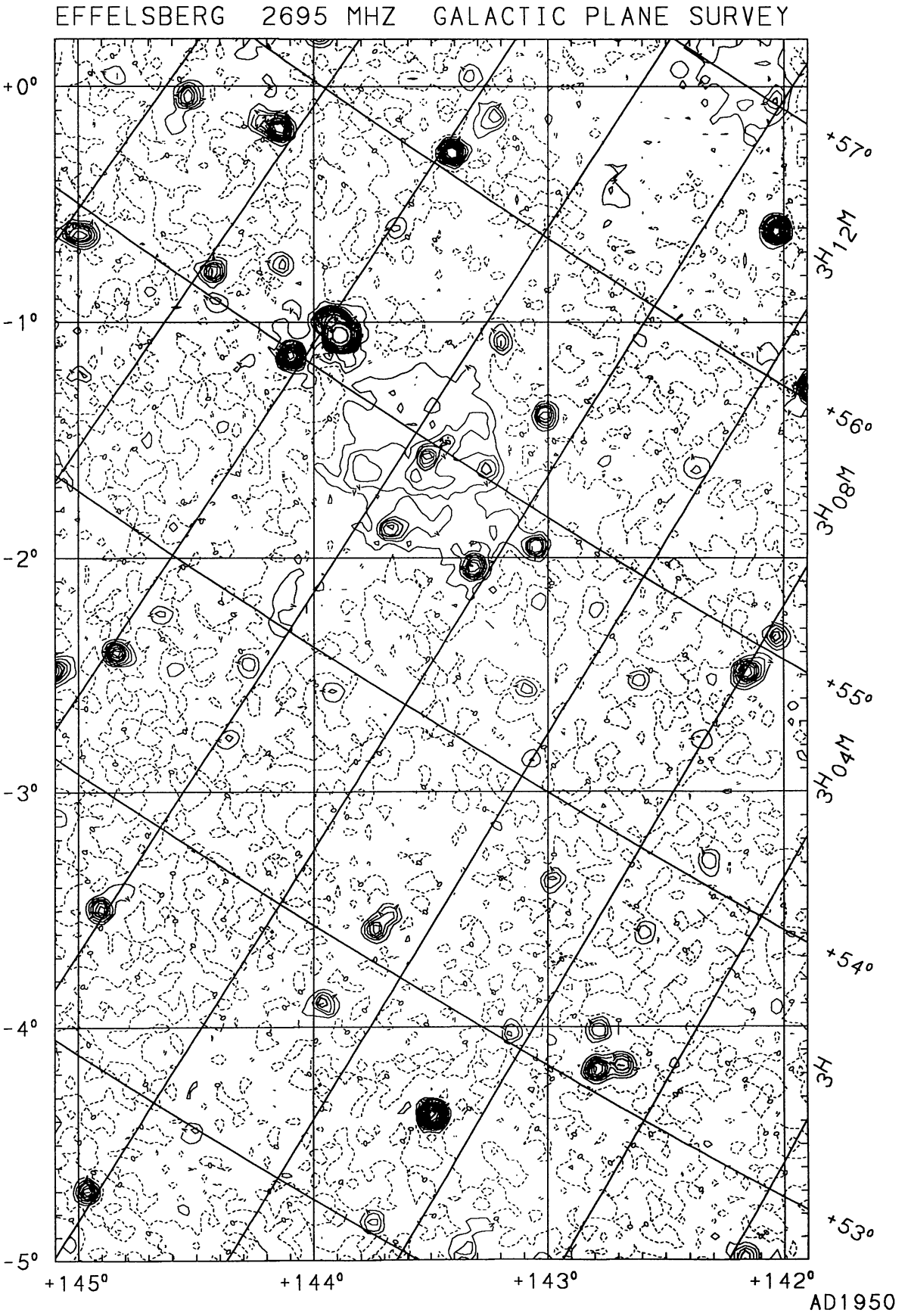

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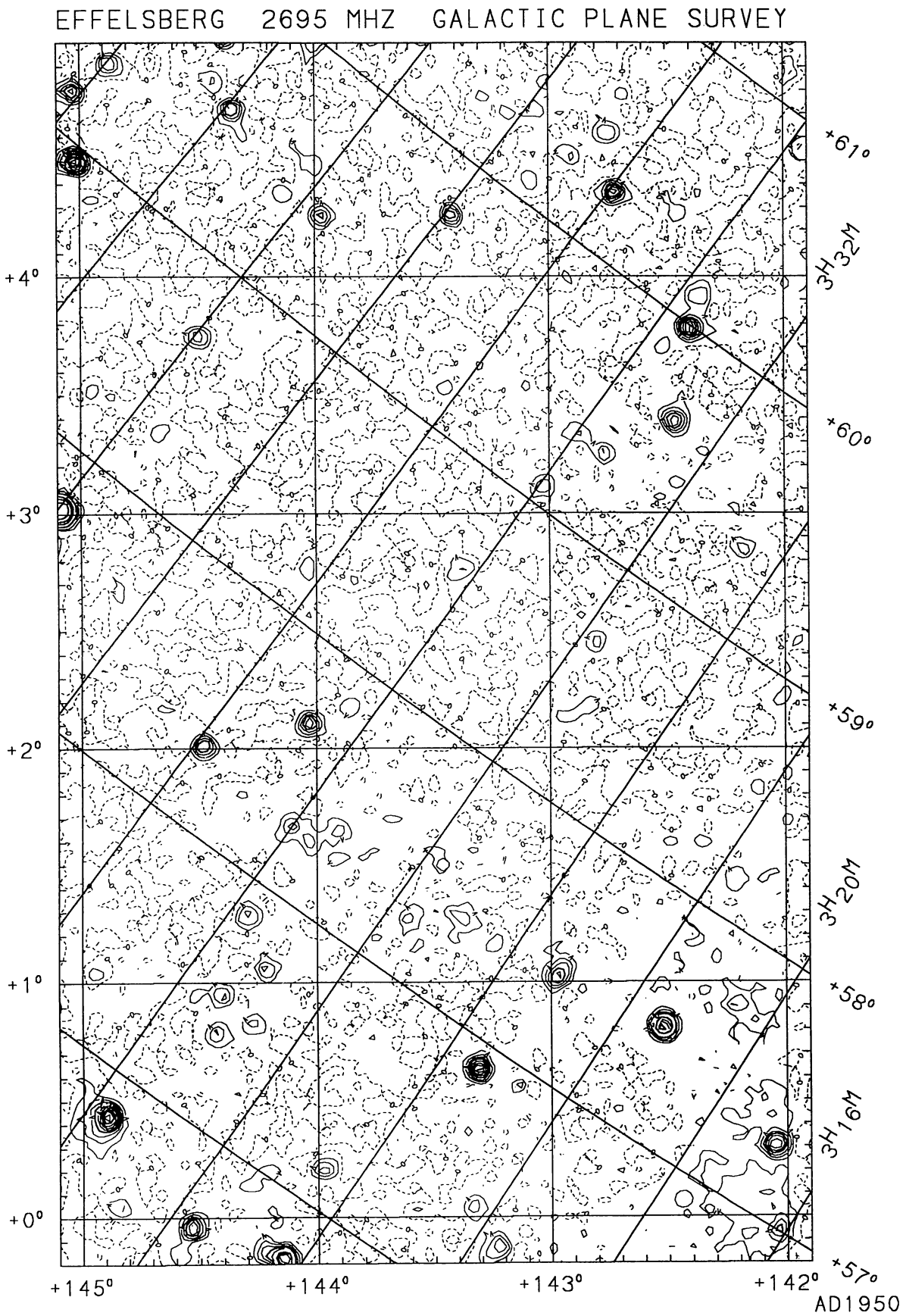

FIGURE 46

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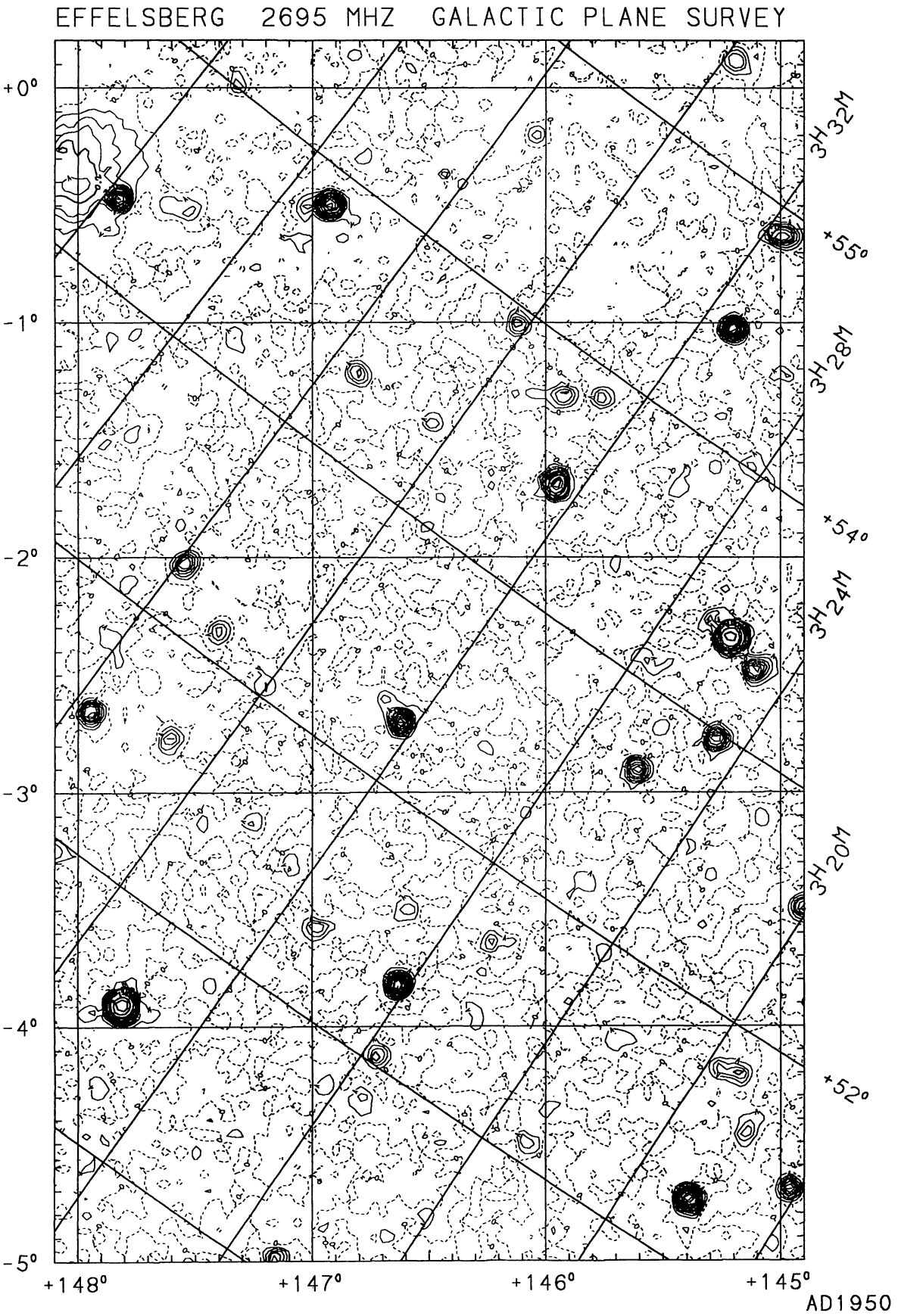

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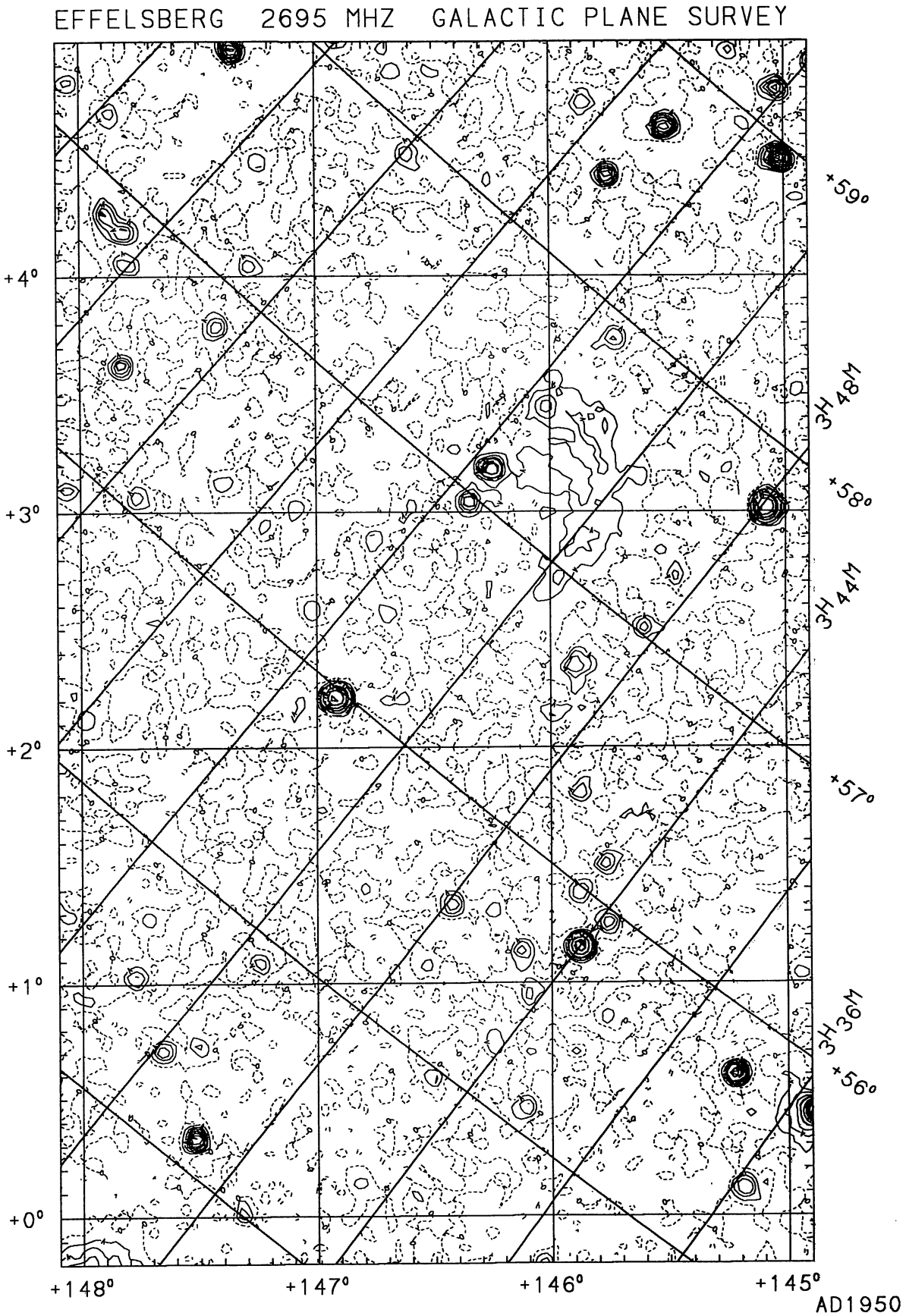

FIGURE 48

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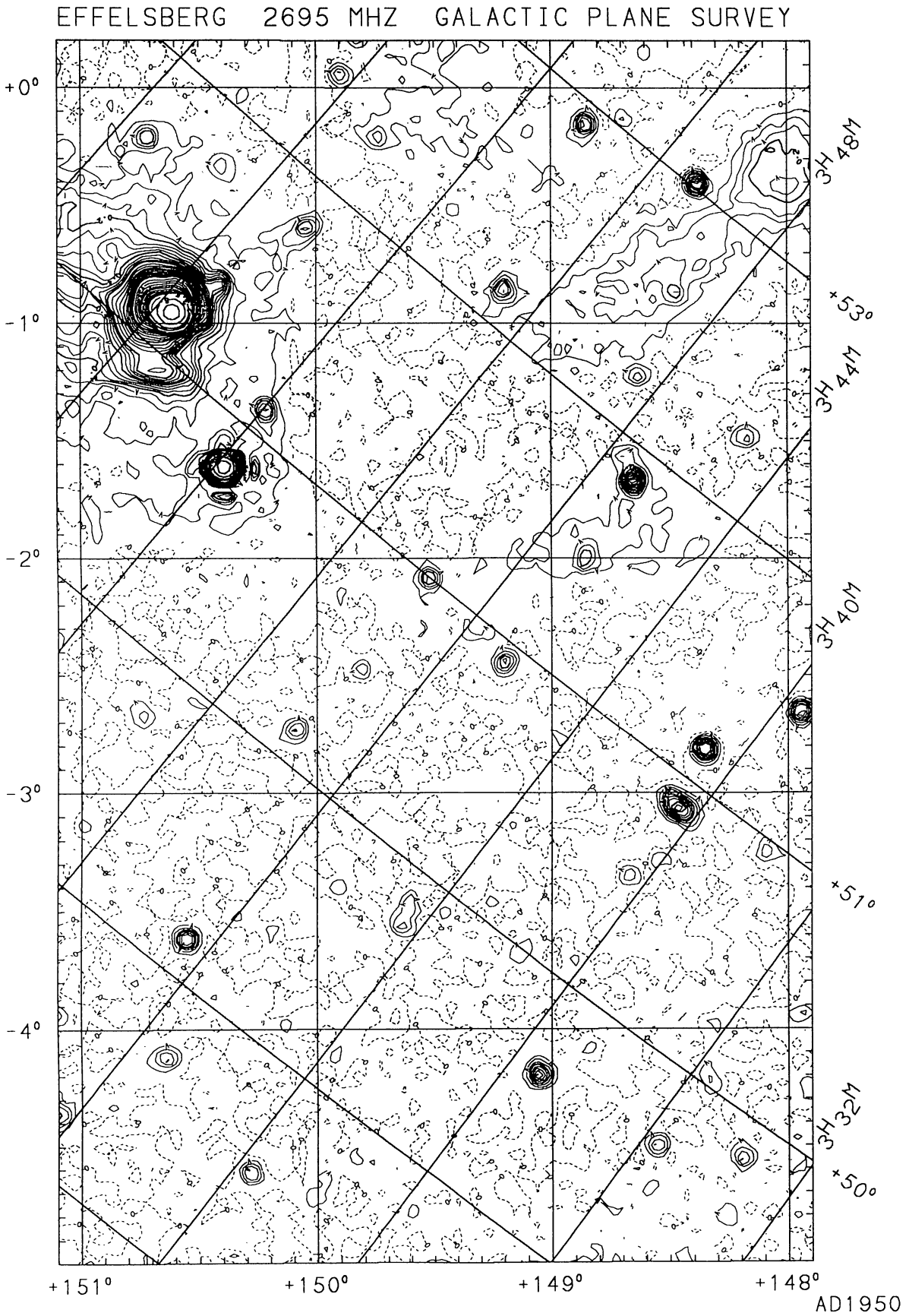

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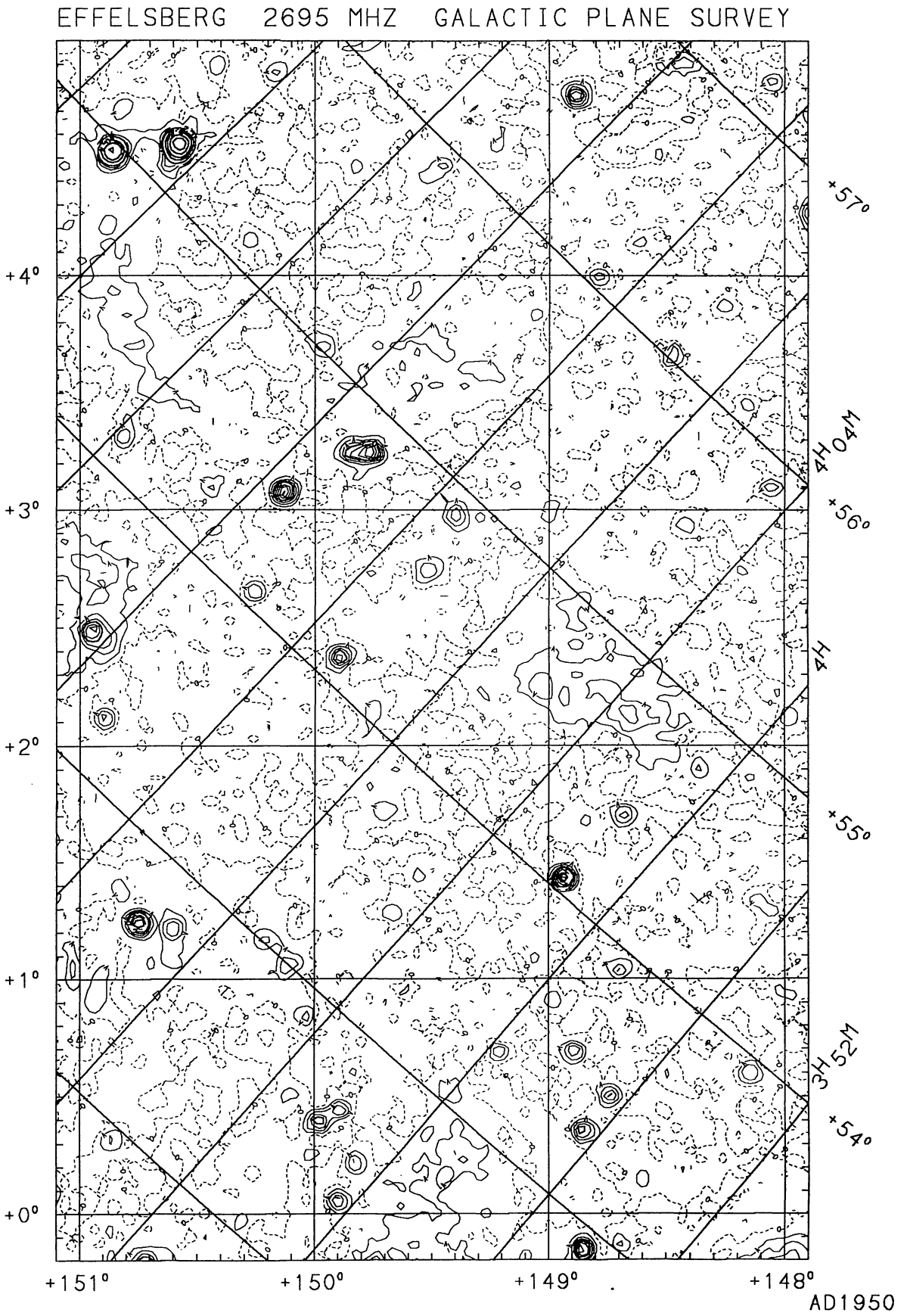

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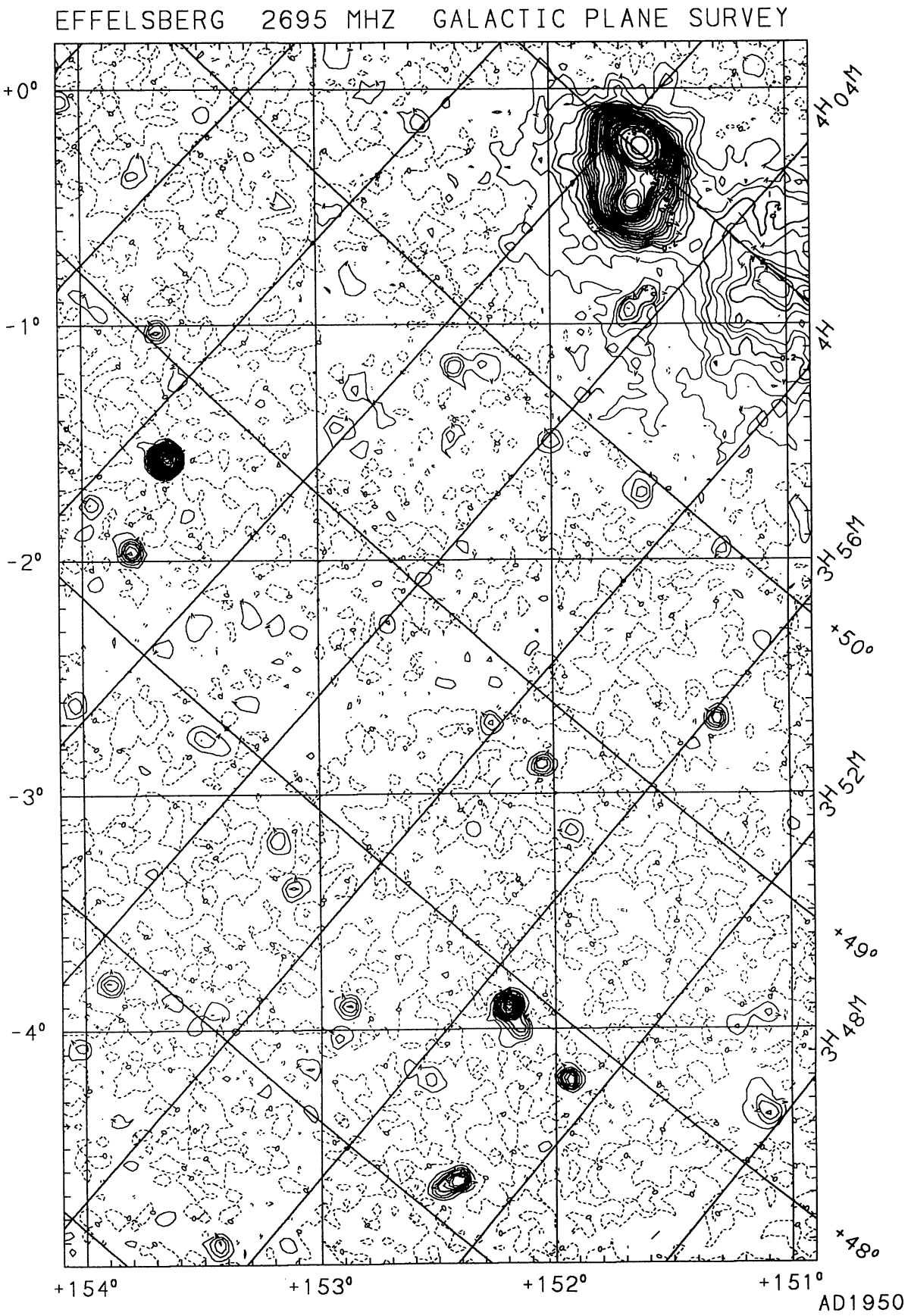

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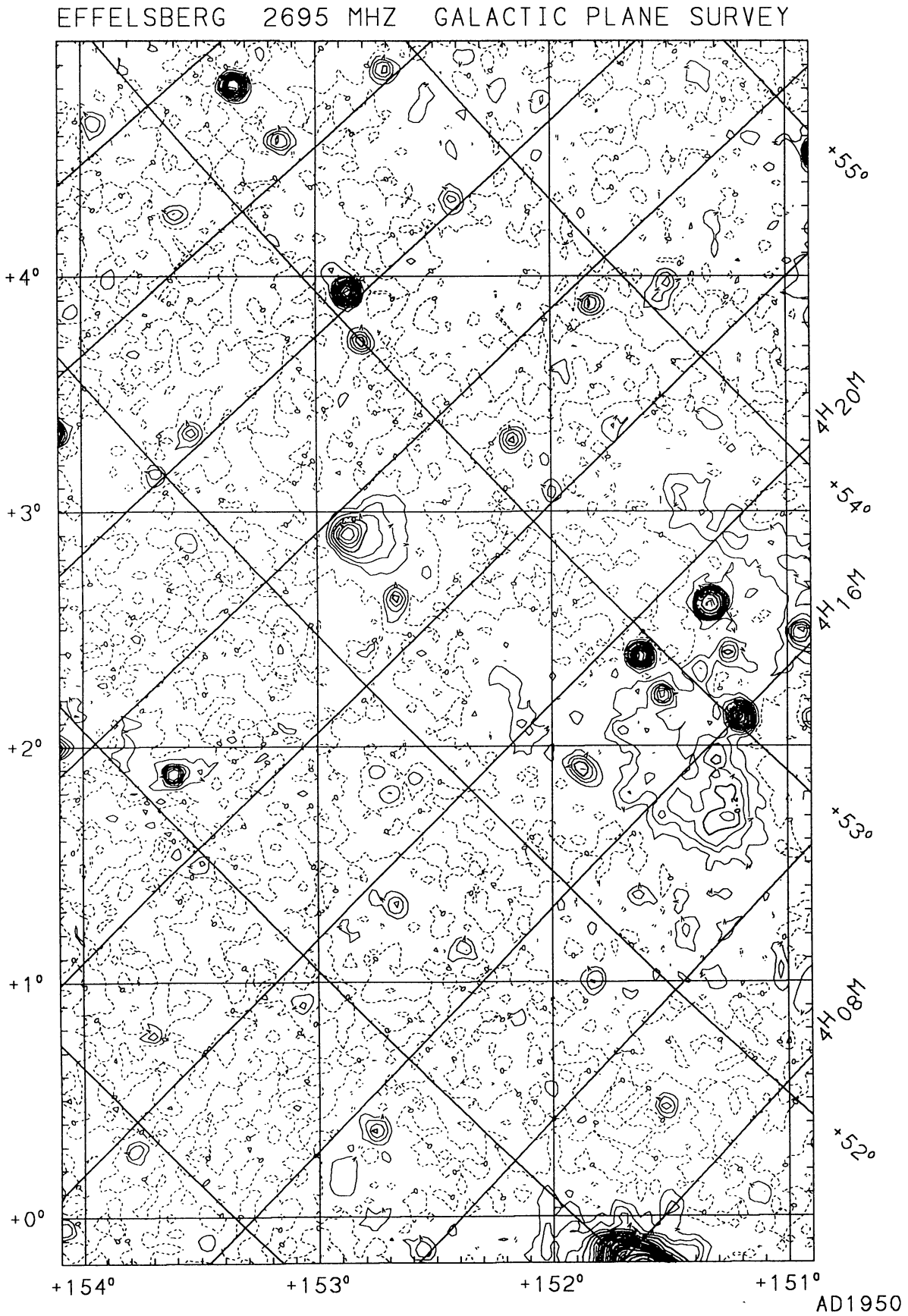

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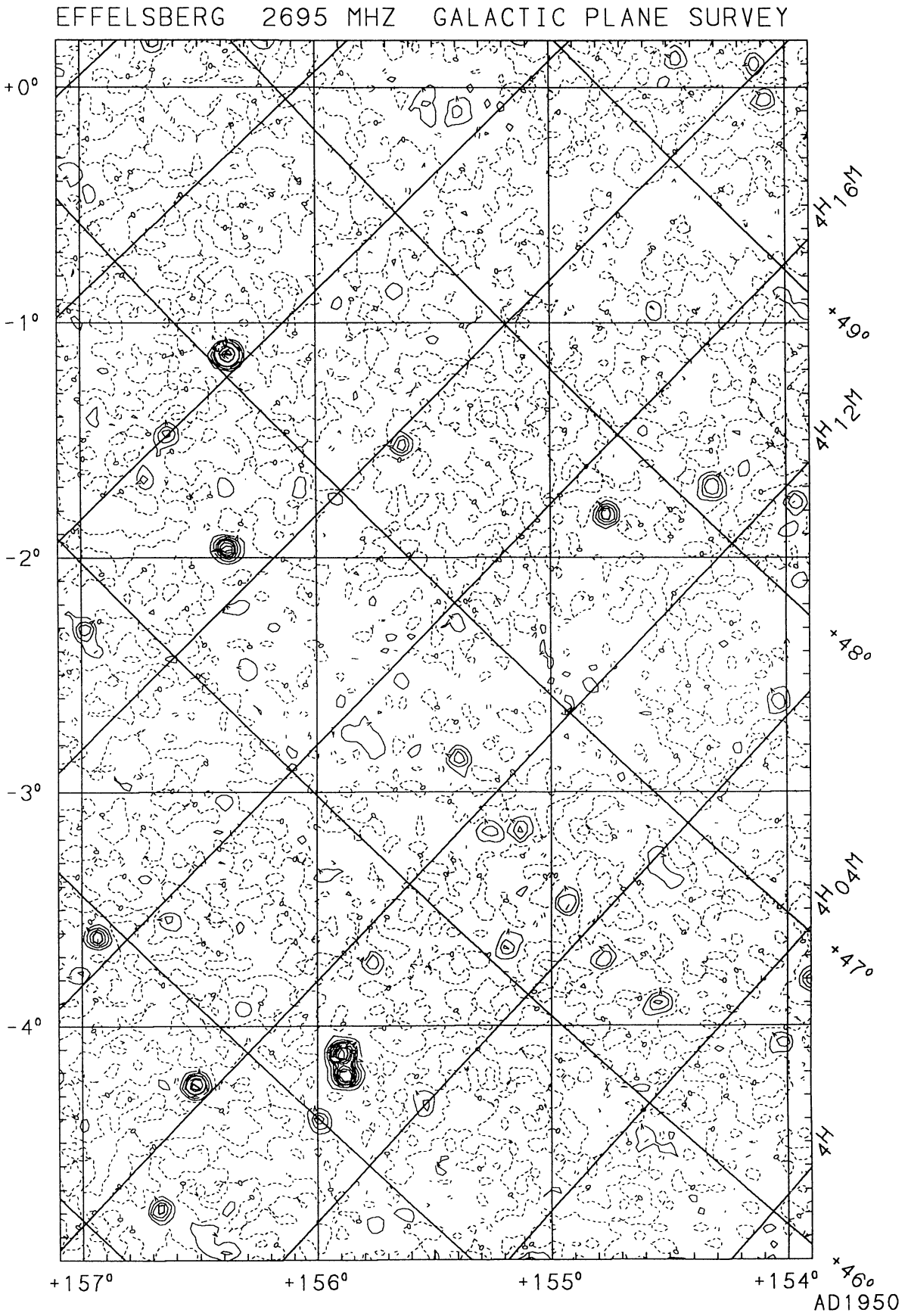

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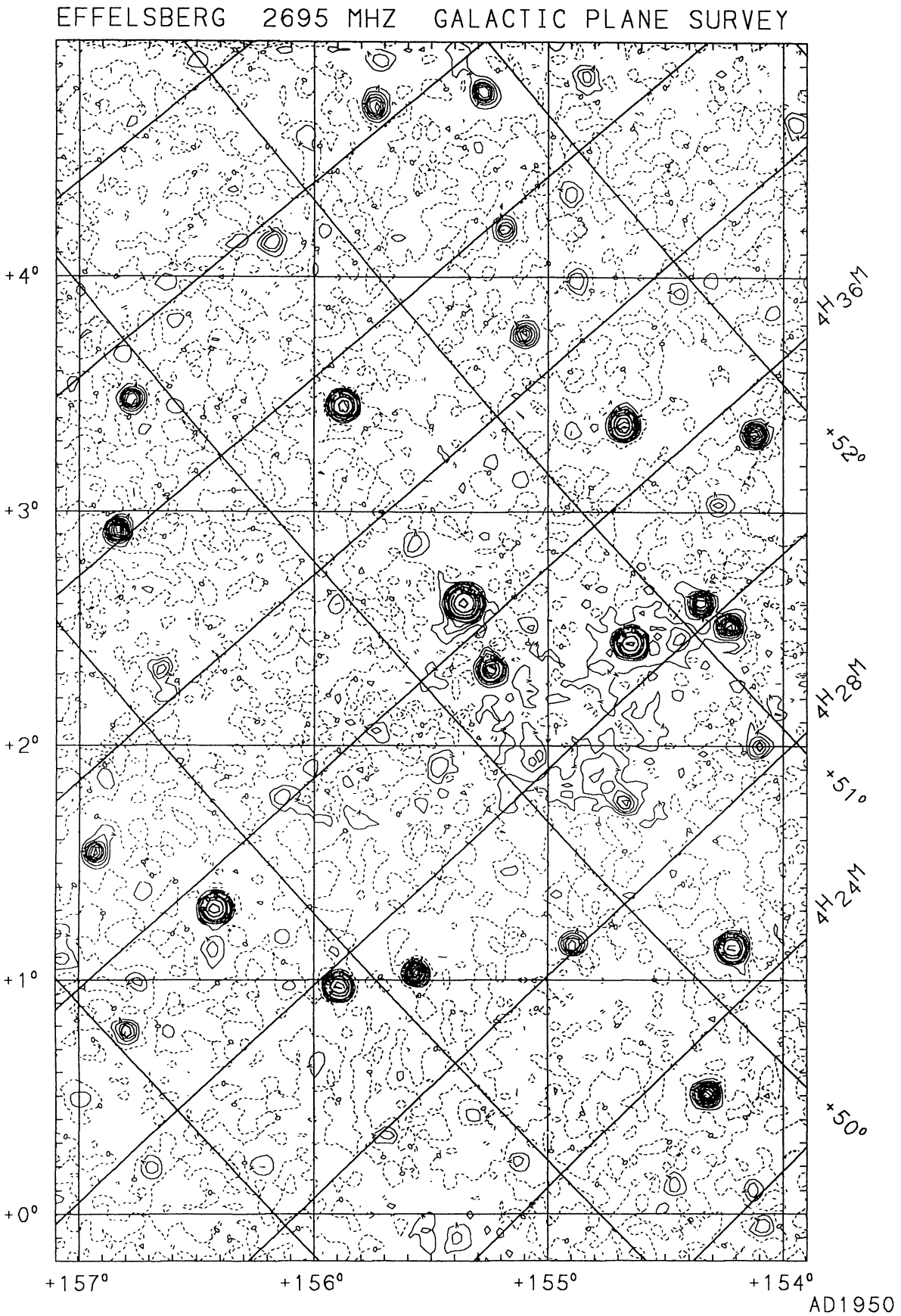

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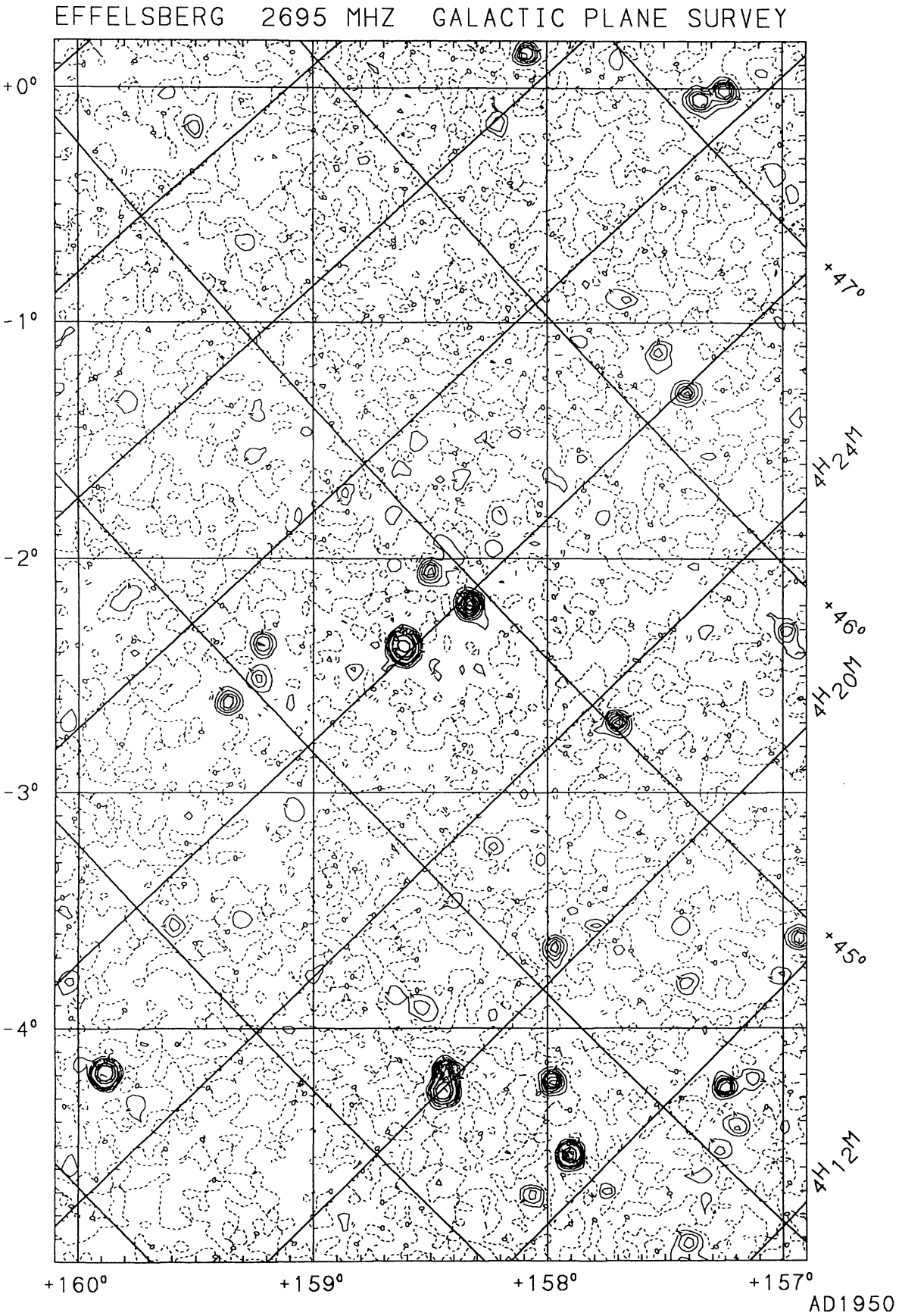

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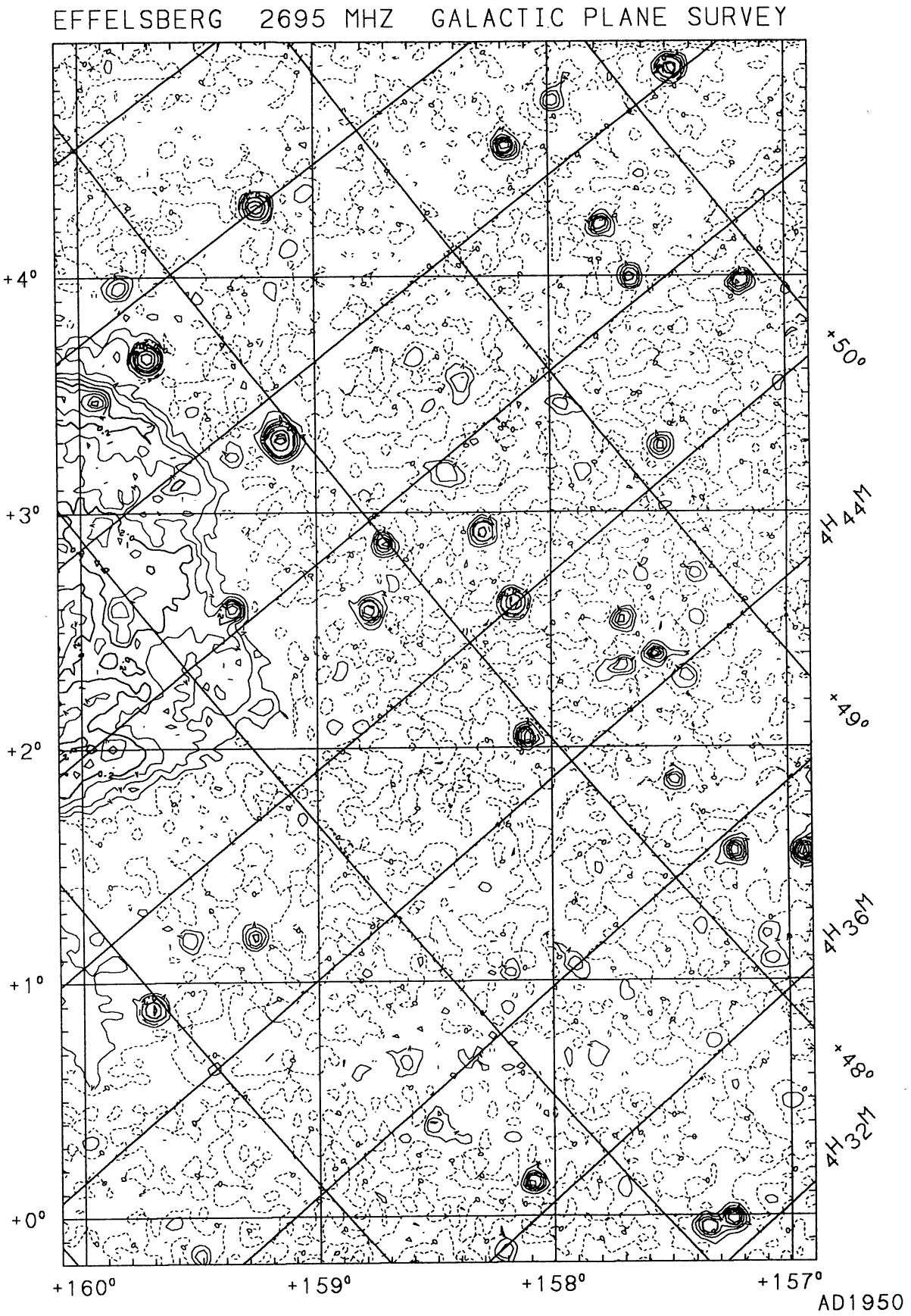

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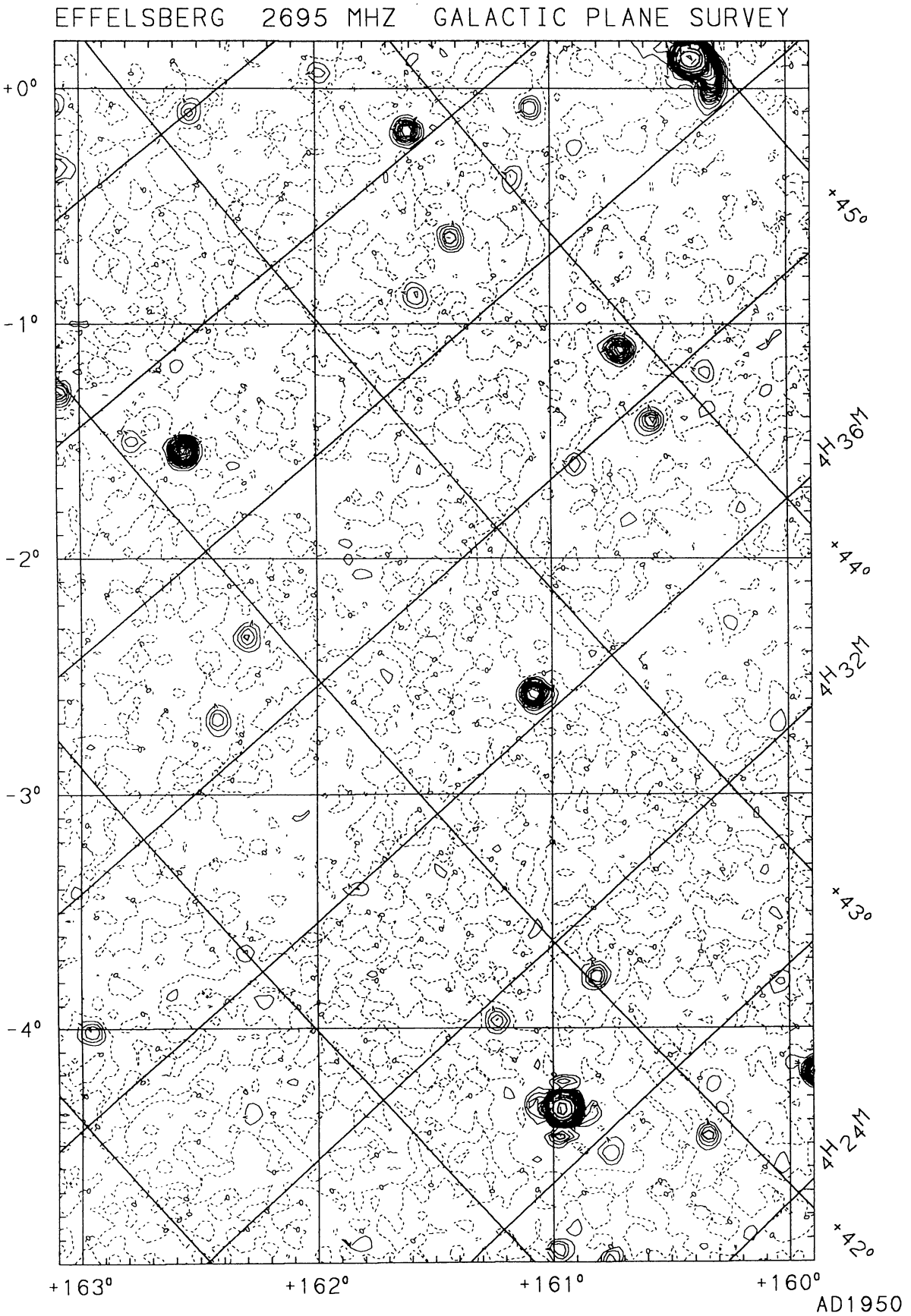

FIGURE 57

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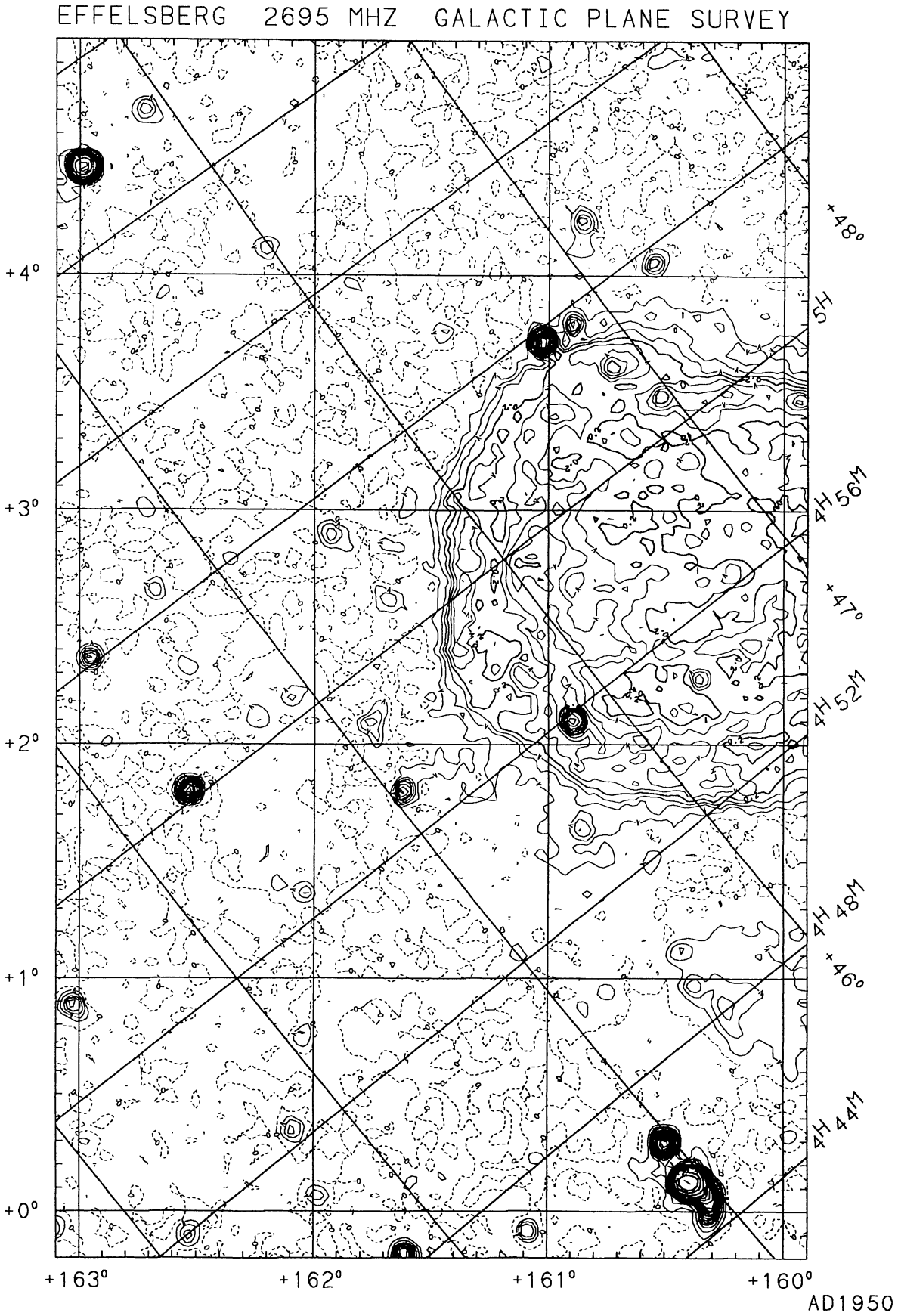

FIGURE 58

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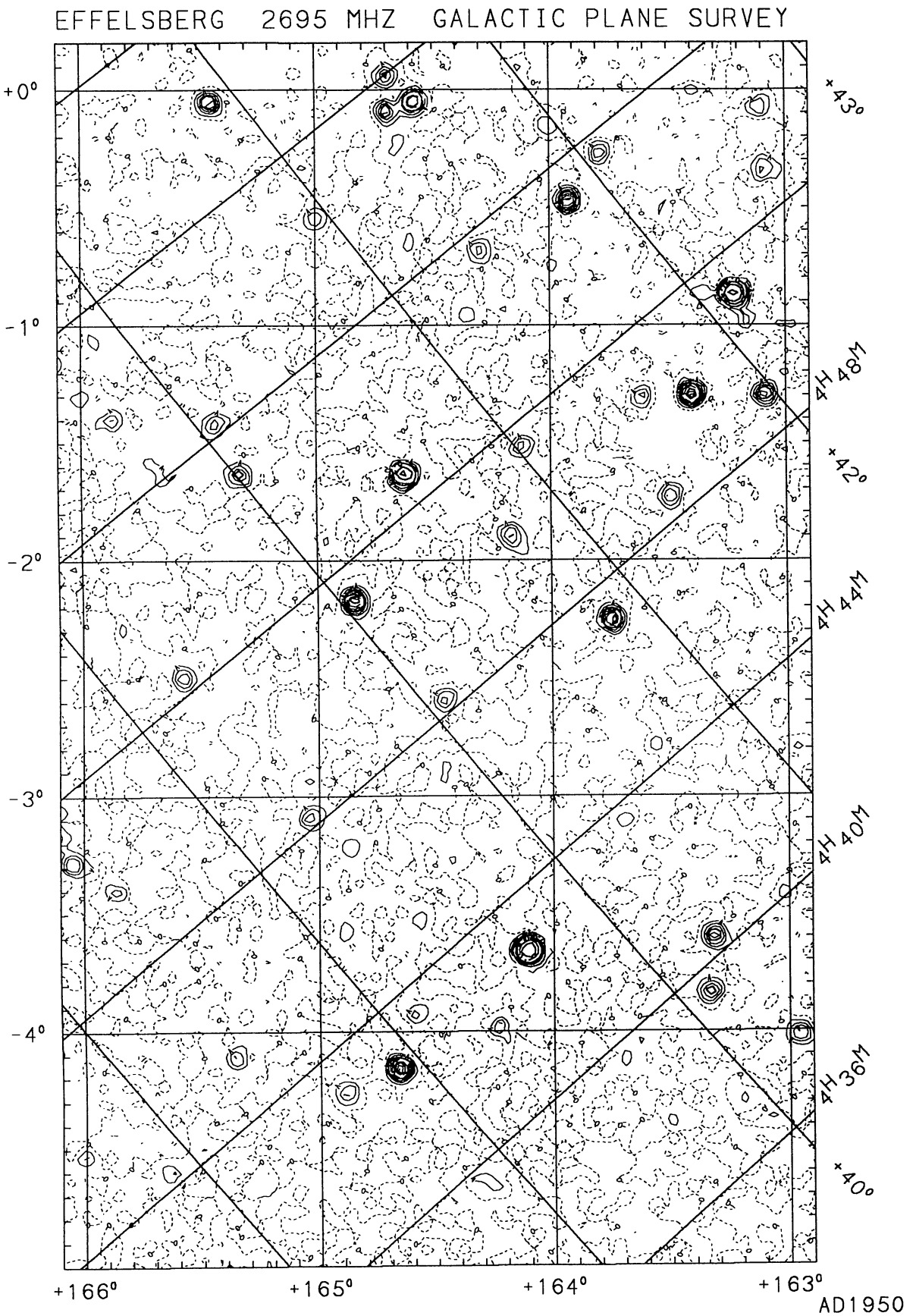

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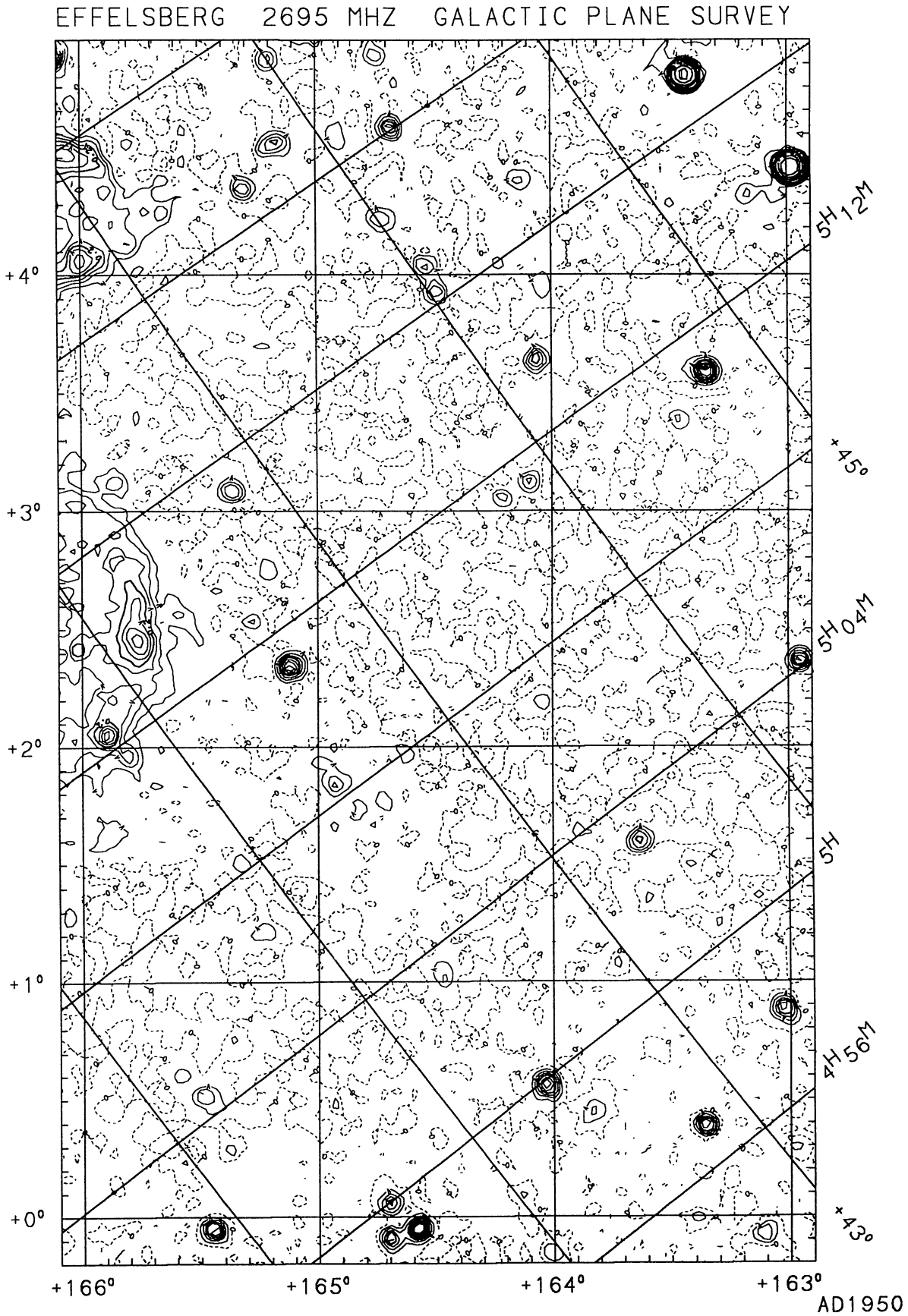

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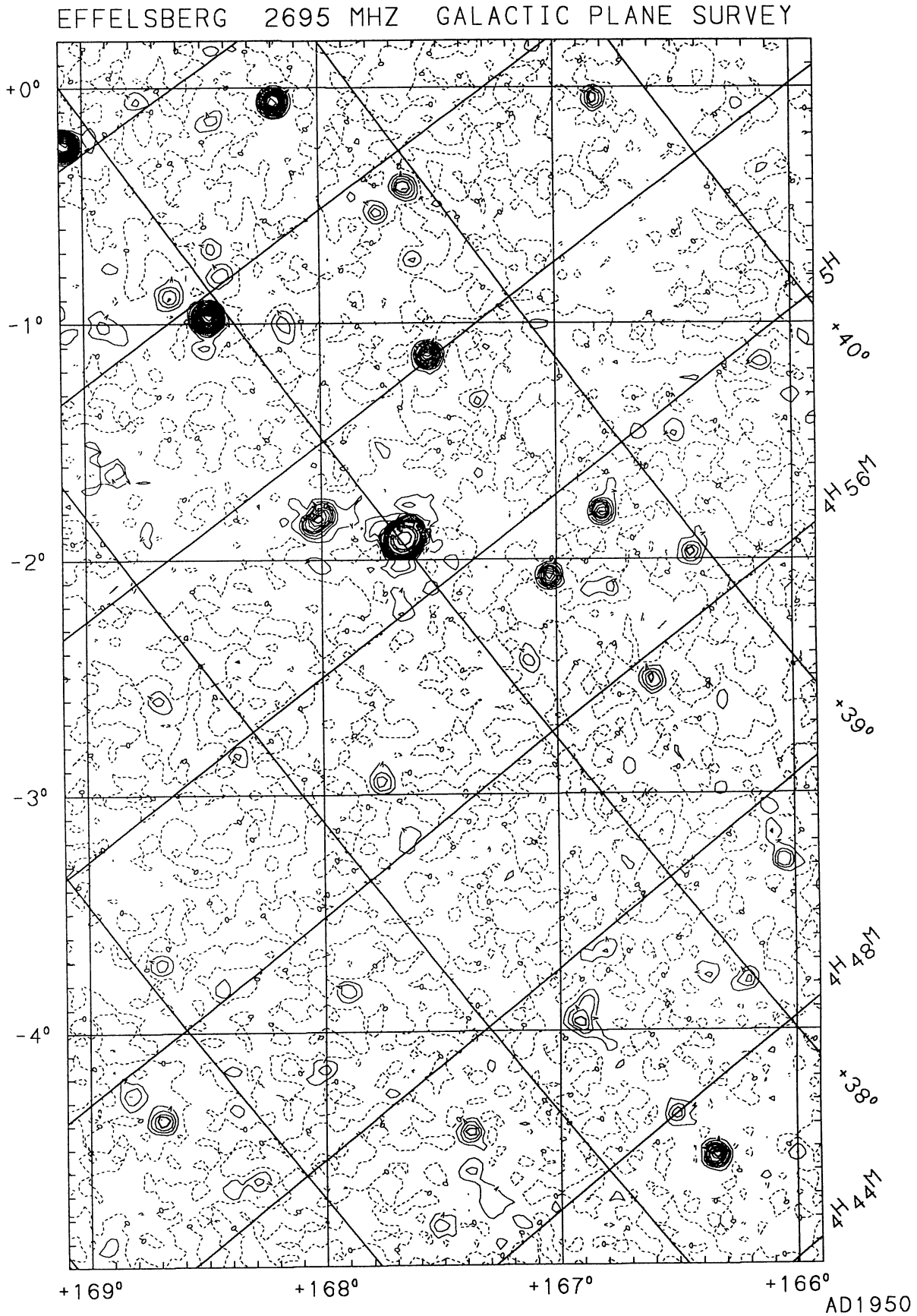

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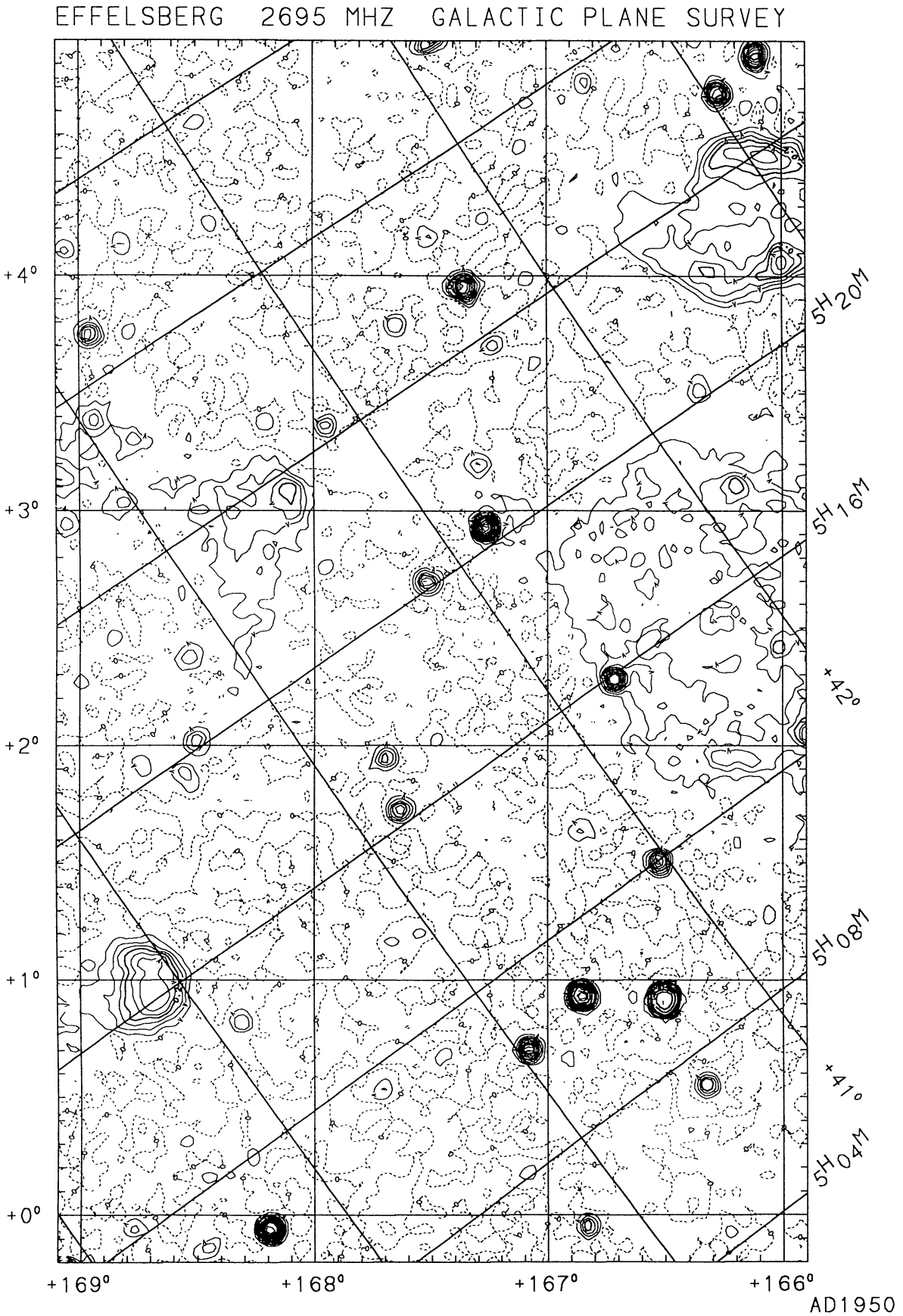

FIGURE 62

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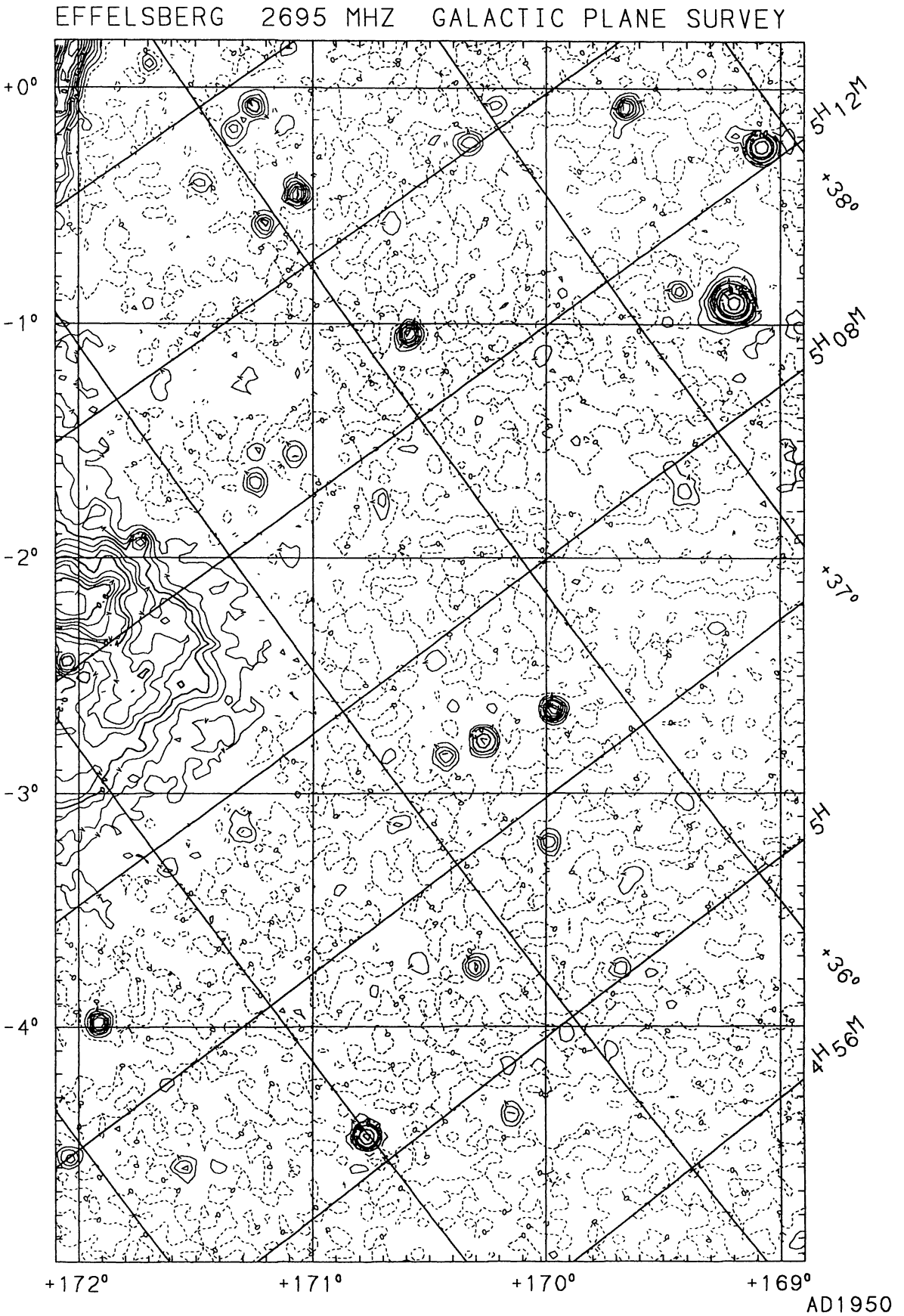

FIGURE 63

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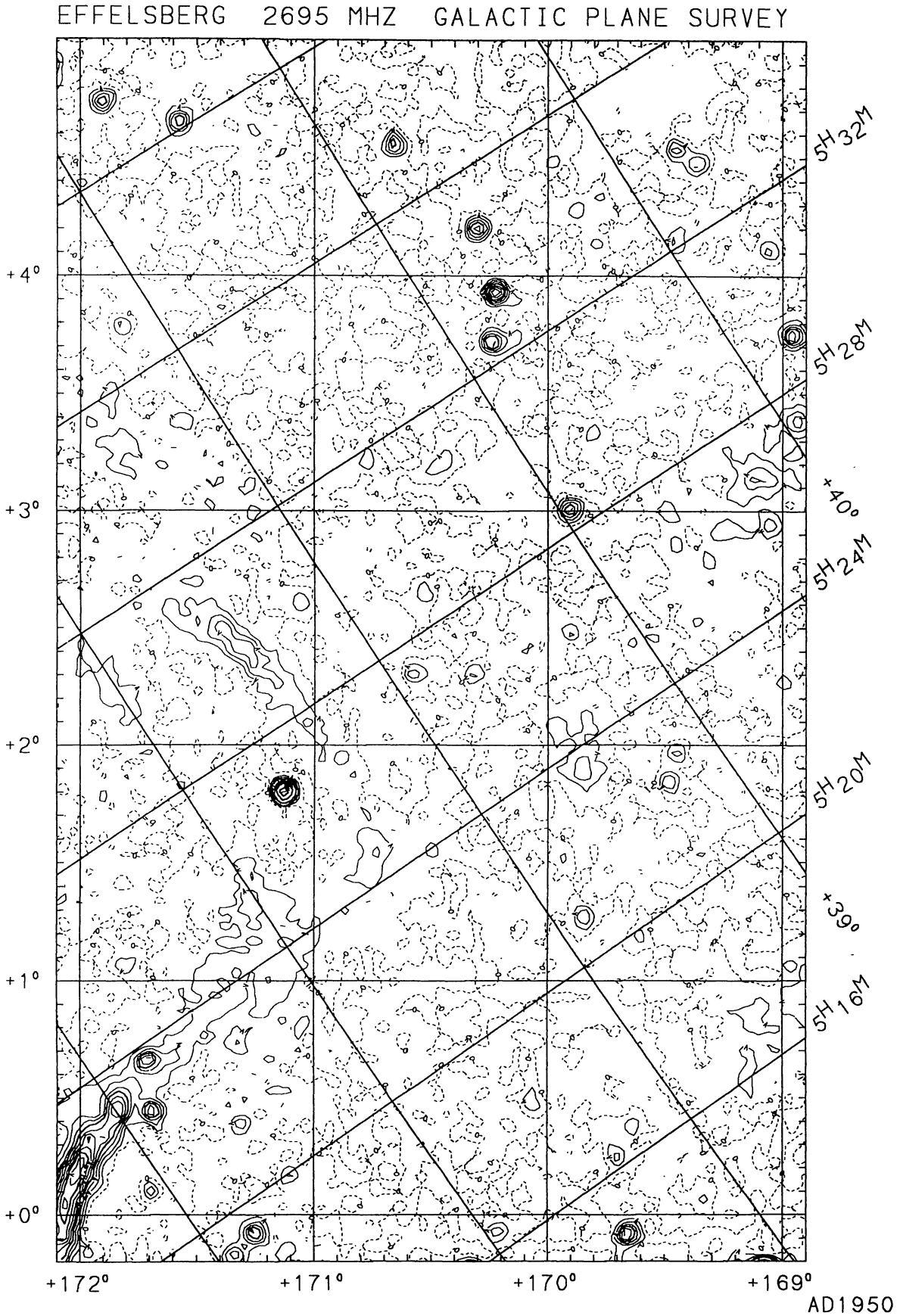

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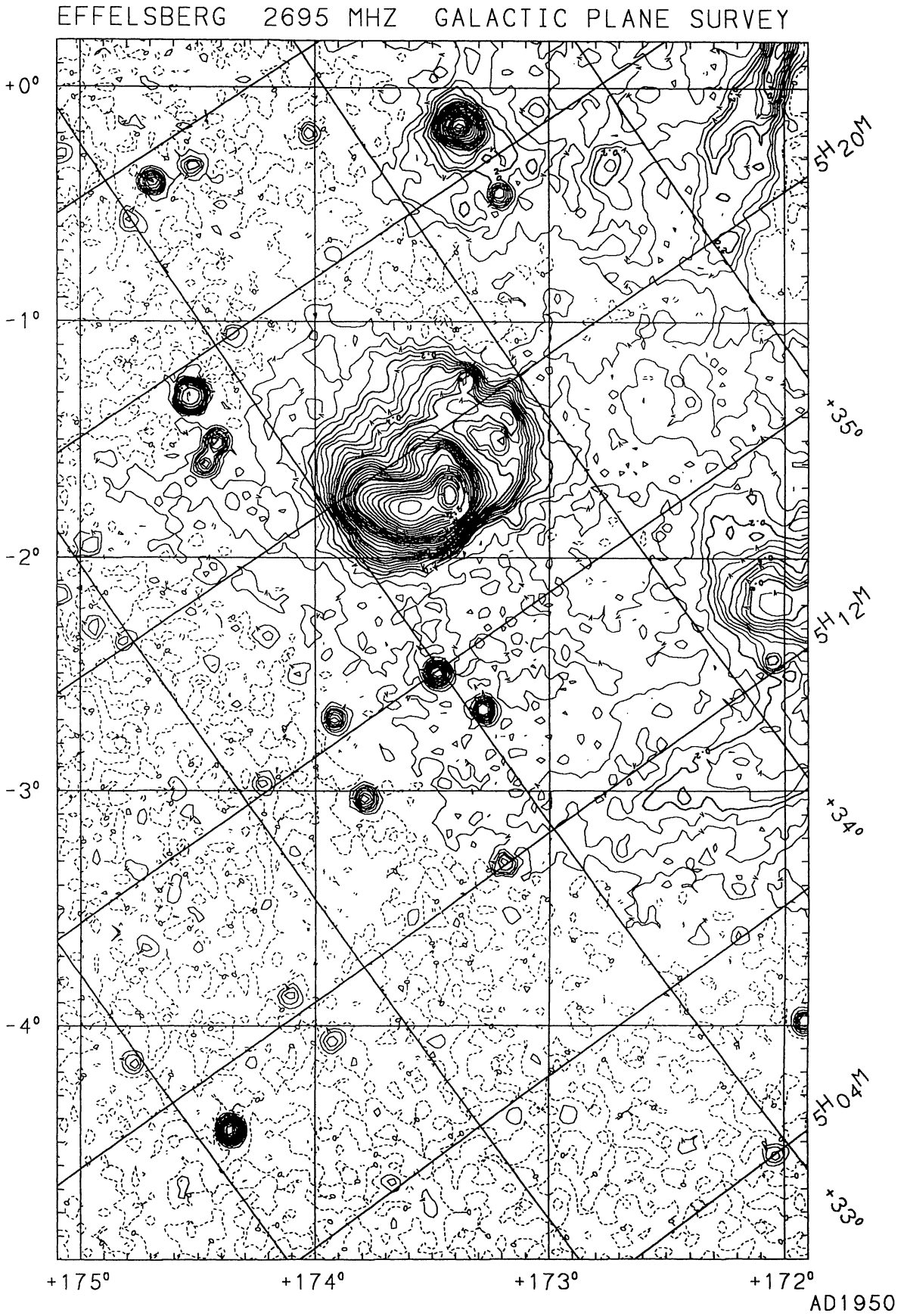

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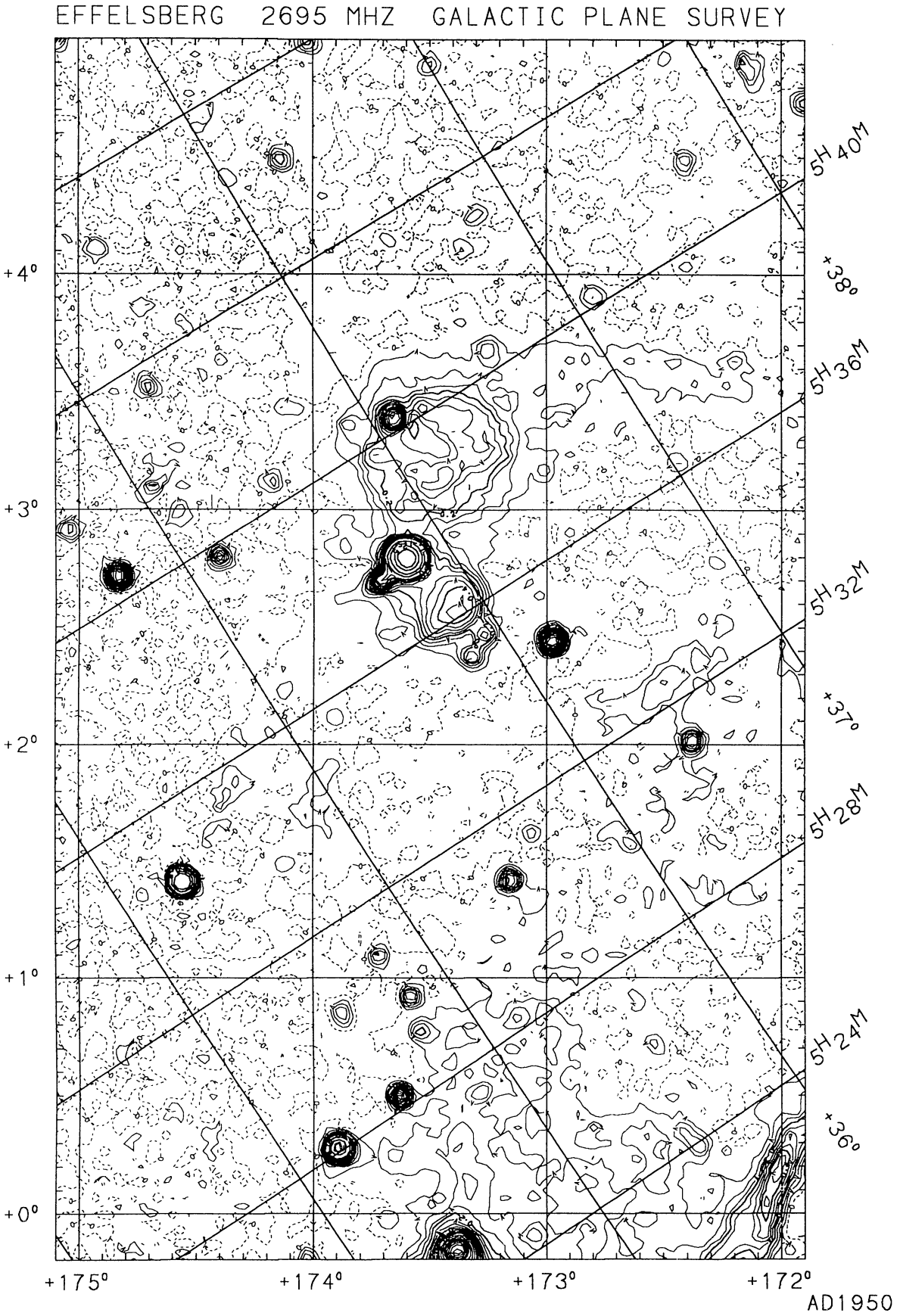

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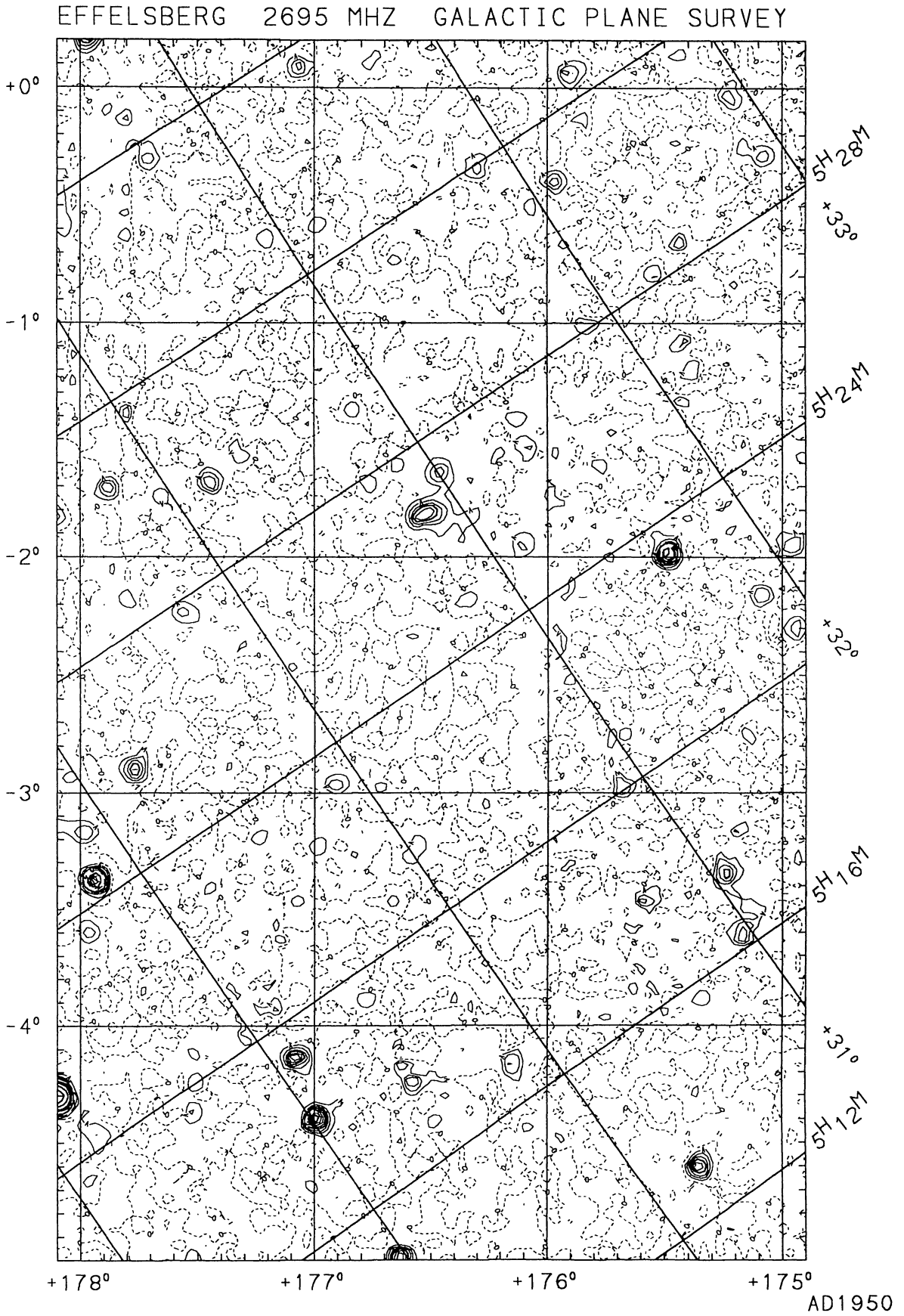

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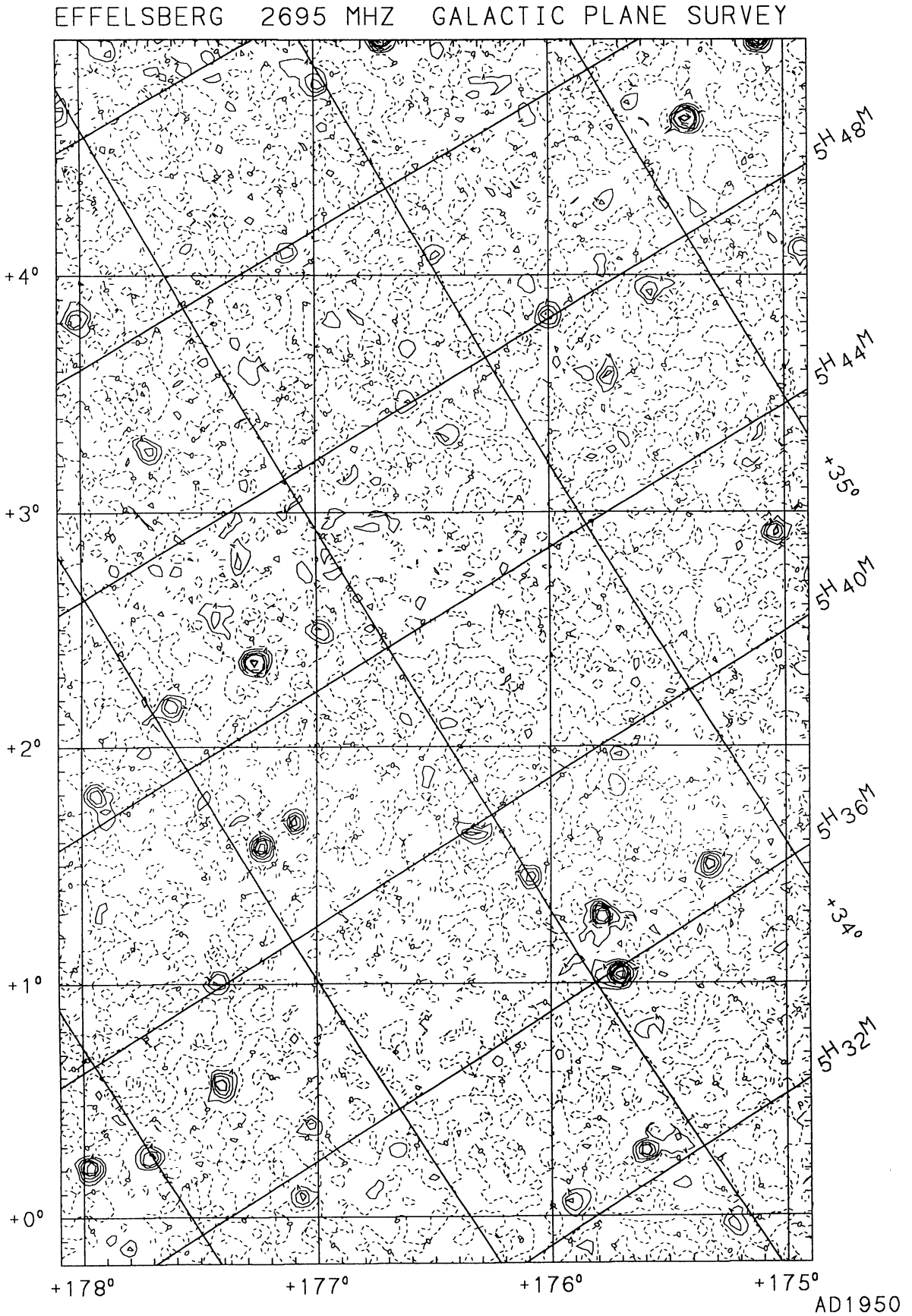

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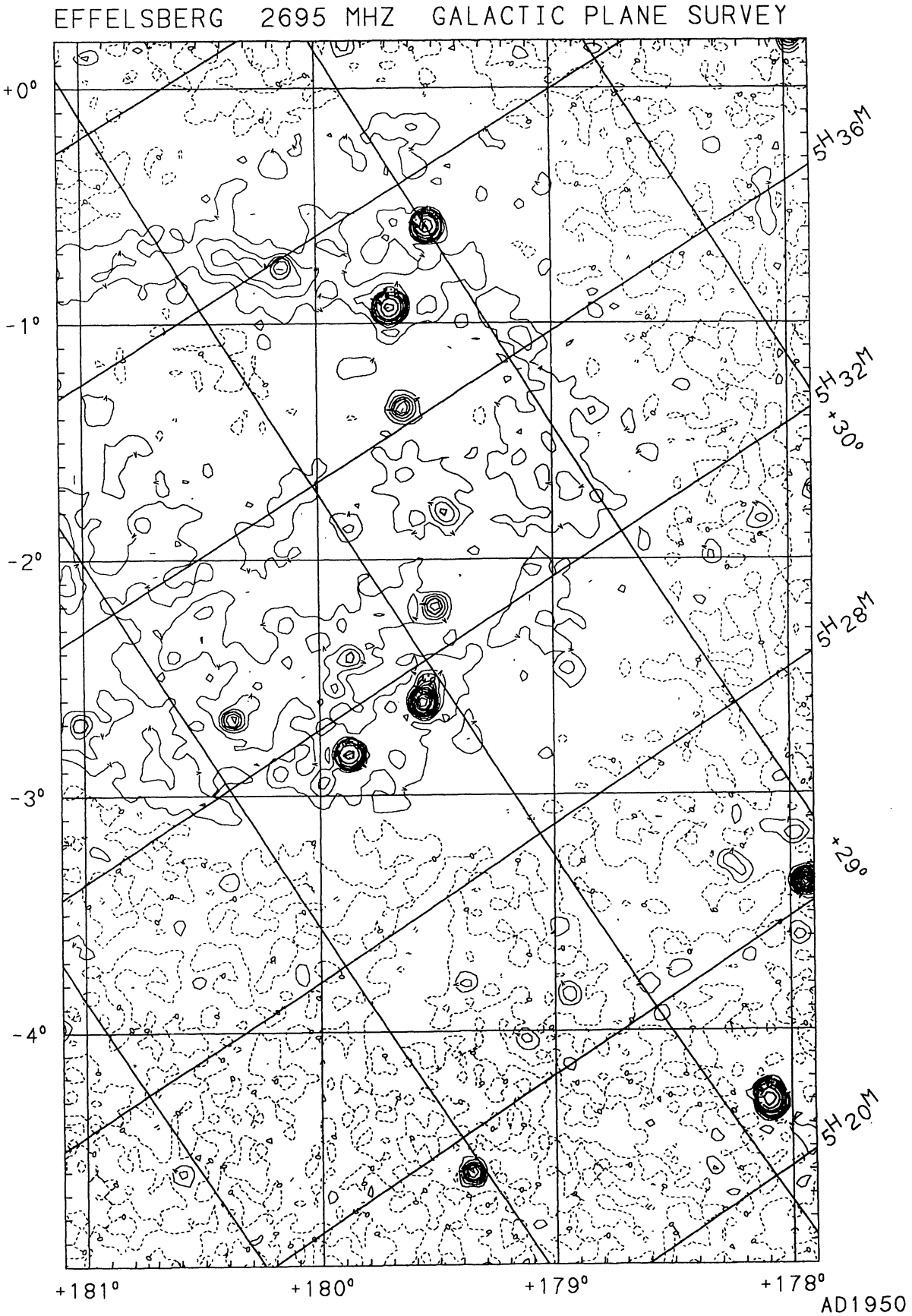

FIGURE 69

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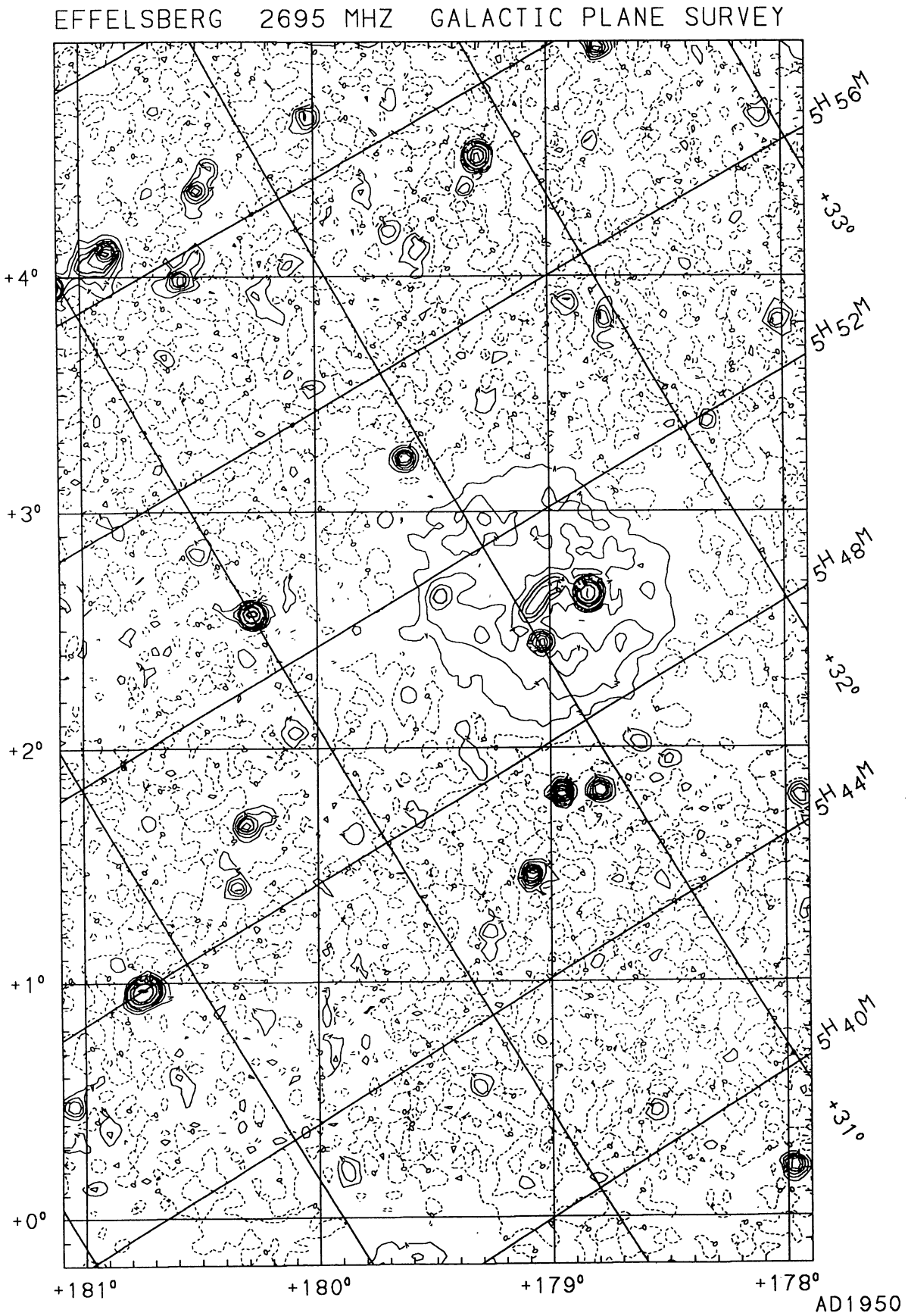

FIGURE 70

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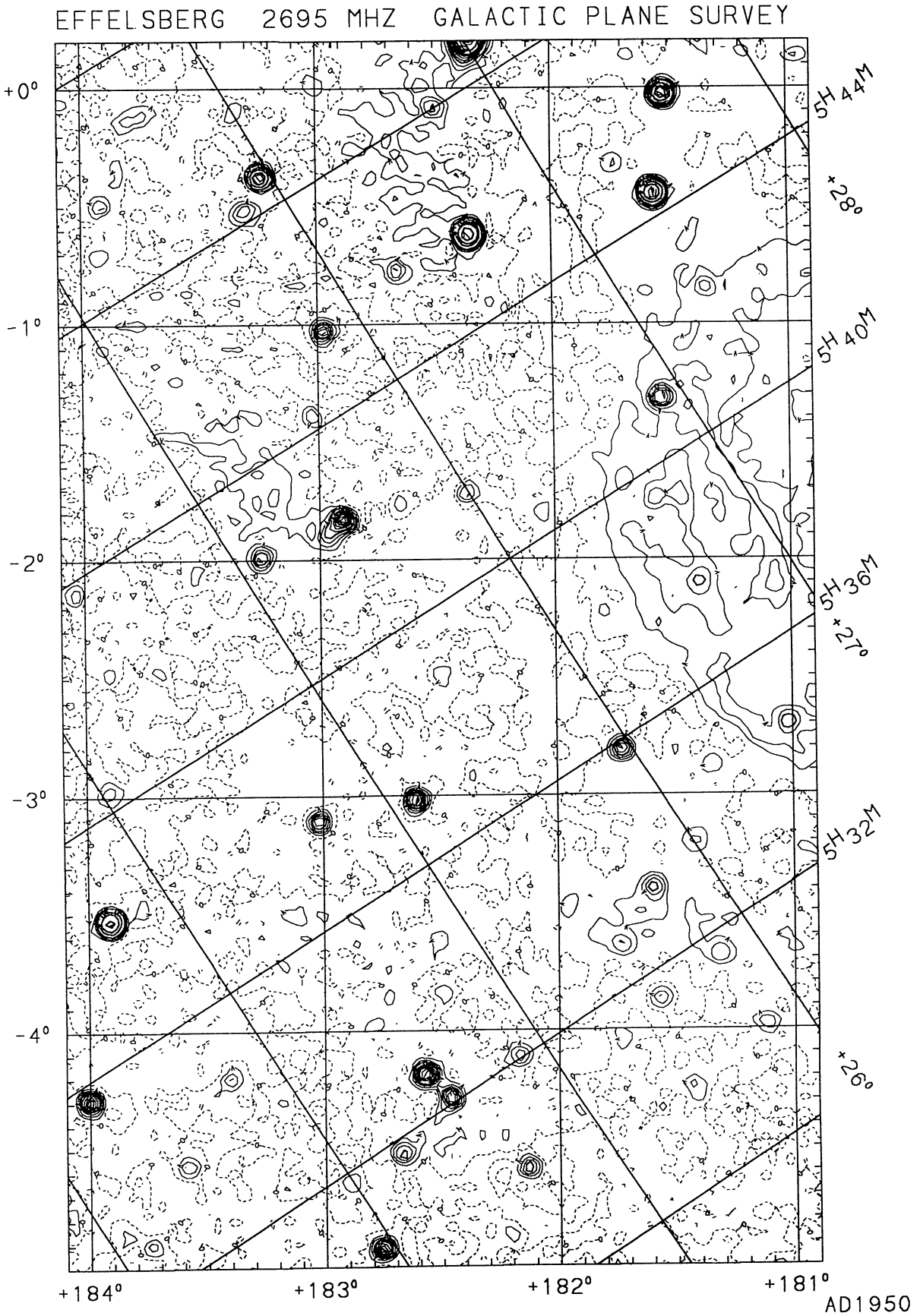

FIGURE 71

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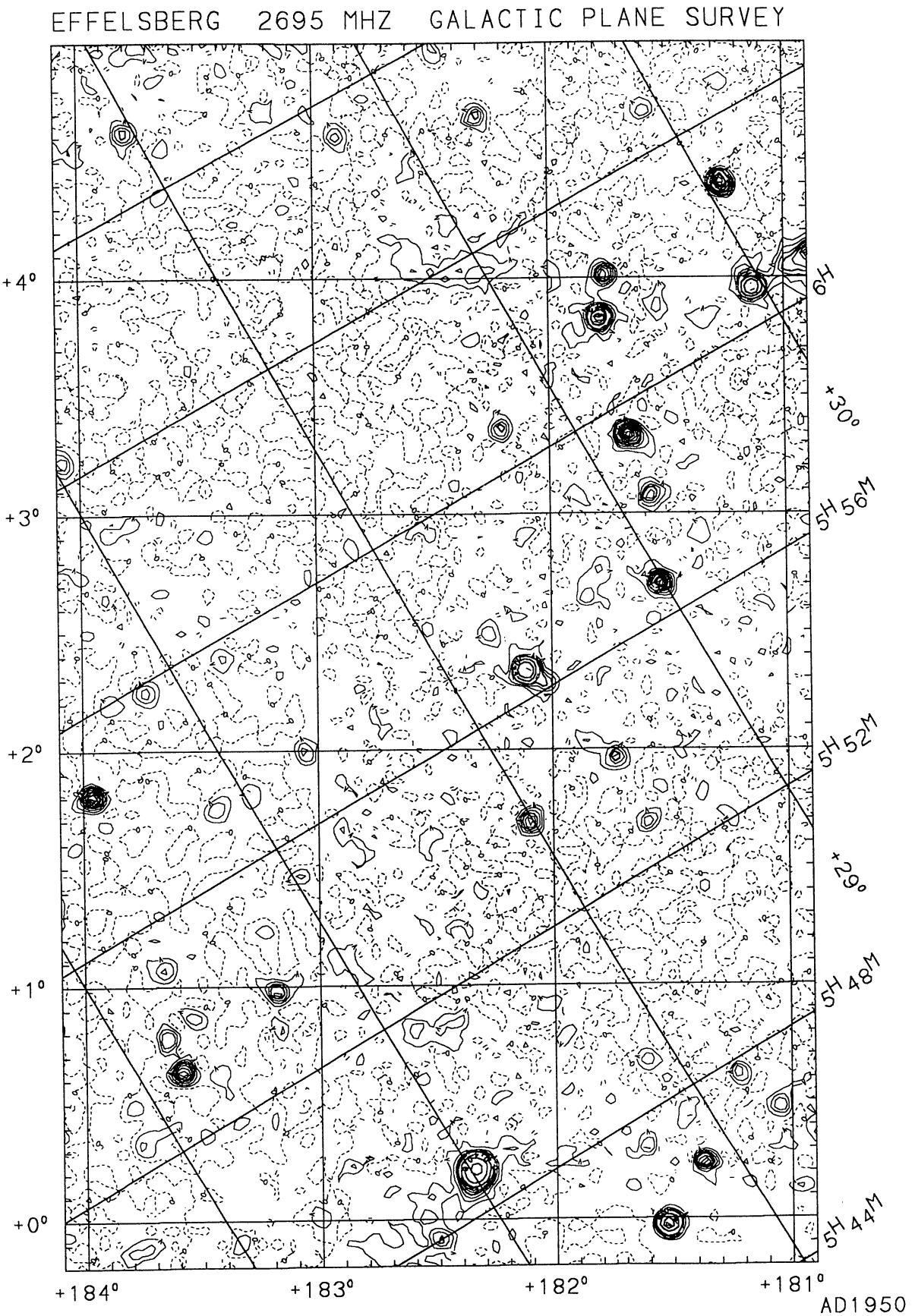

FIGURE 72

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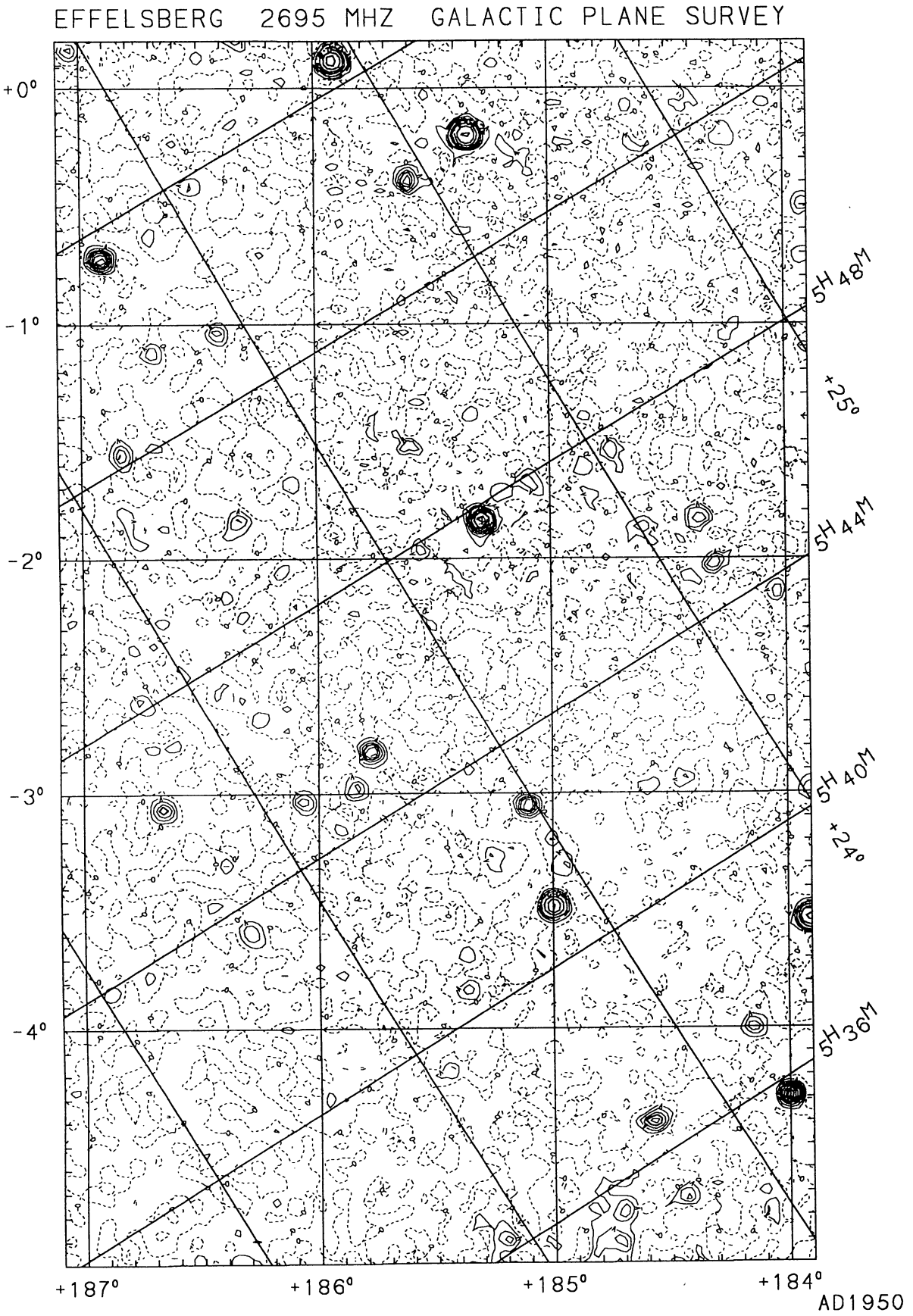

FIGURE 73

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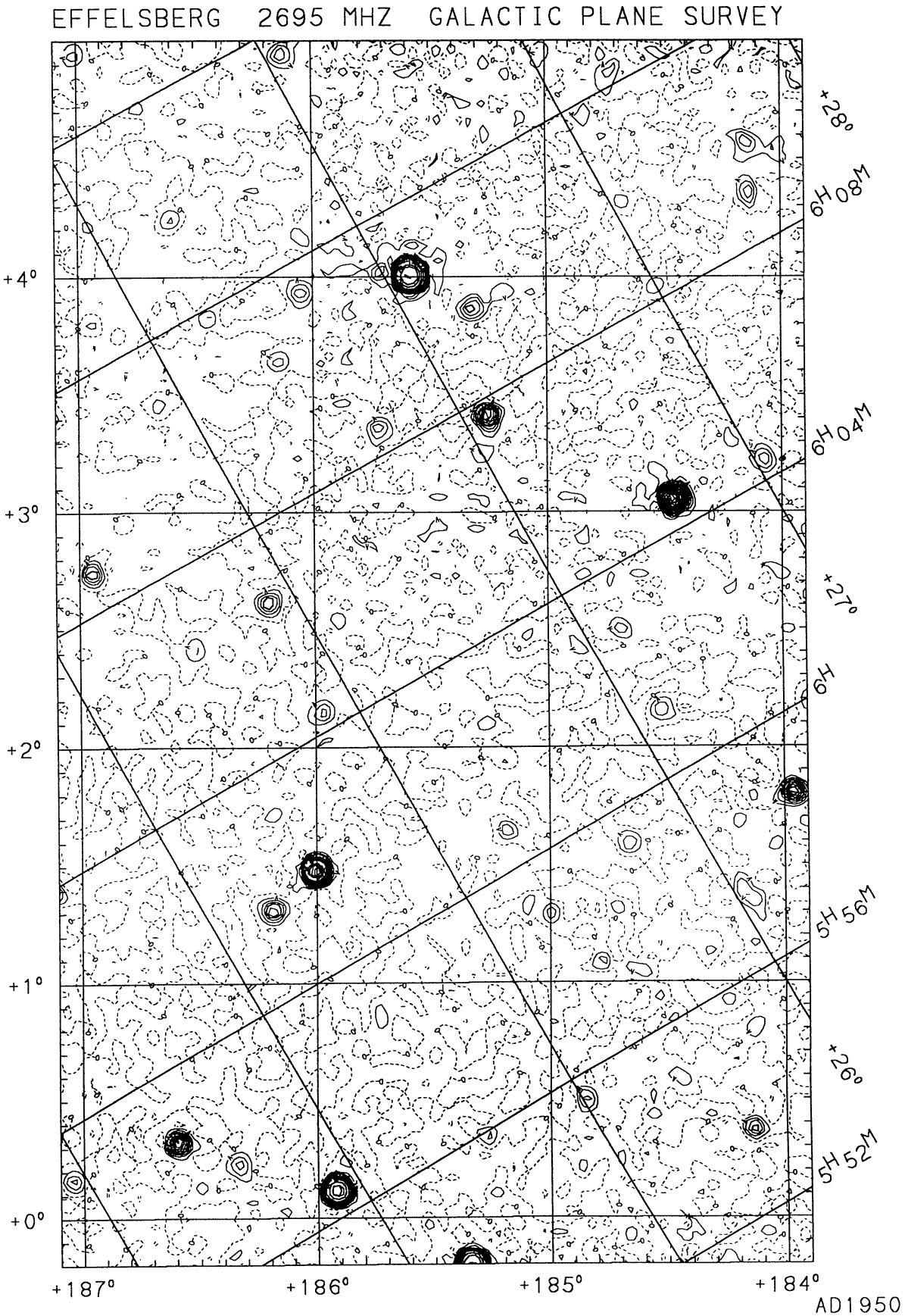

FIGURE 74

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1990A&AS...85..691F

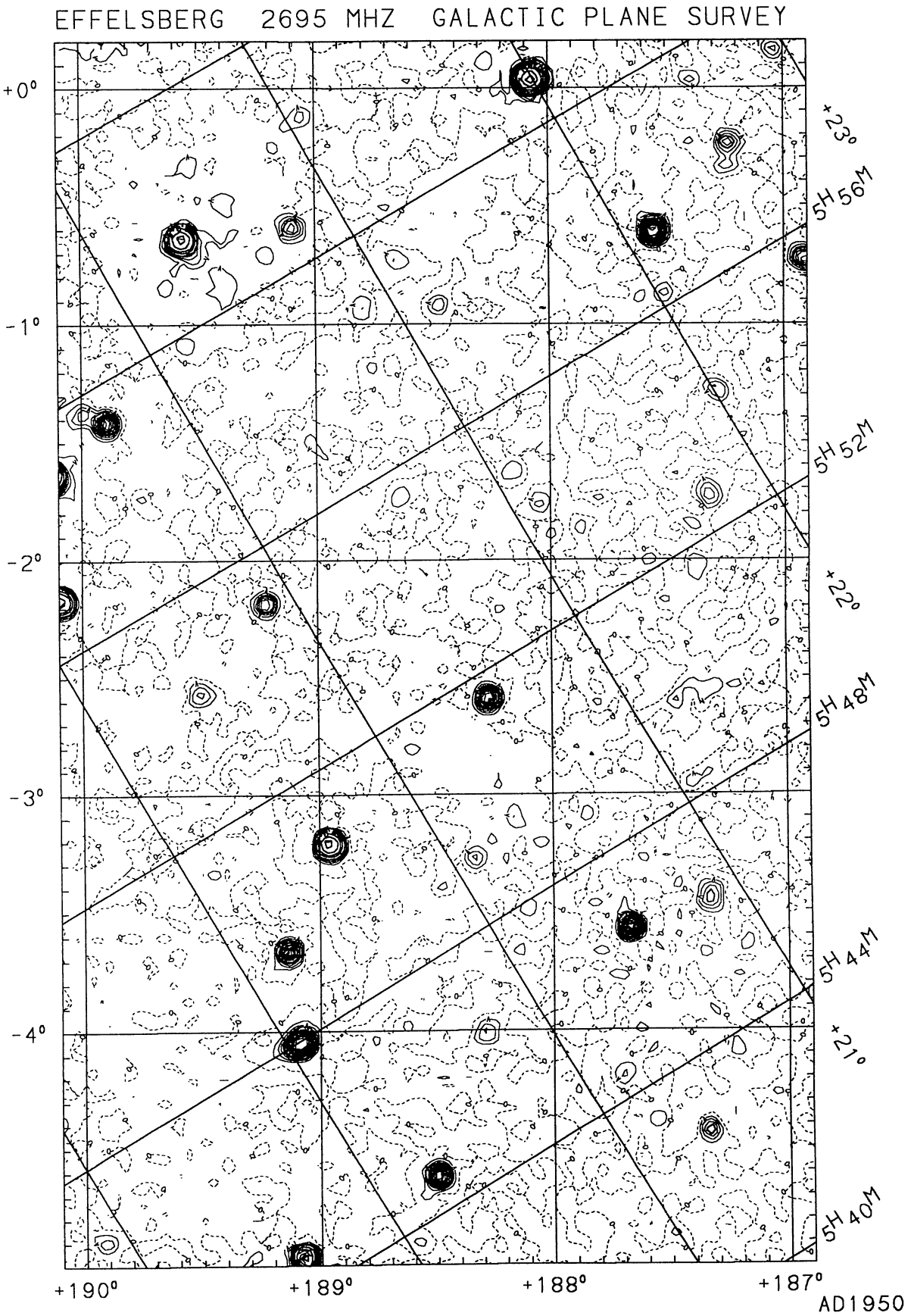

FIGURE 75

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1990A&AS...85..691F

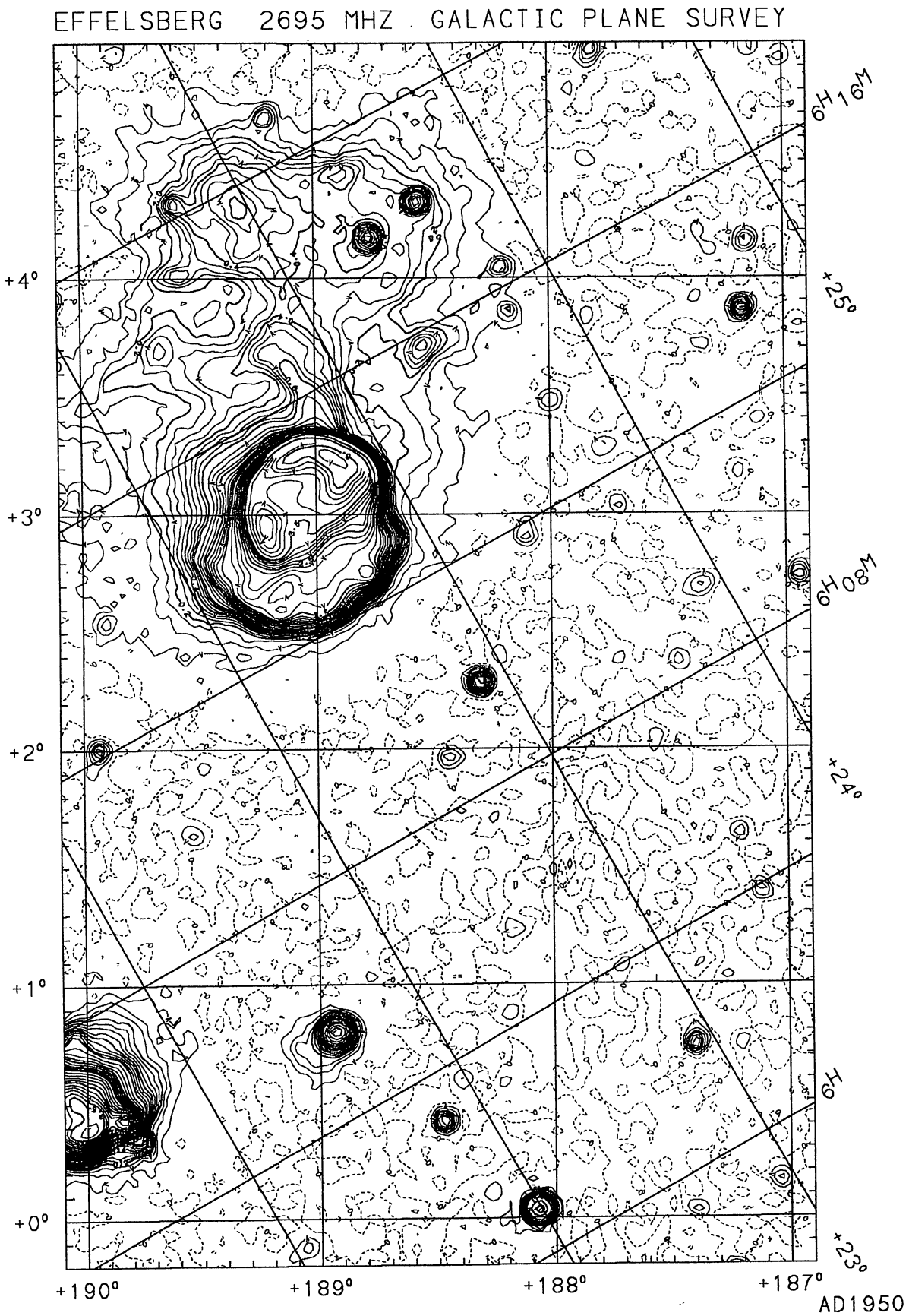

FIGURE 76

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1990A&AS...85..691F

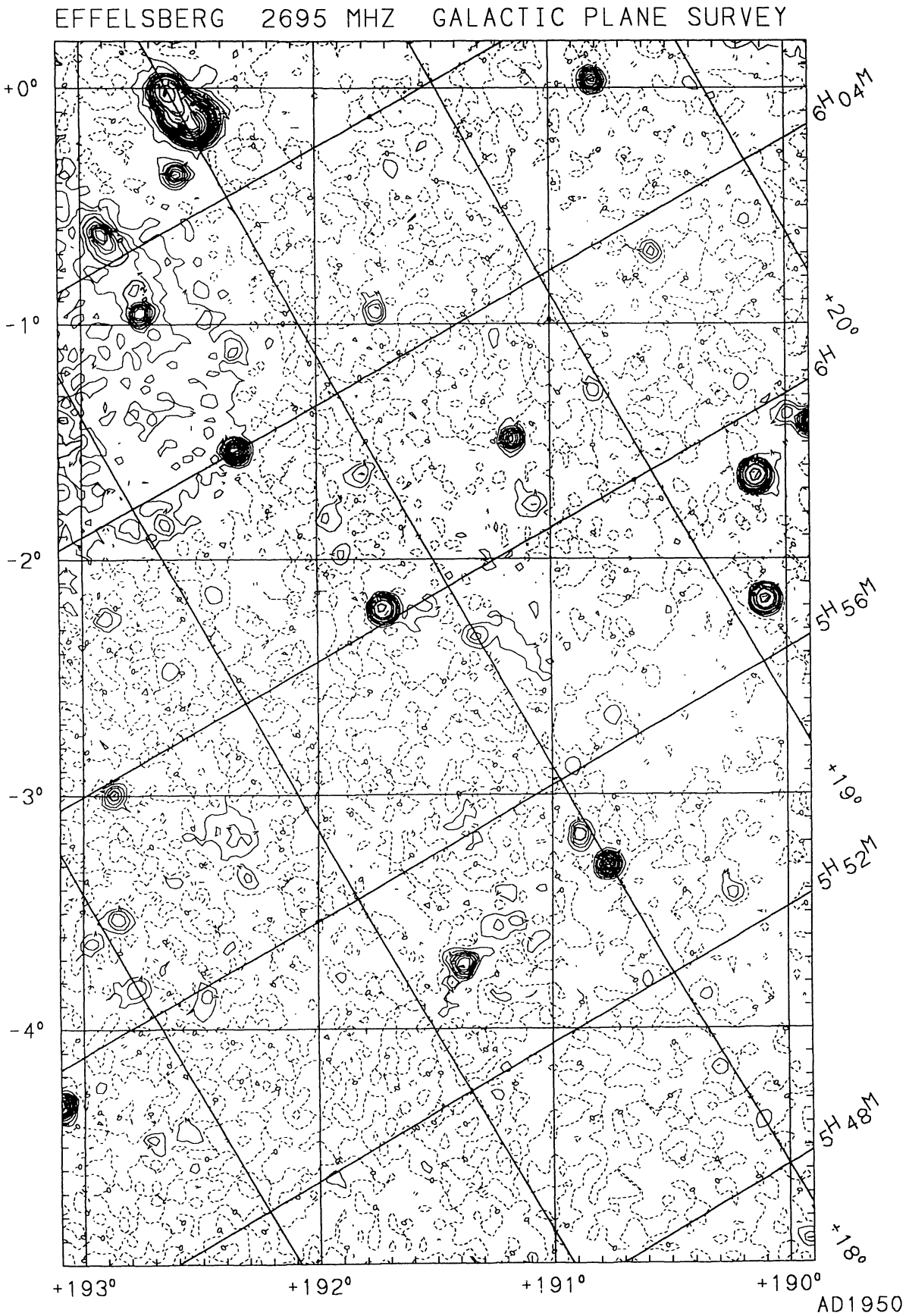

FIGURE 77

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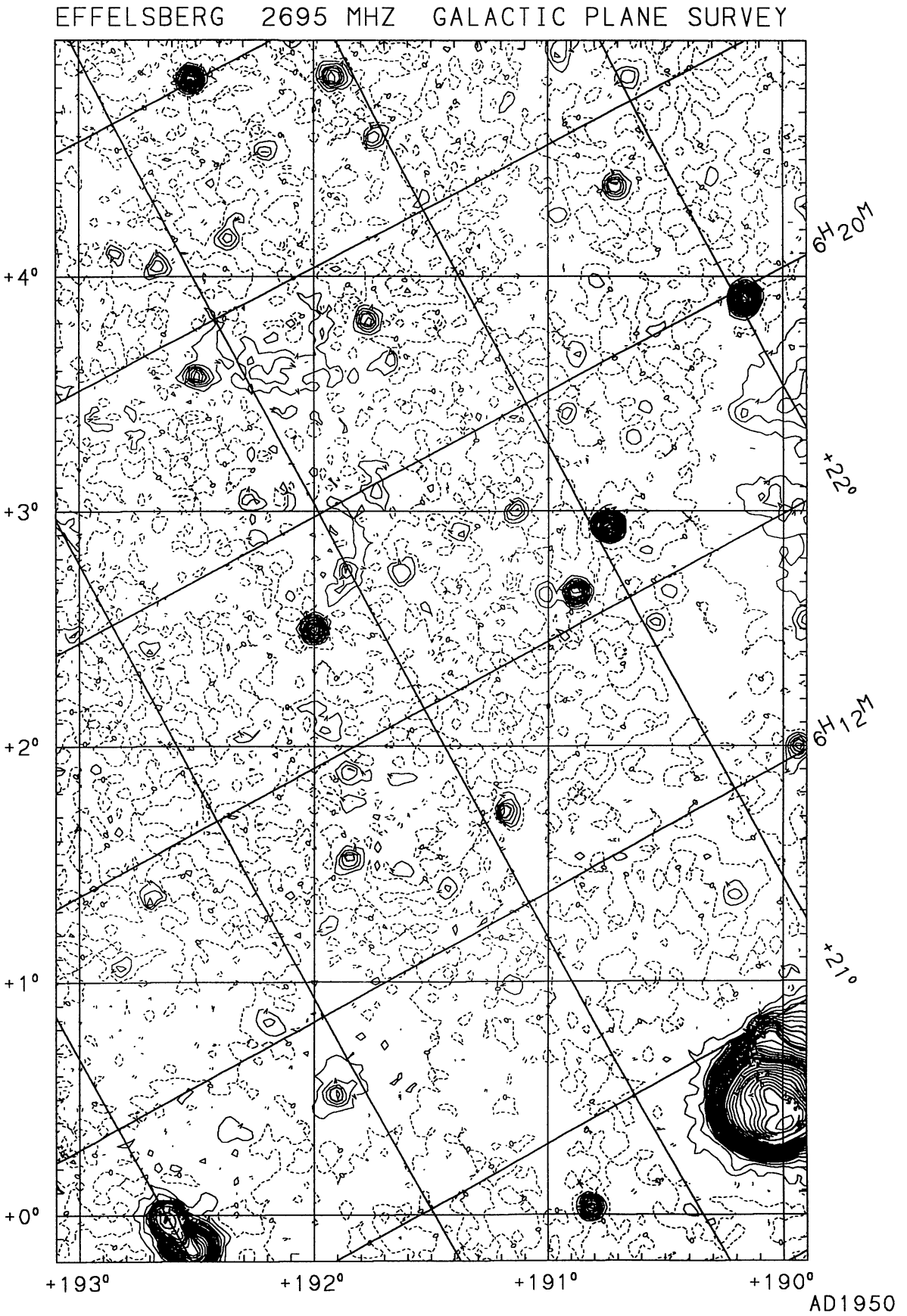

FIGURE 78

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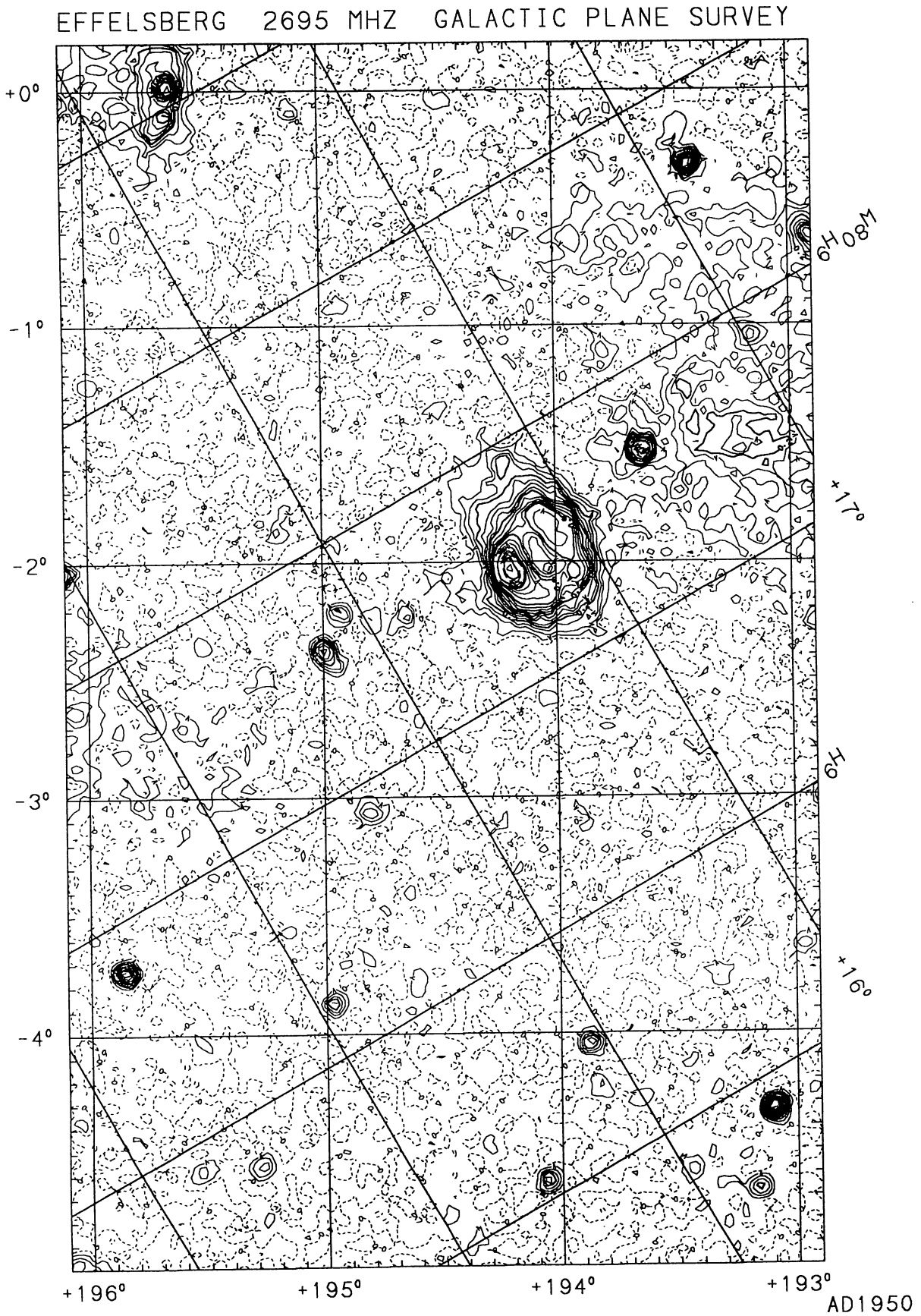

FIGURE 79

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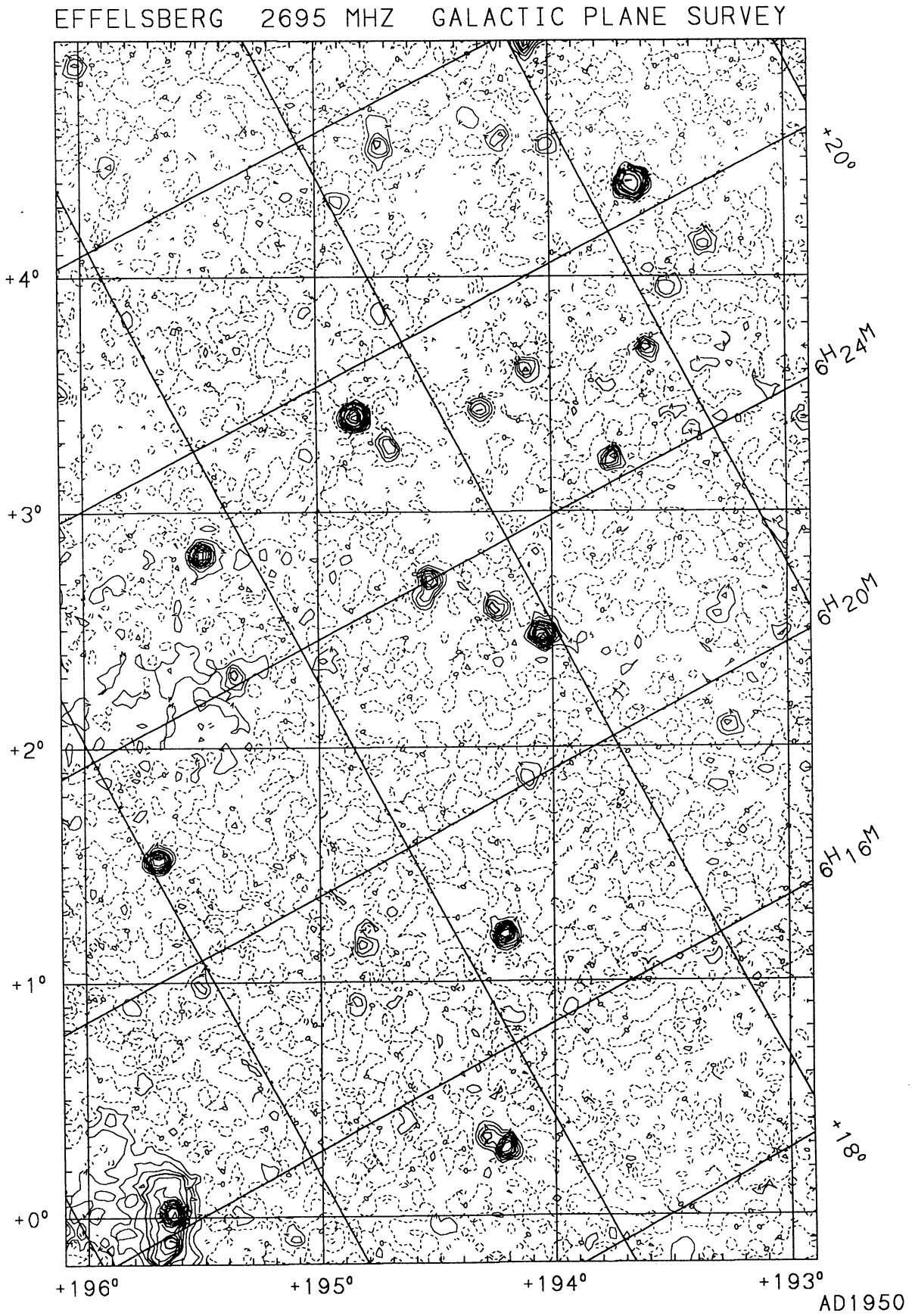

FIGURE 80

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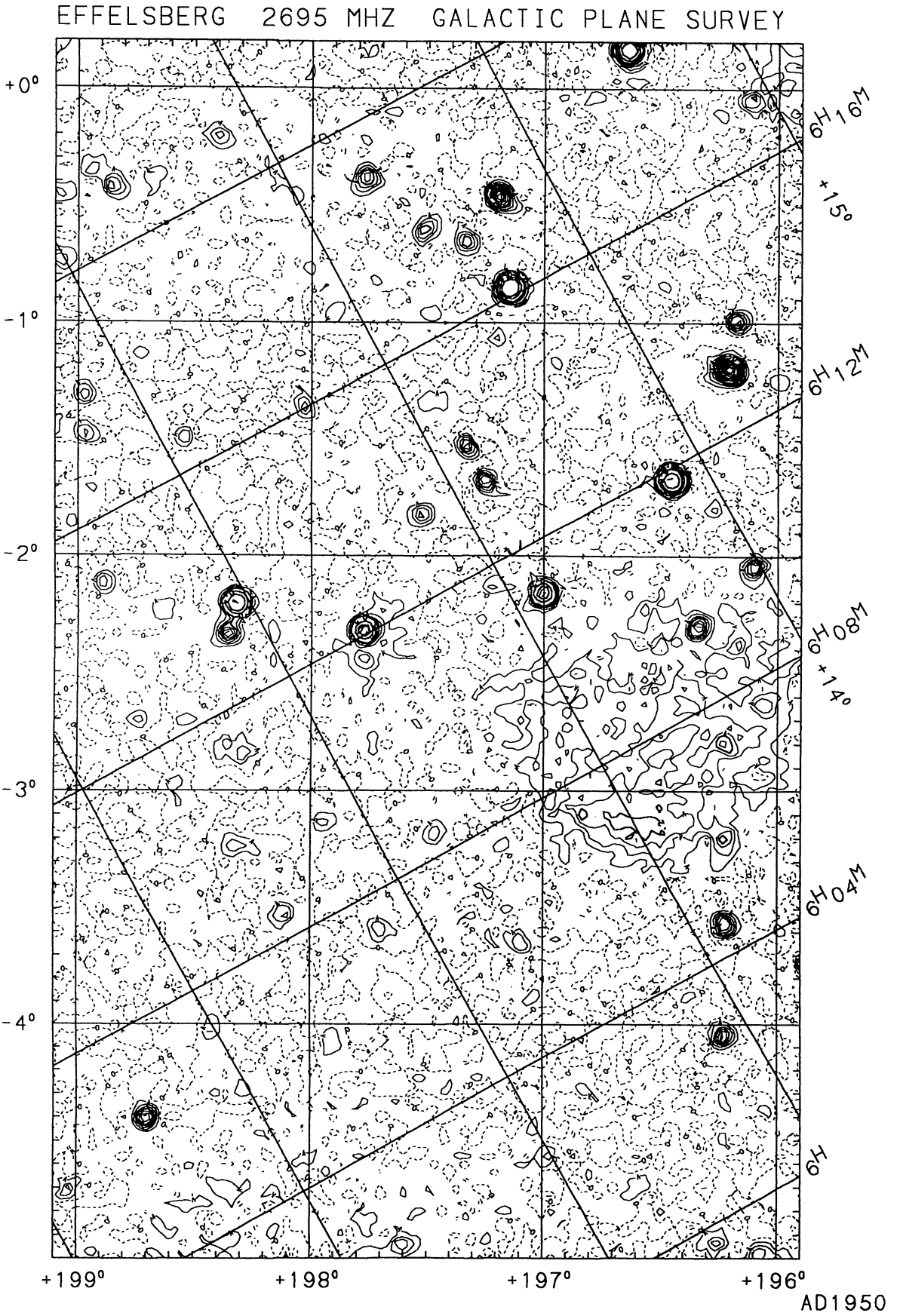

FIGURE 81

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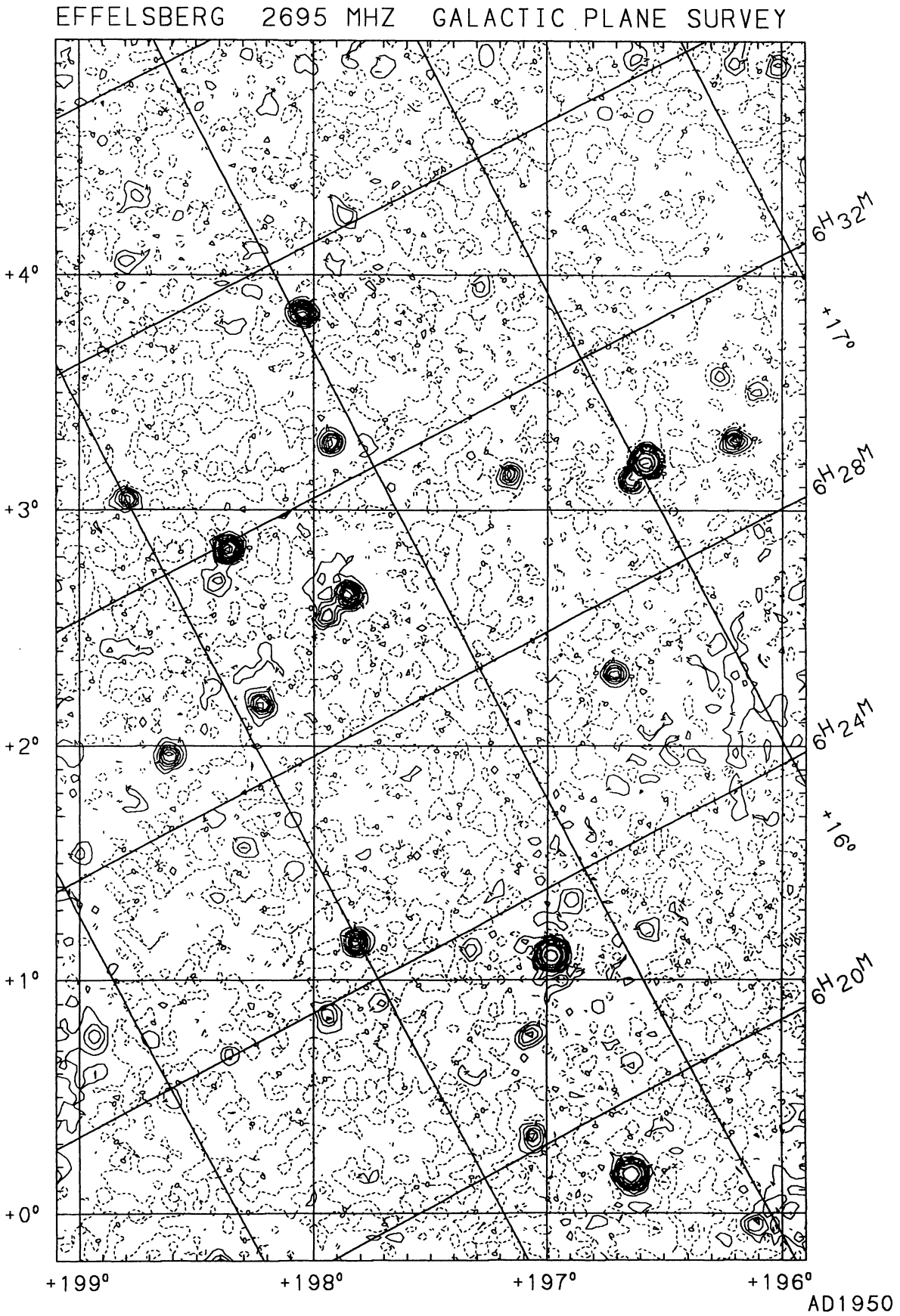

FIGURE 82

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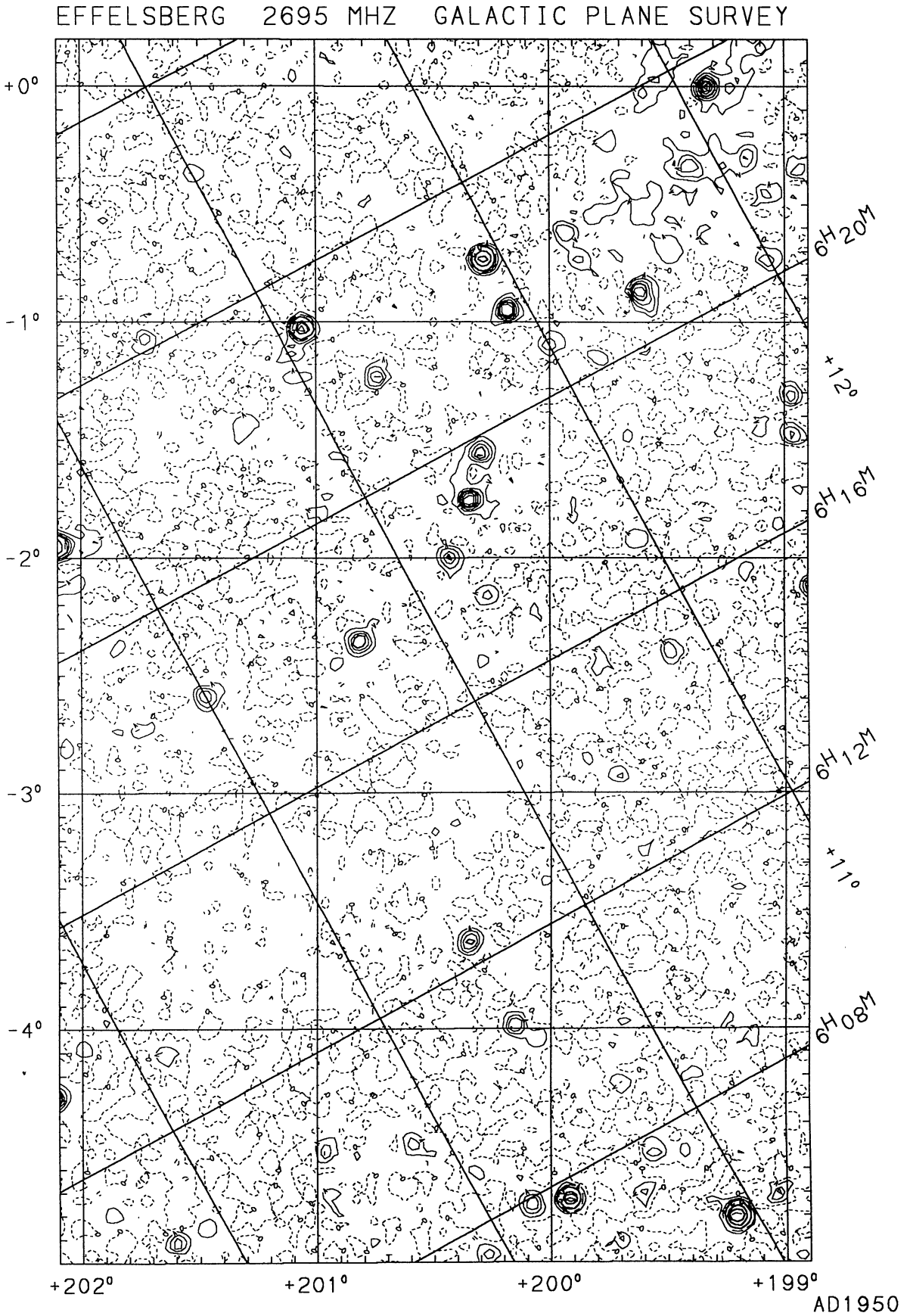

FIGURE 83

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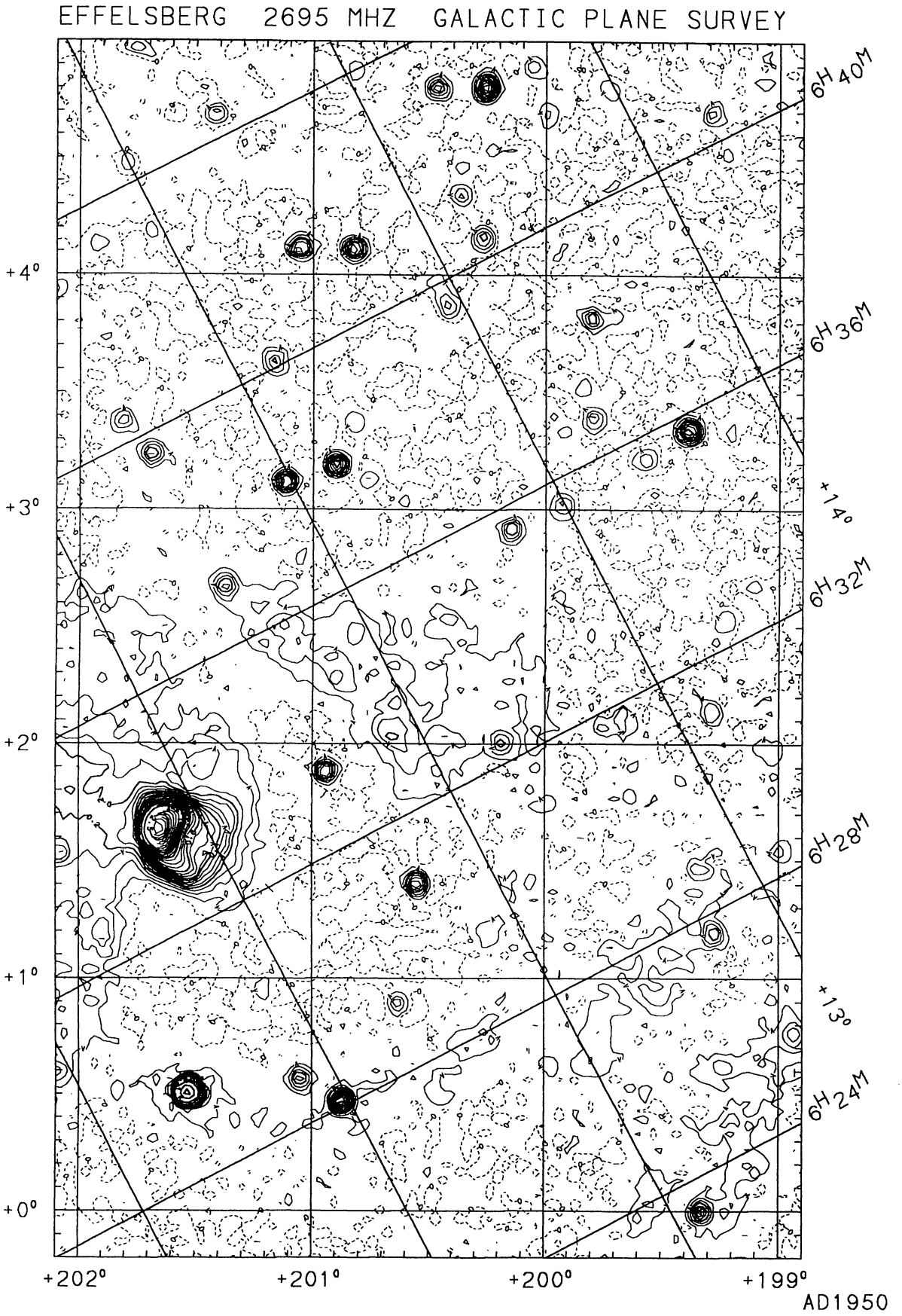

FIGURE 84

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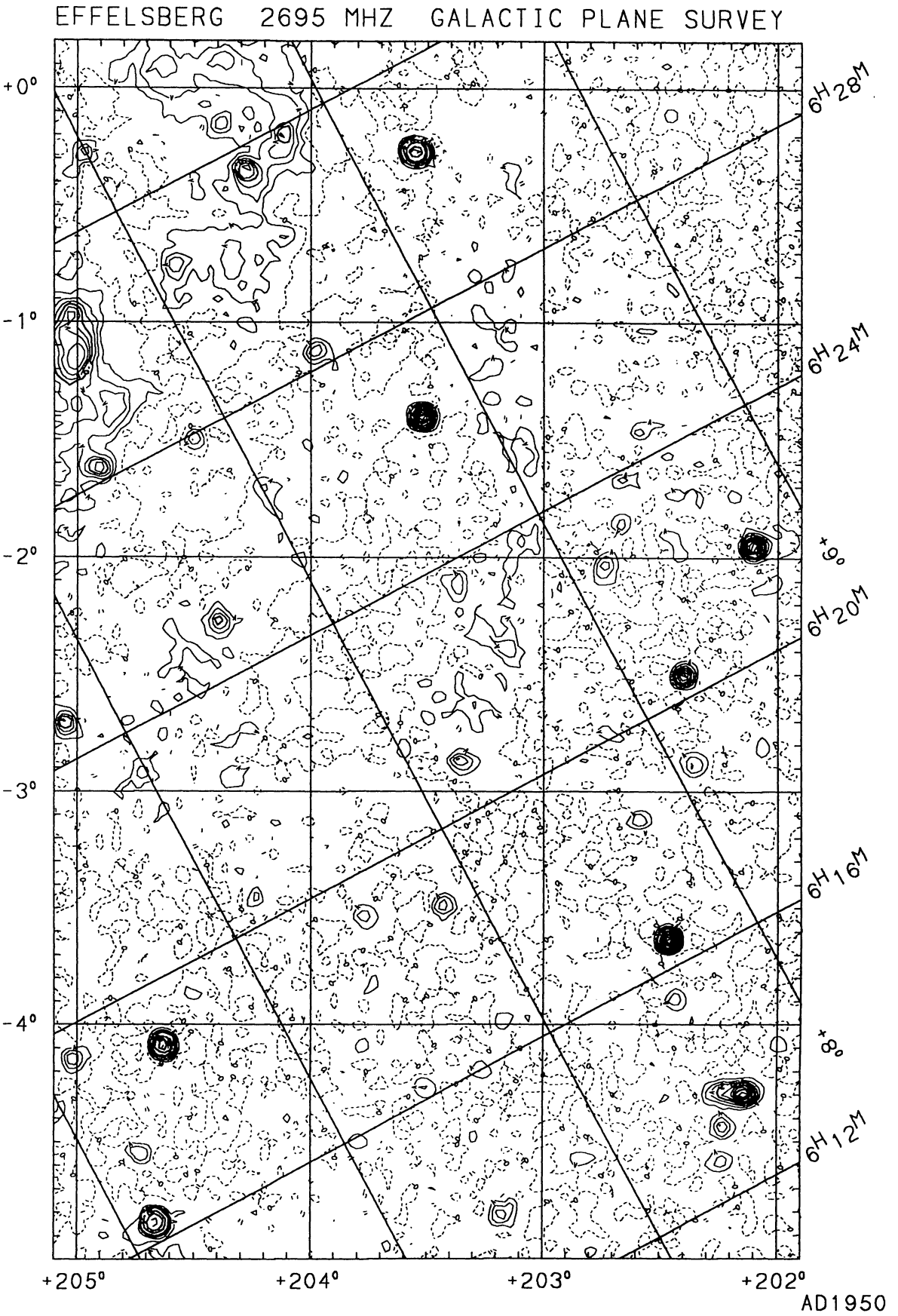

FIGURE 85

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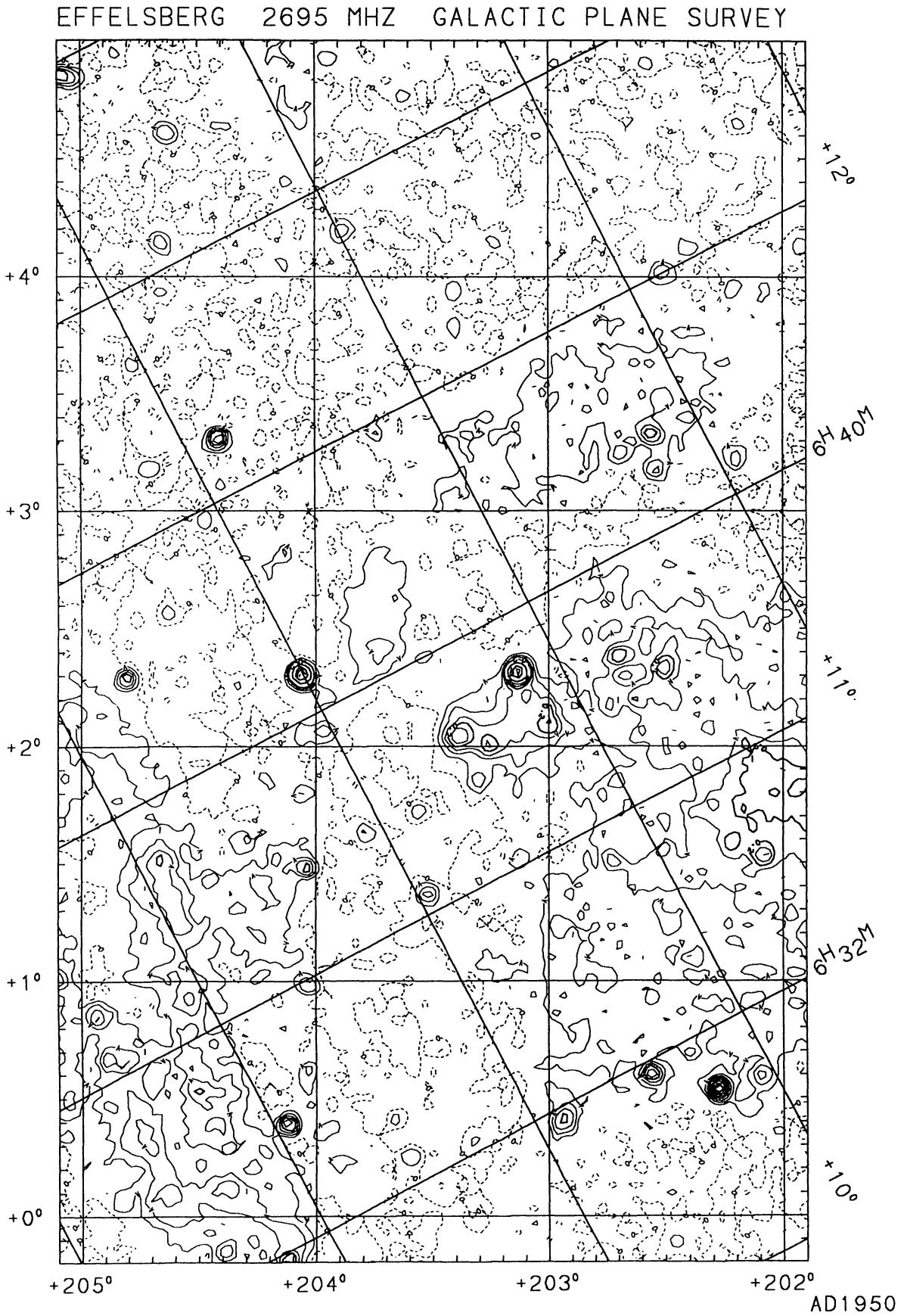

FIGURE 86

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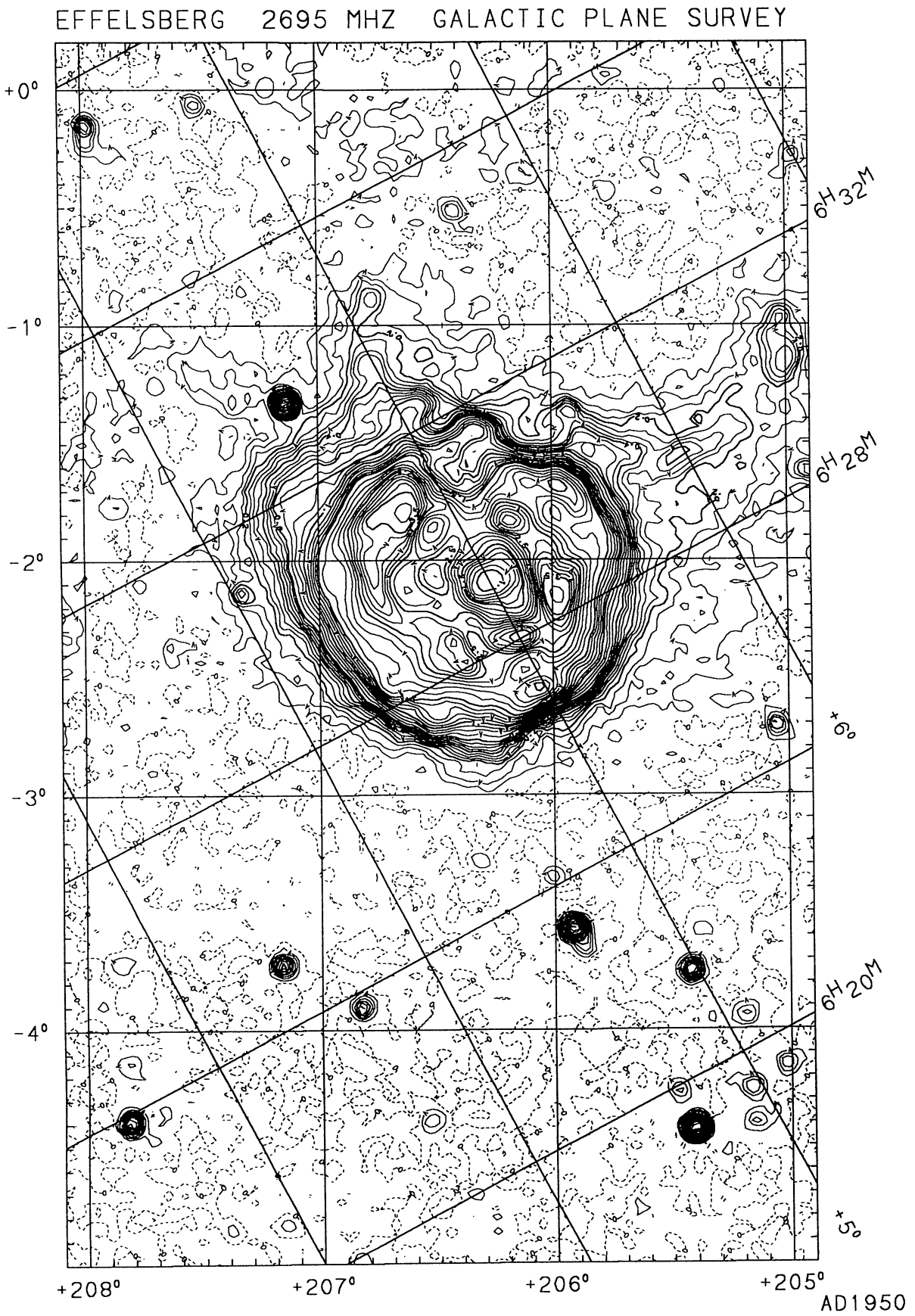

FIGURE 87

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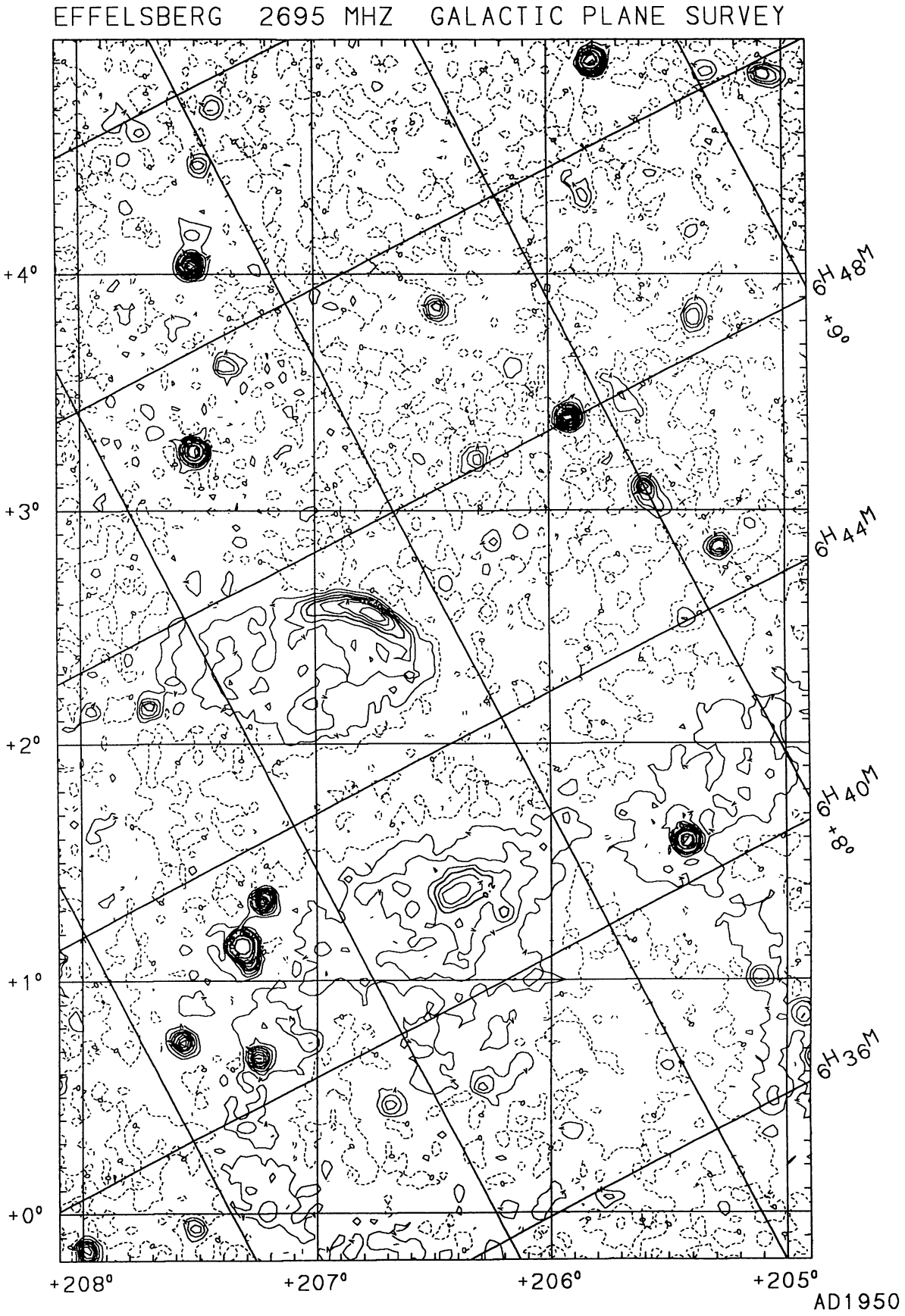

FIGURE 88

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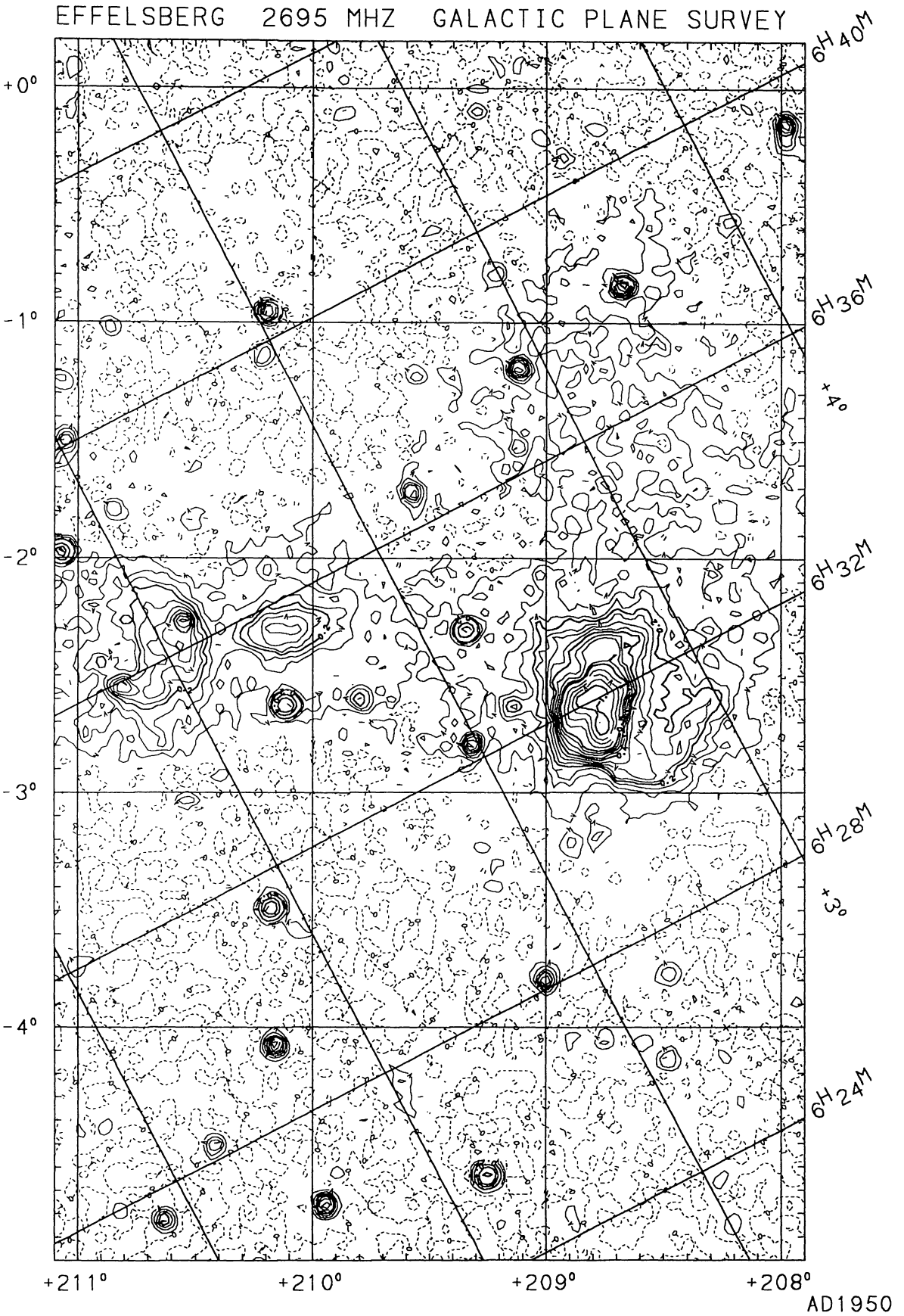

FIGURE 89

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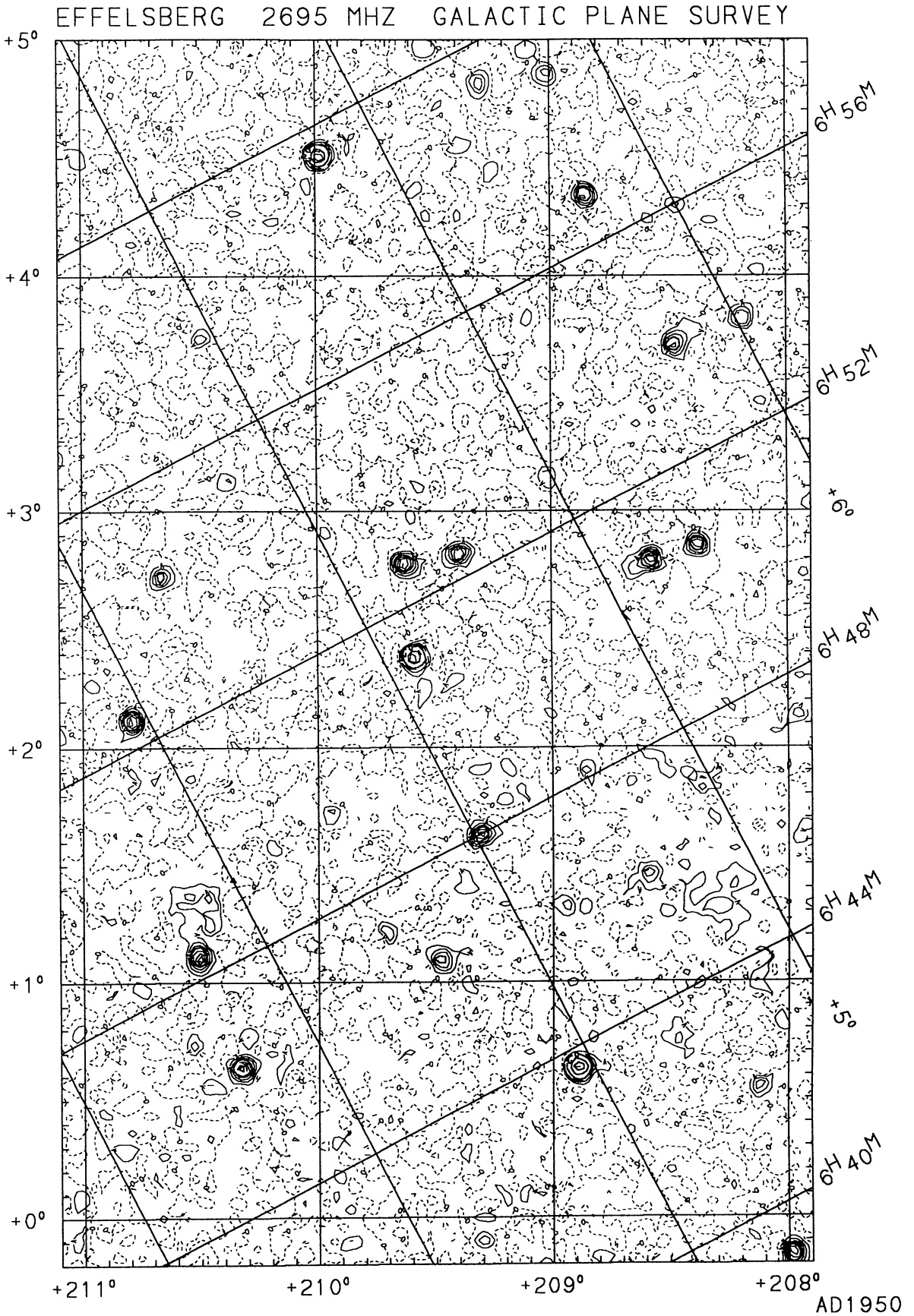

FIGURE 90

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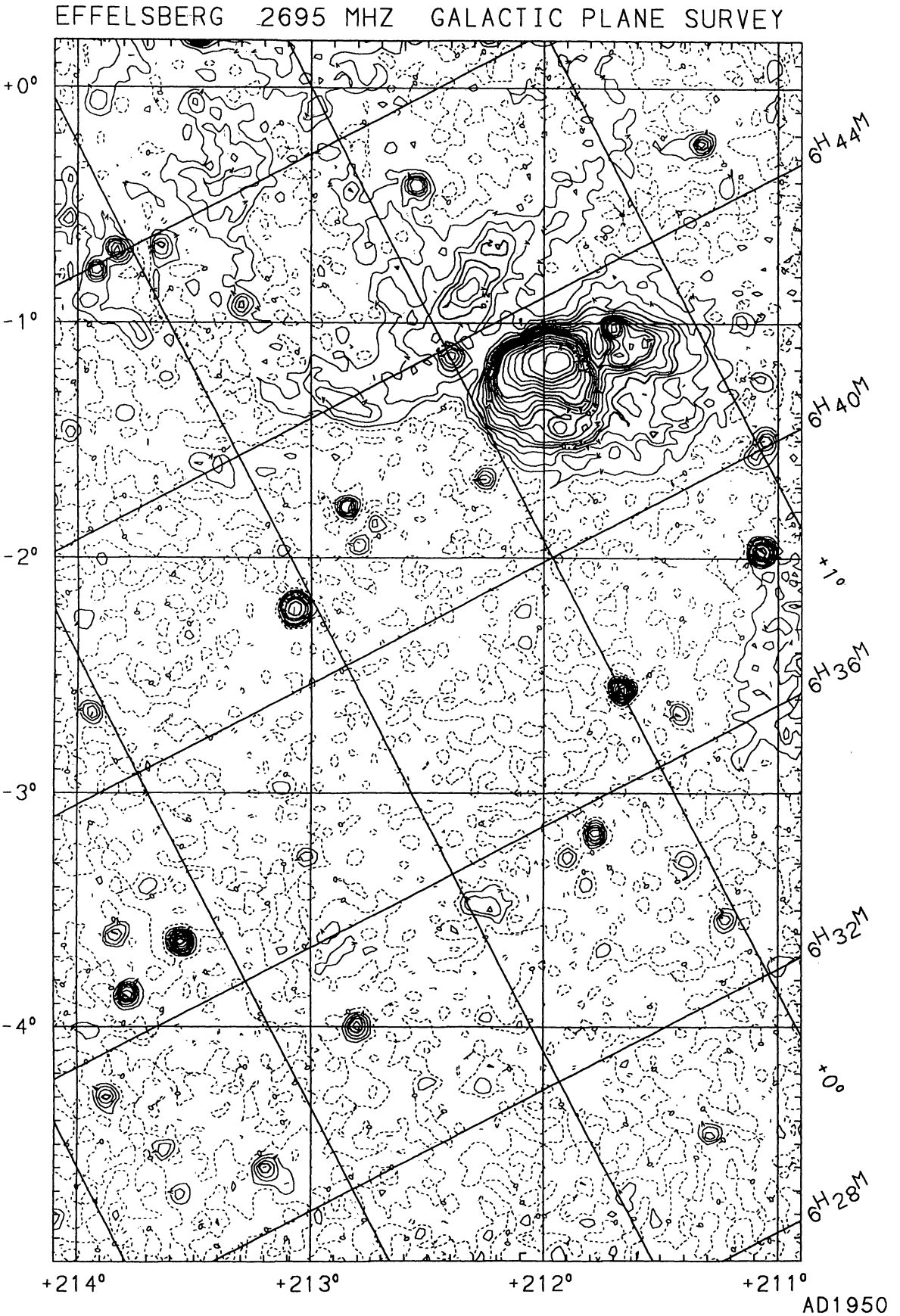

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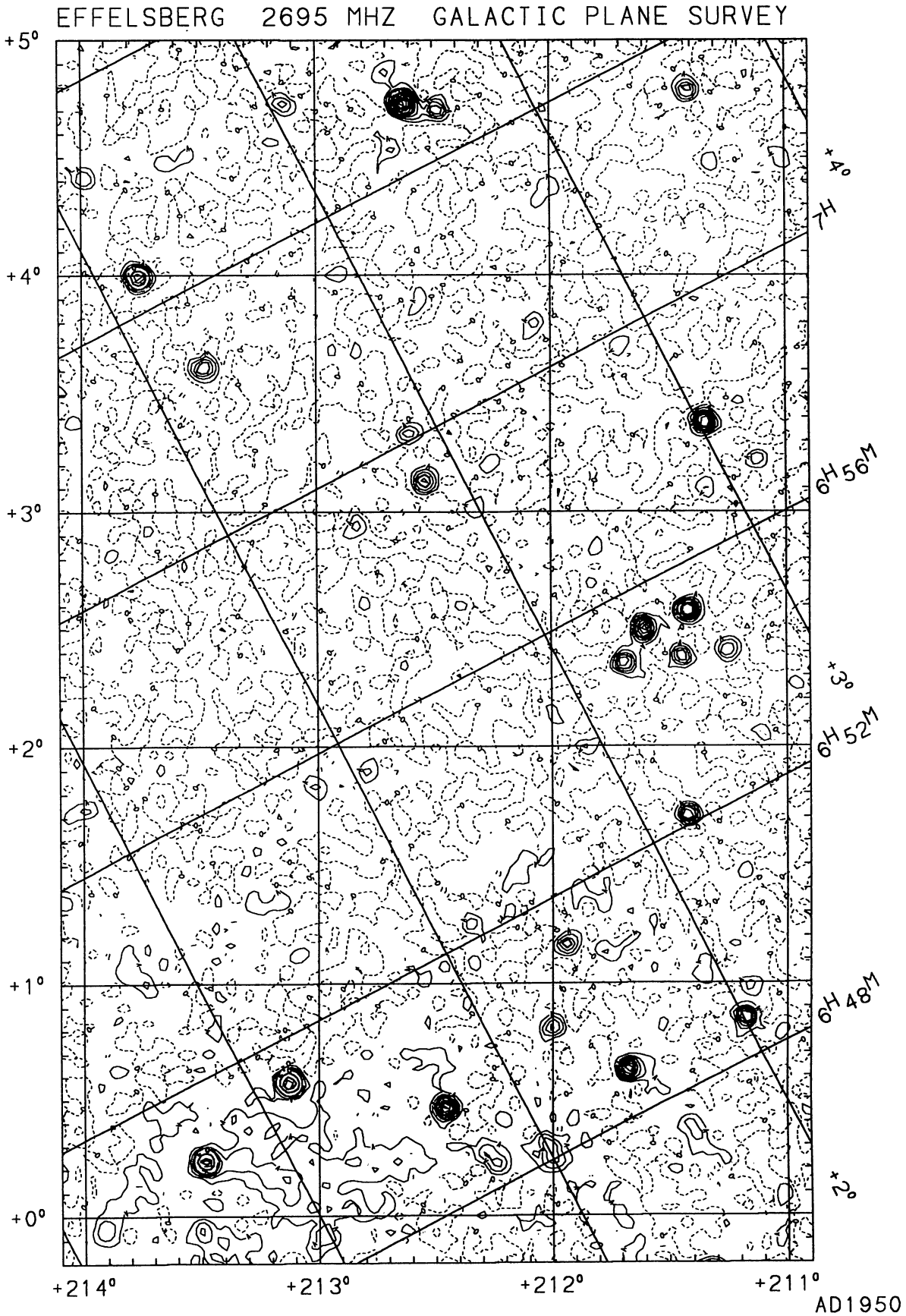

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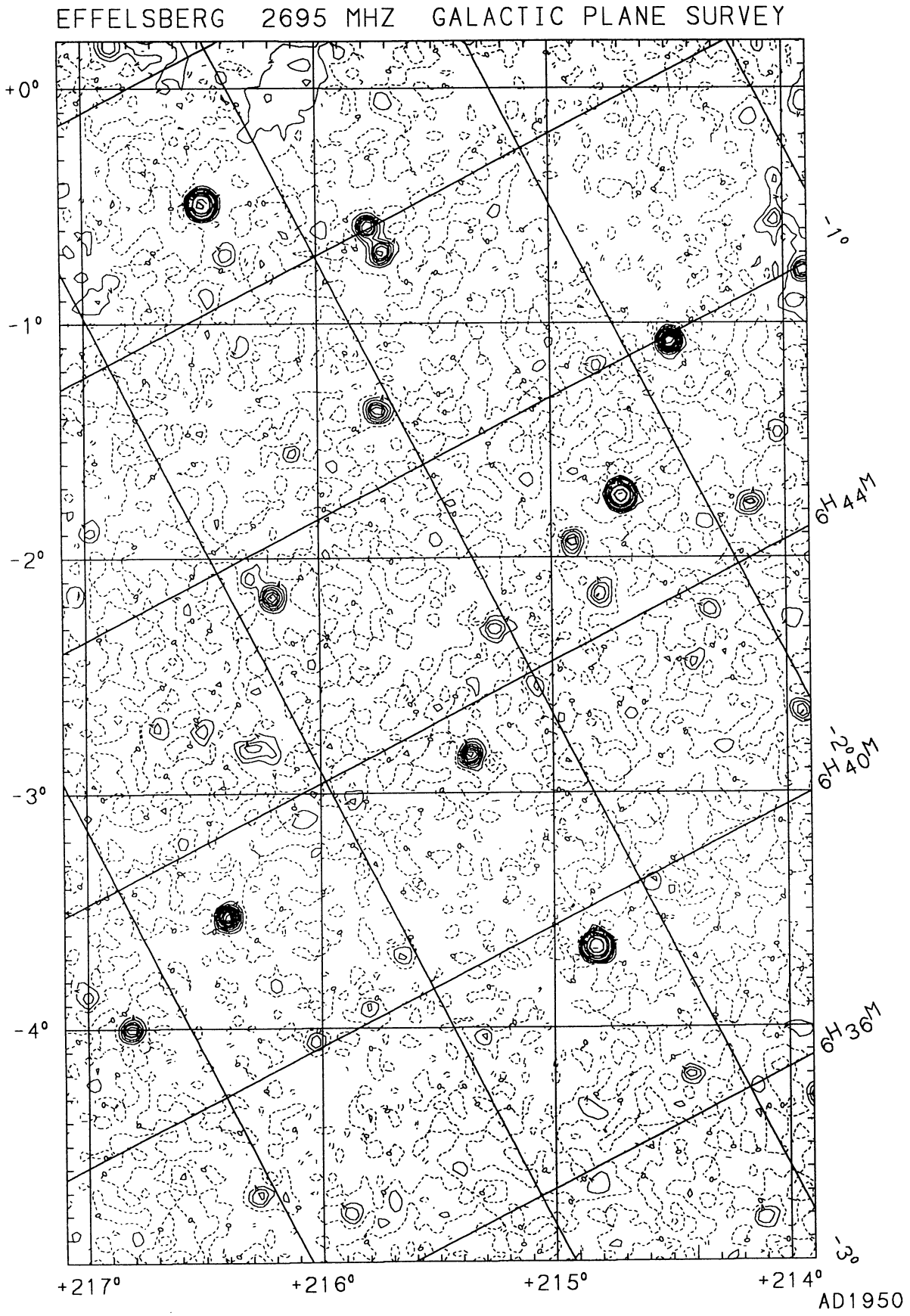

FIGURE 93

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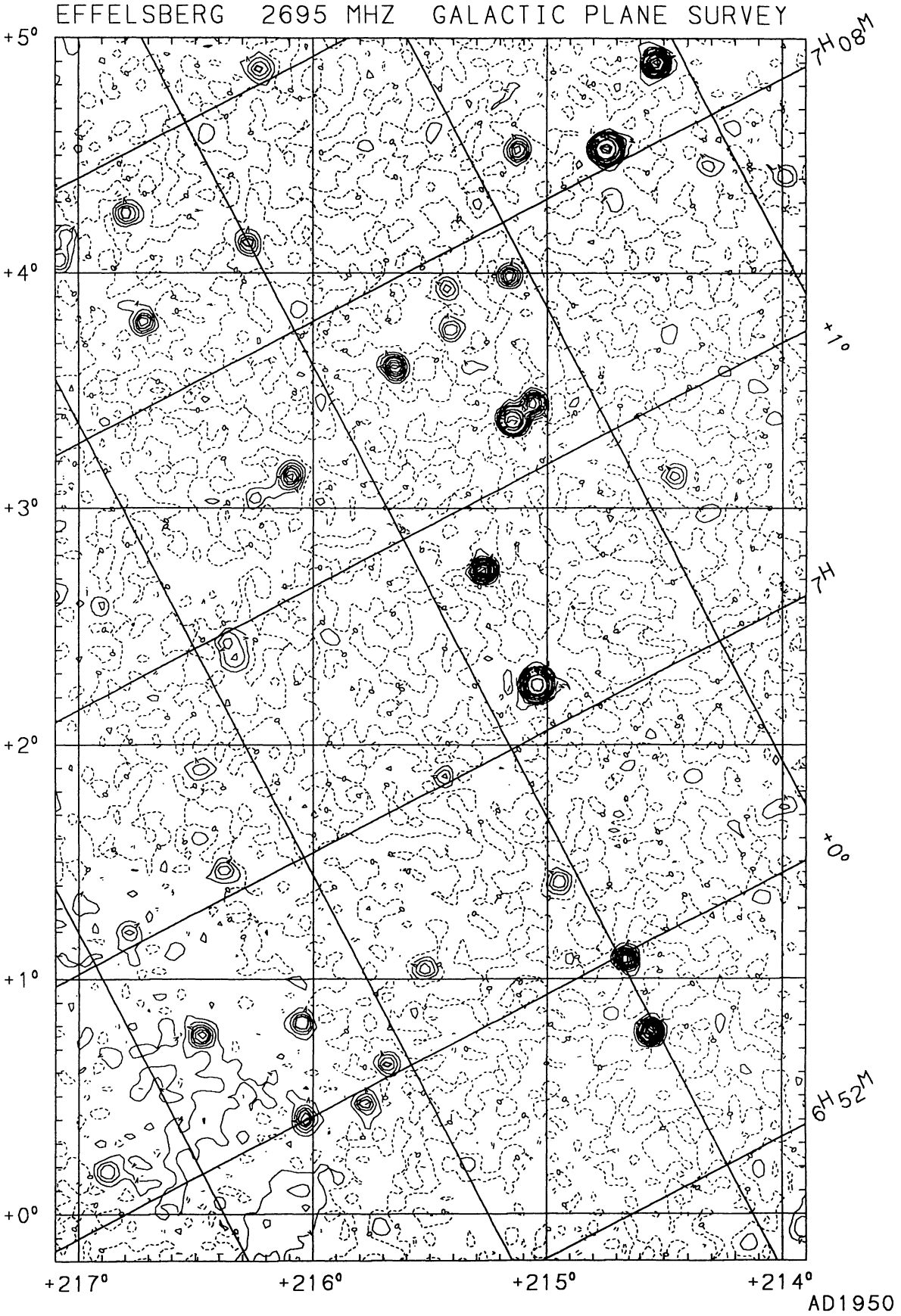

FIGURE 94

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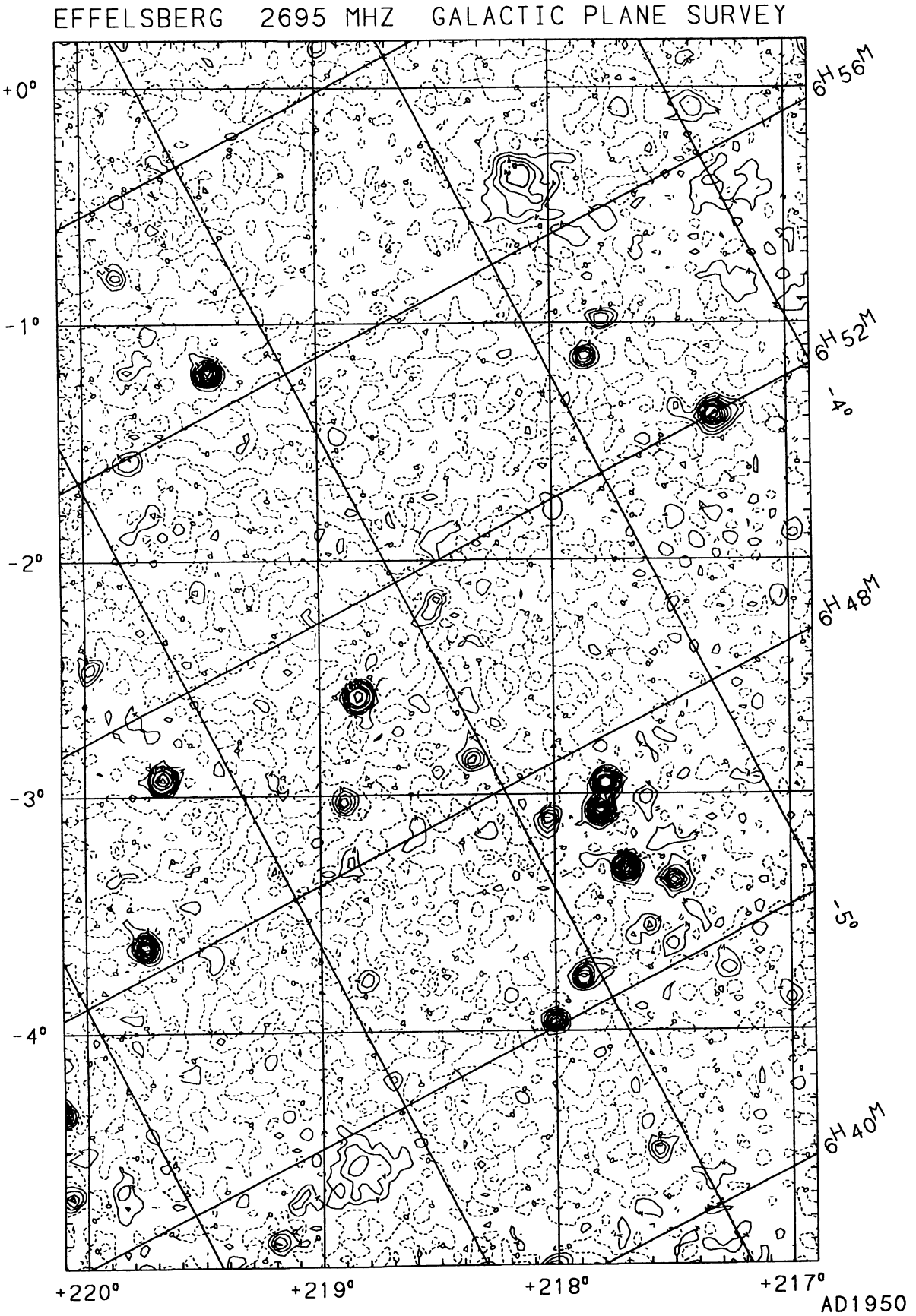

FIGURE 95

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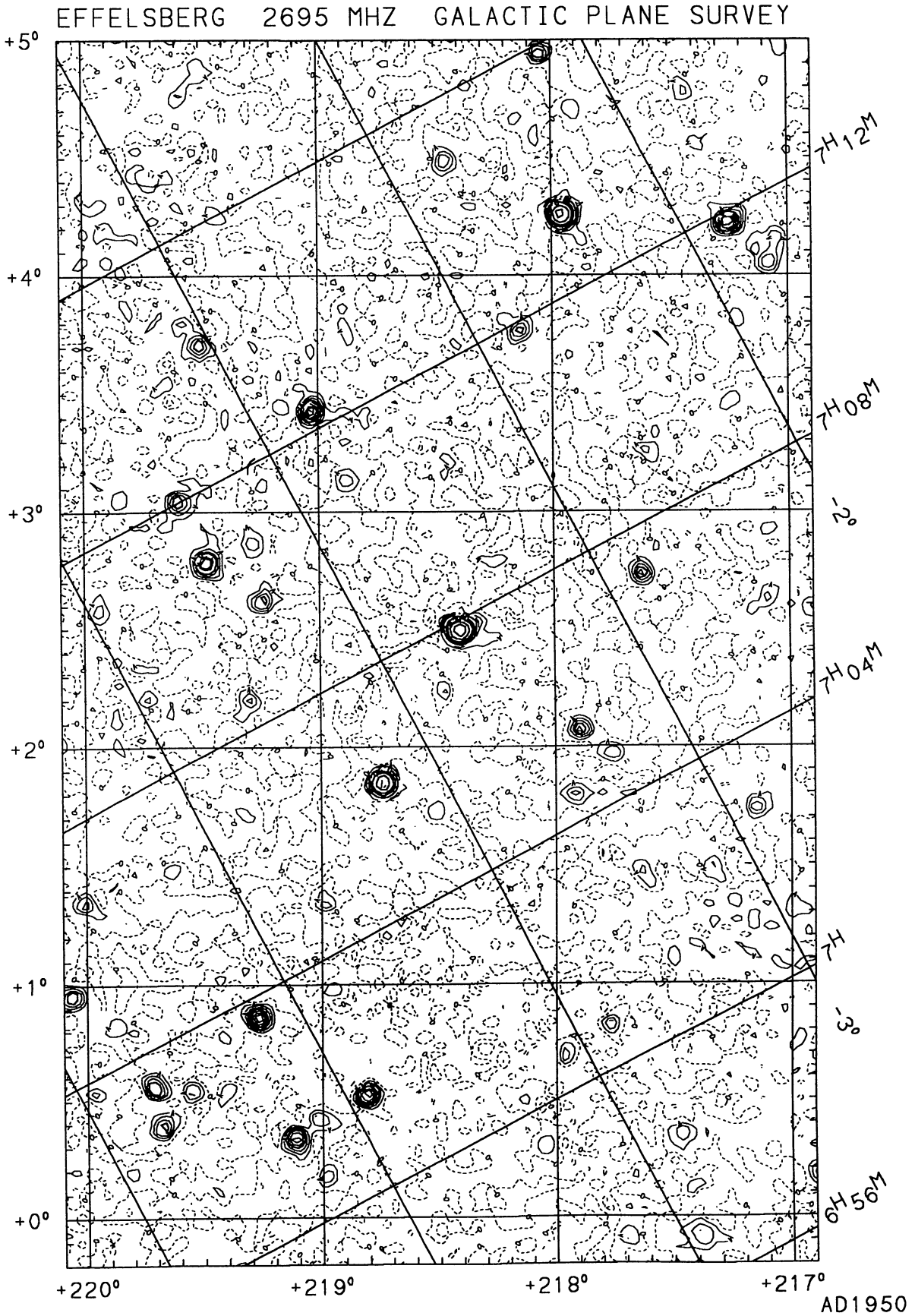

FIGURE 96

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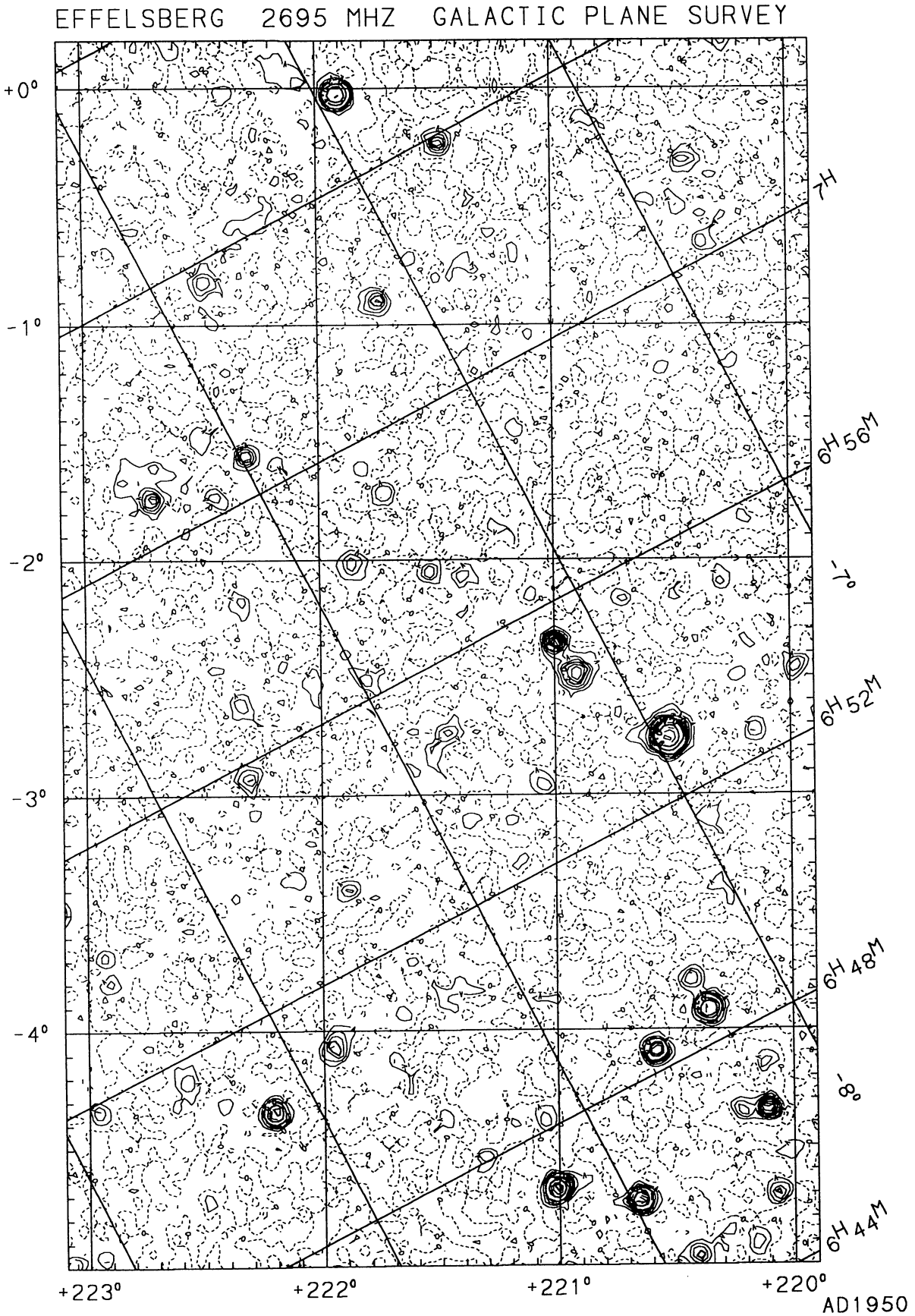

FIGURE 97

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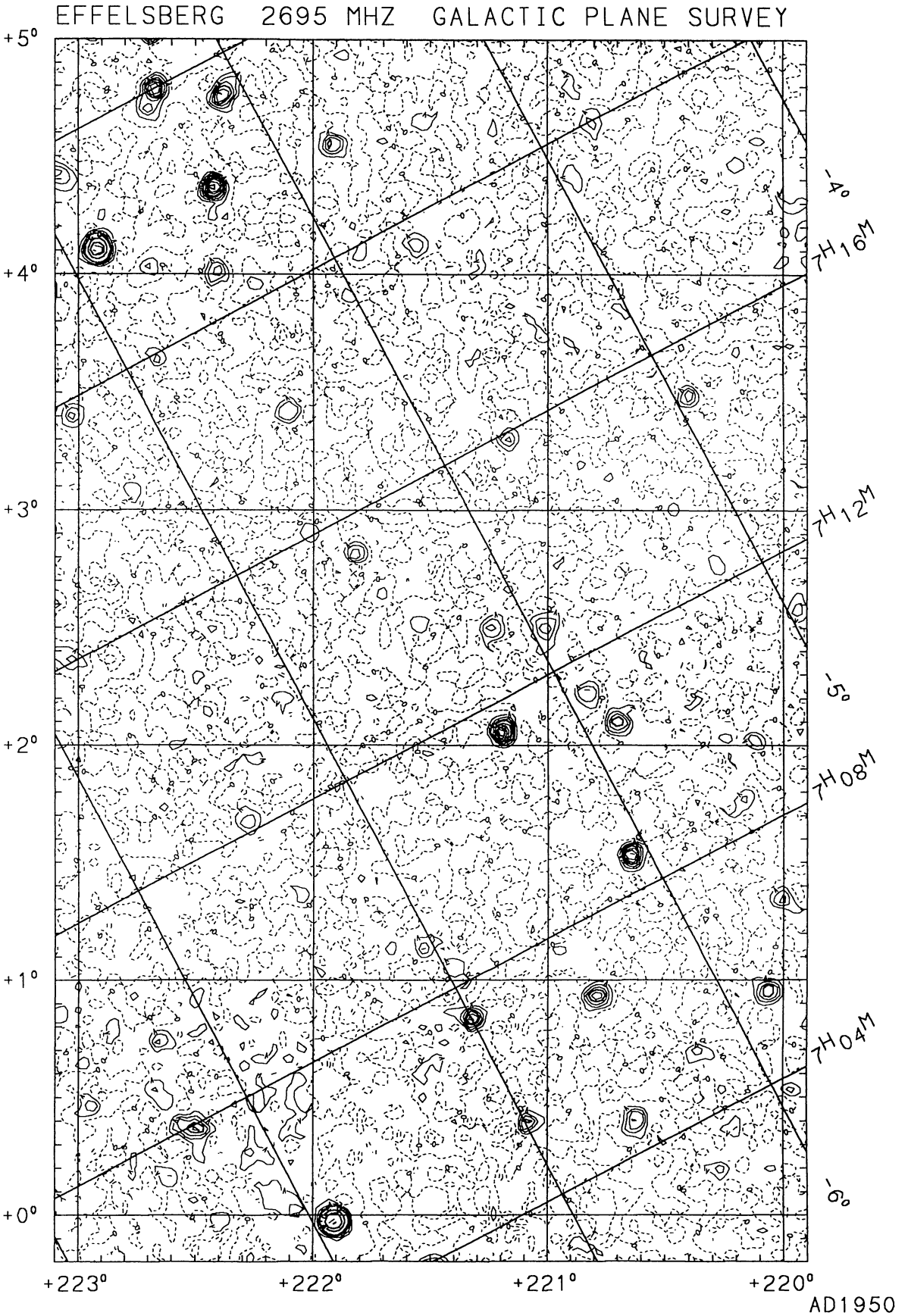

FIGURE 98

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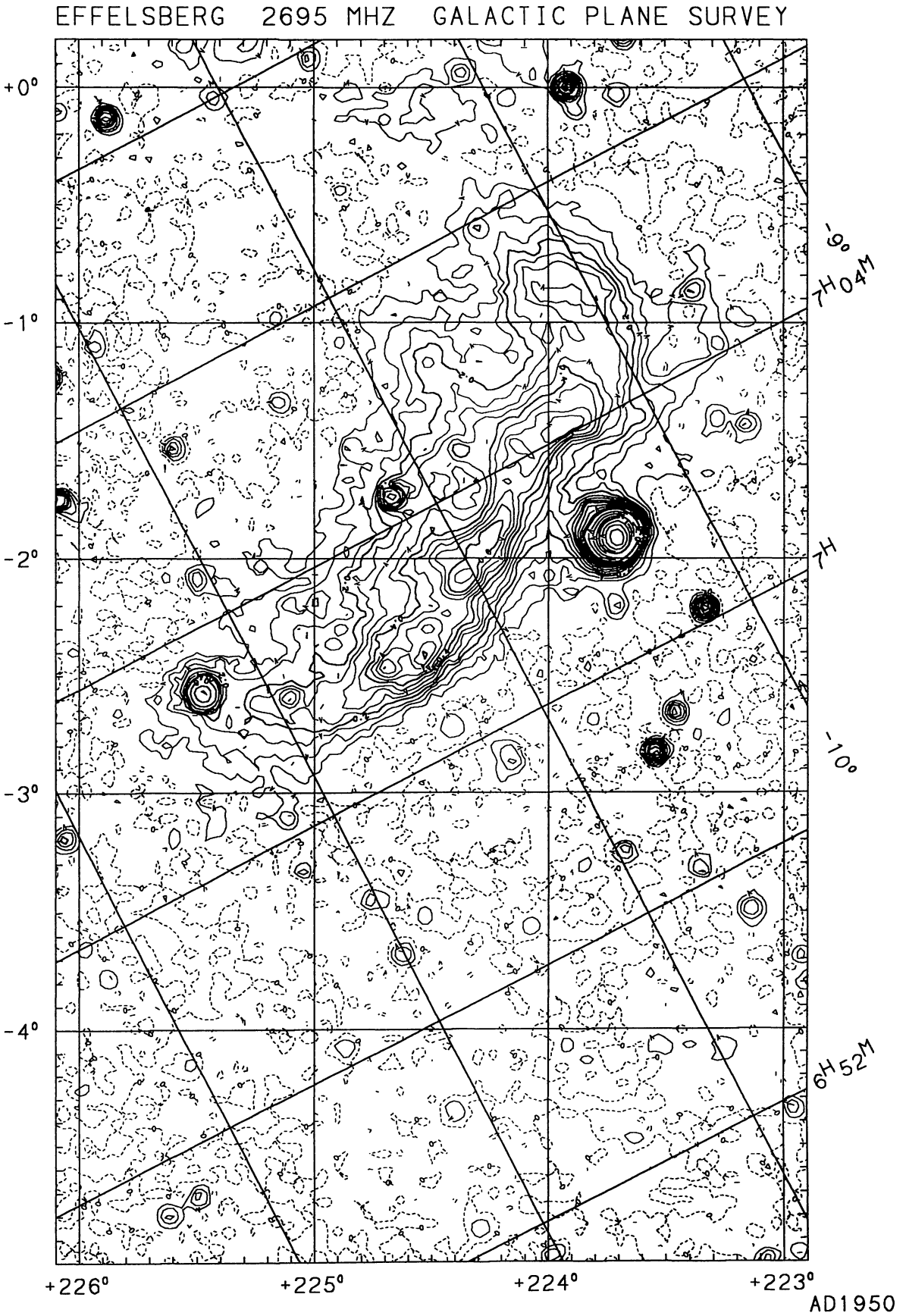

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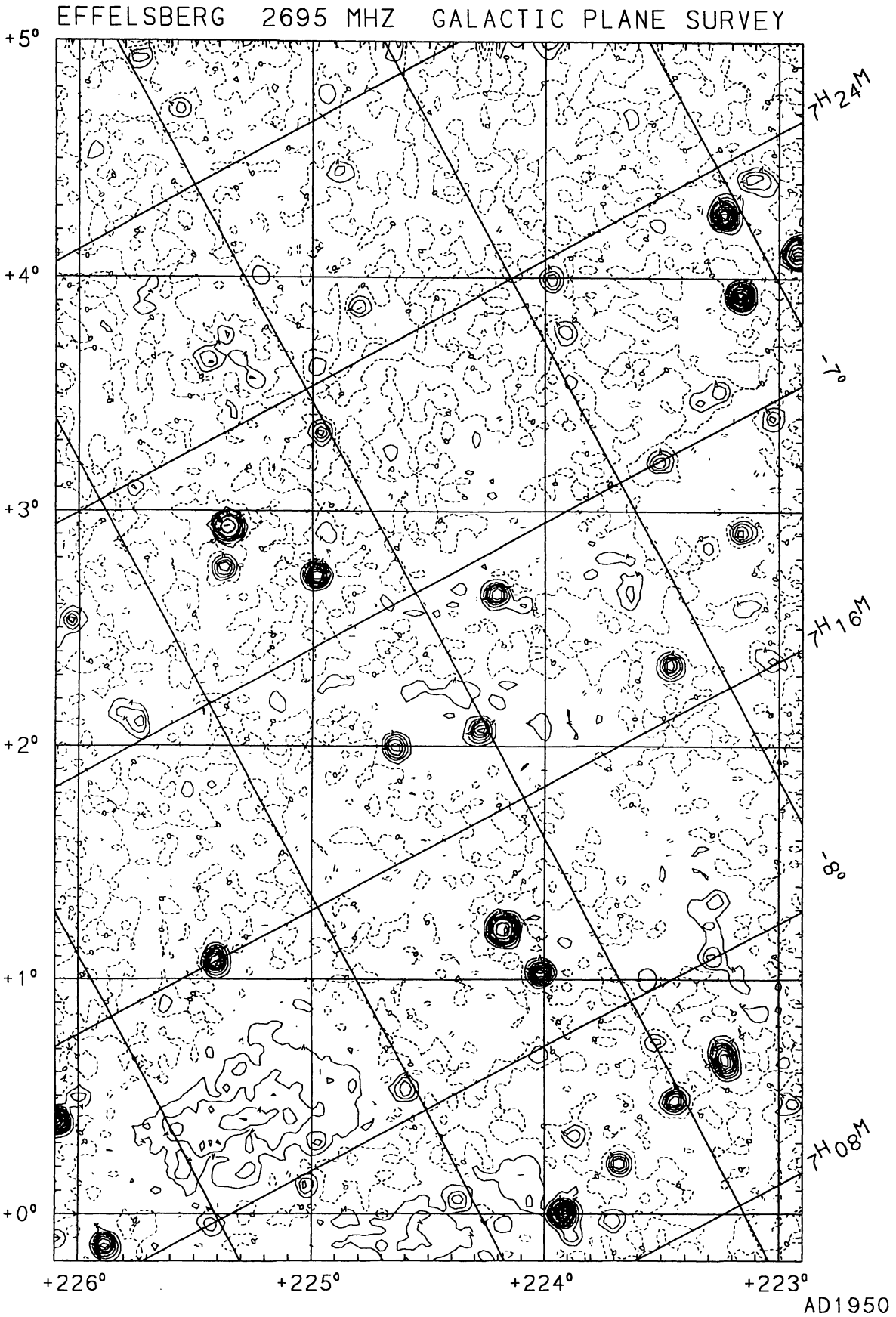

FIGURE 100

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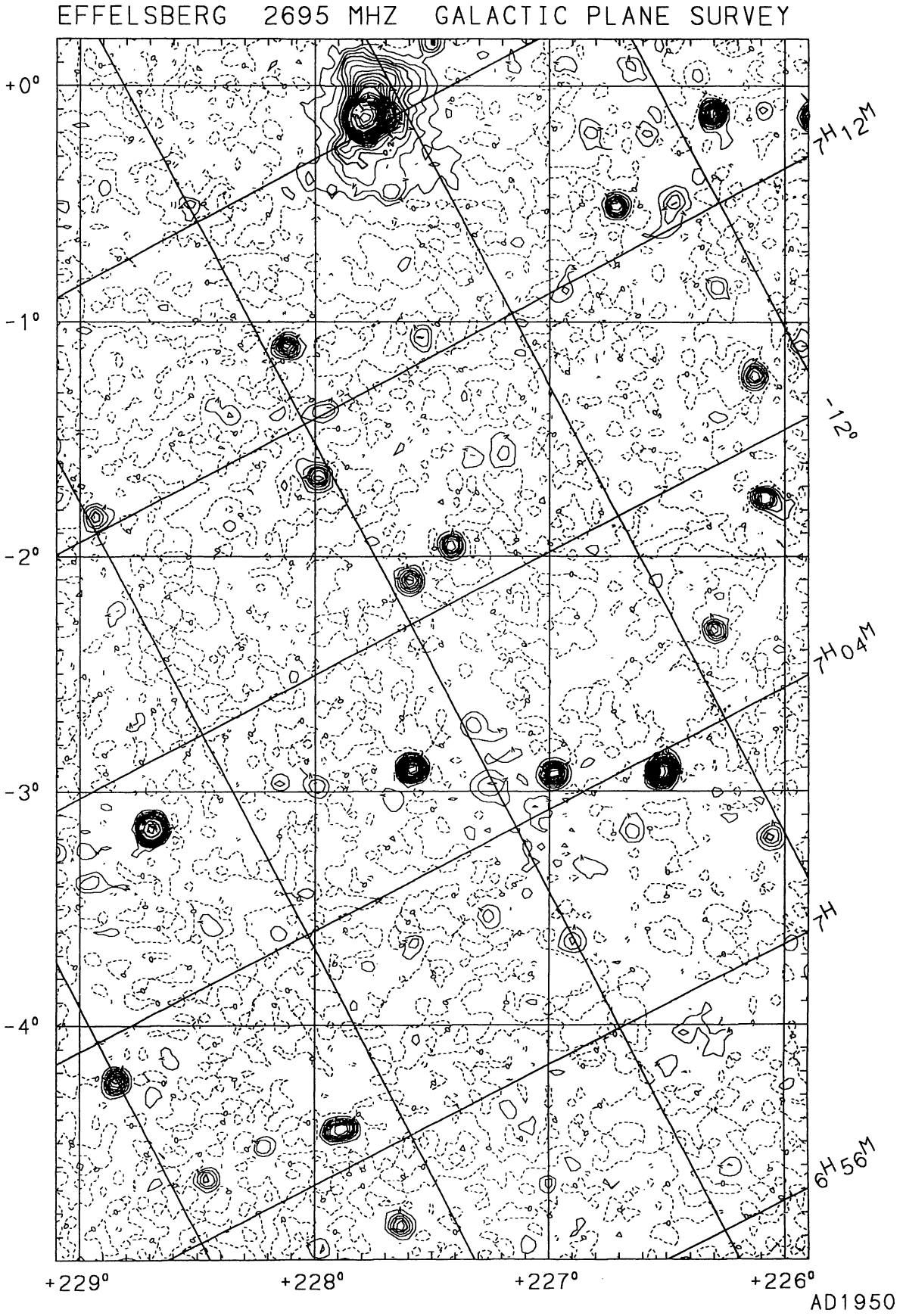

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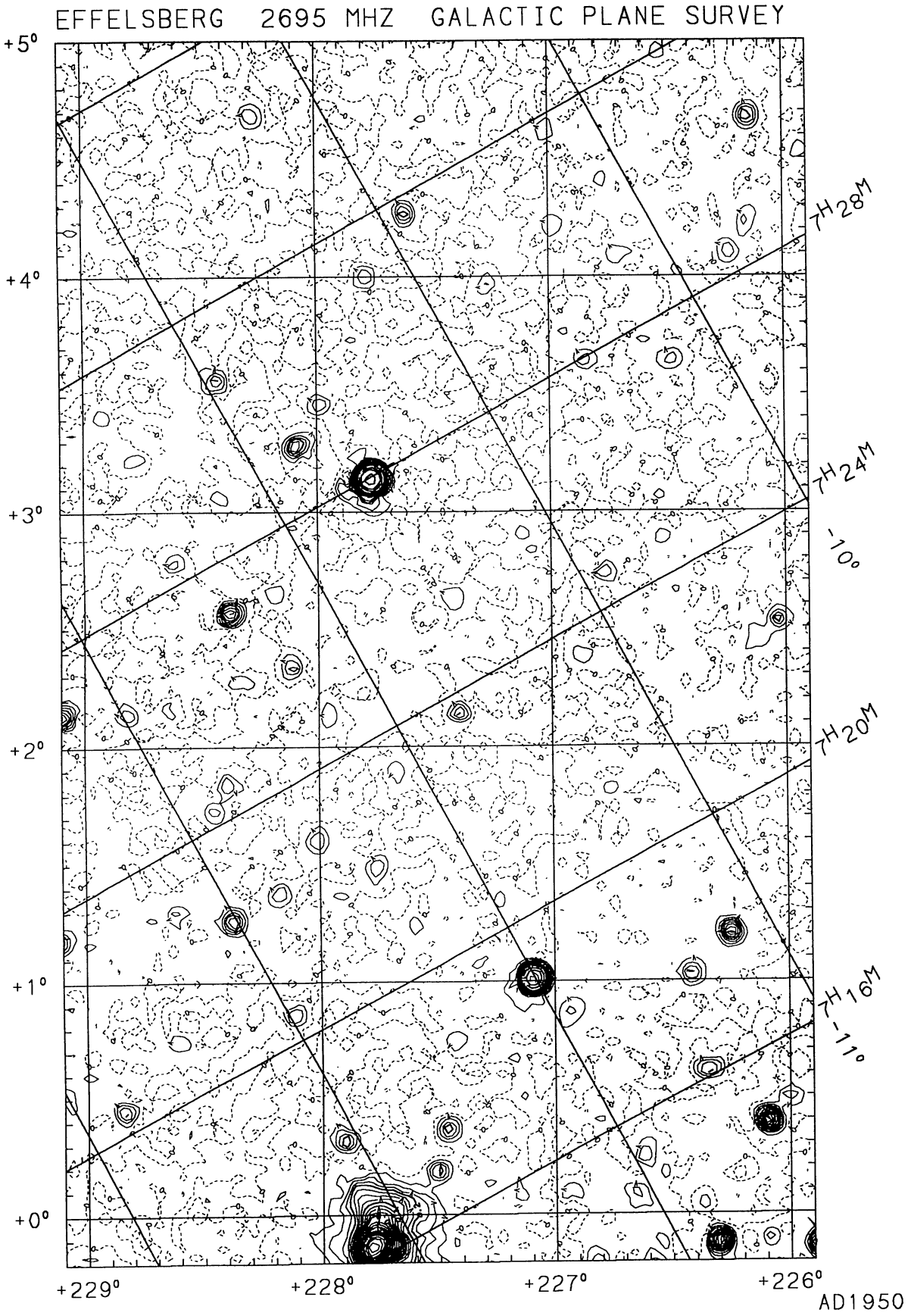

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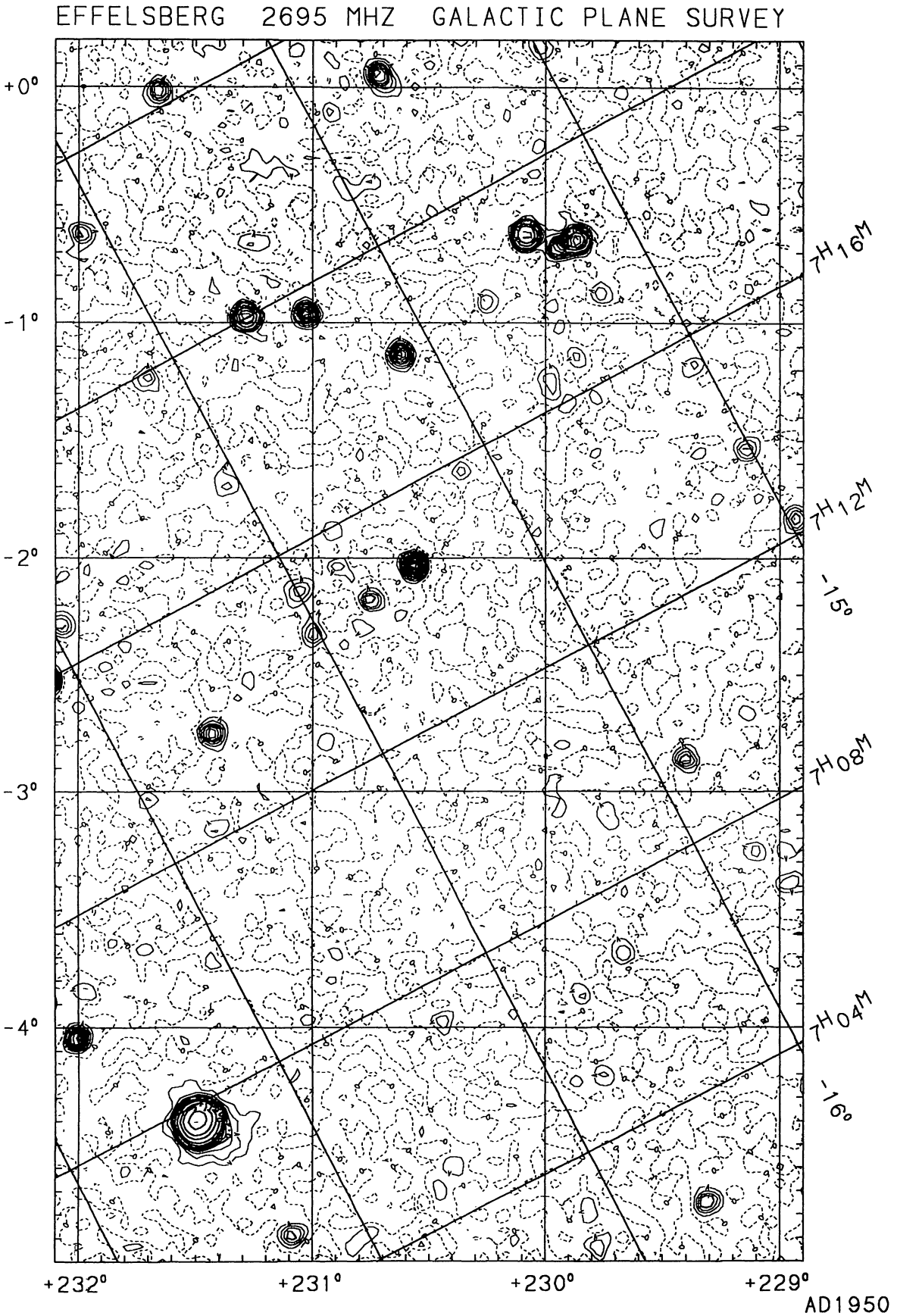

FIGURE 103

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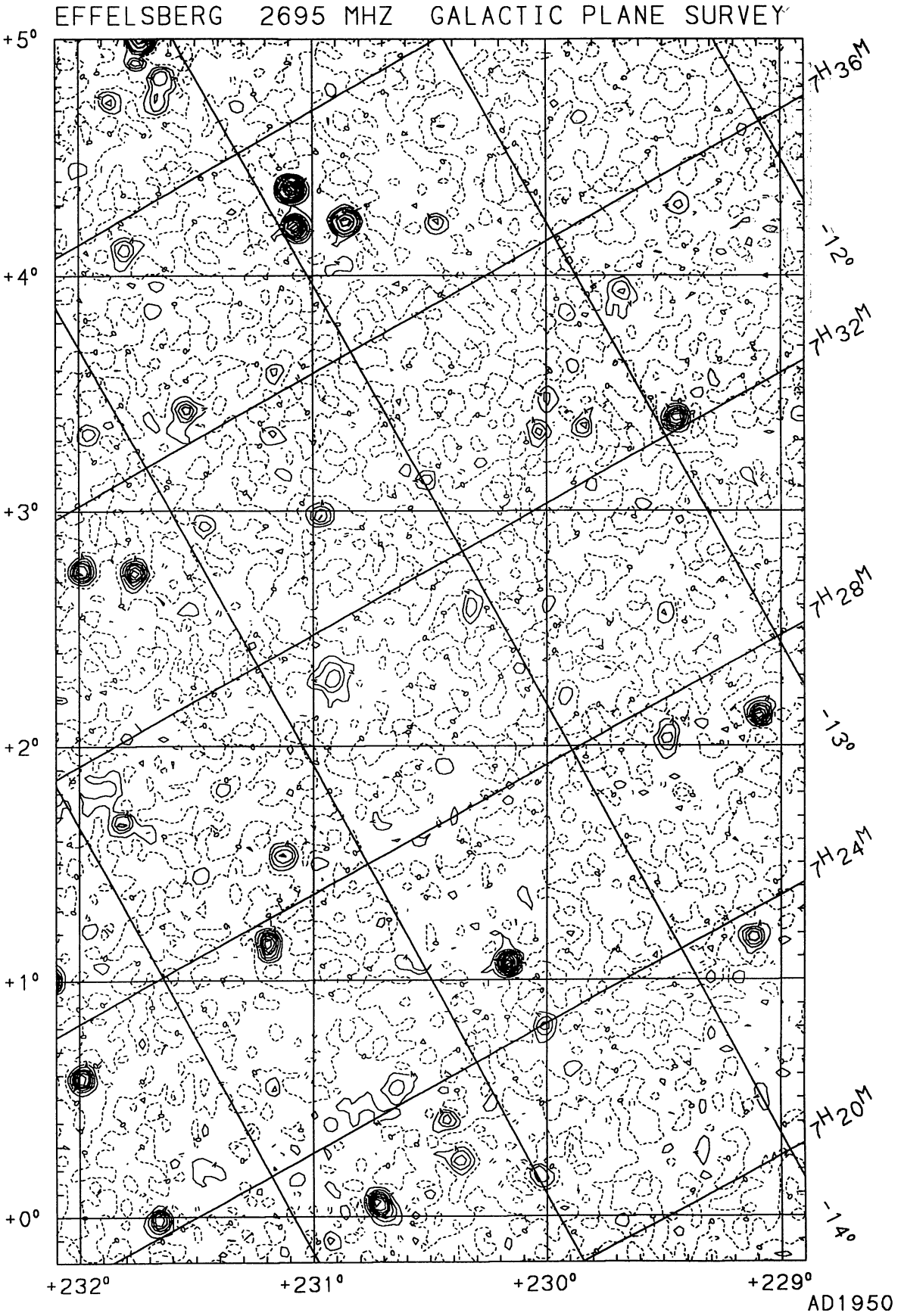

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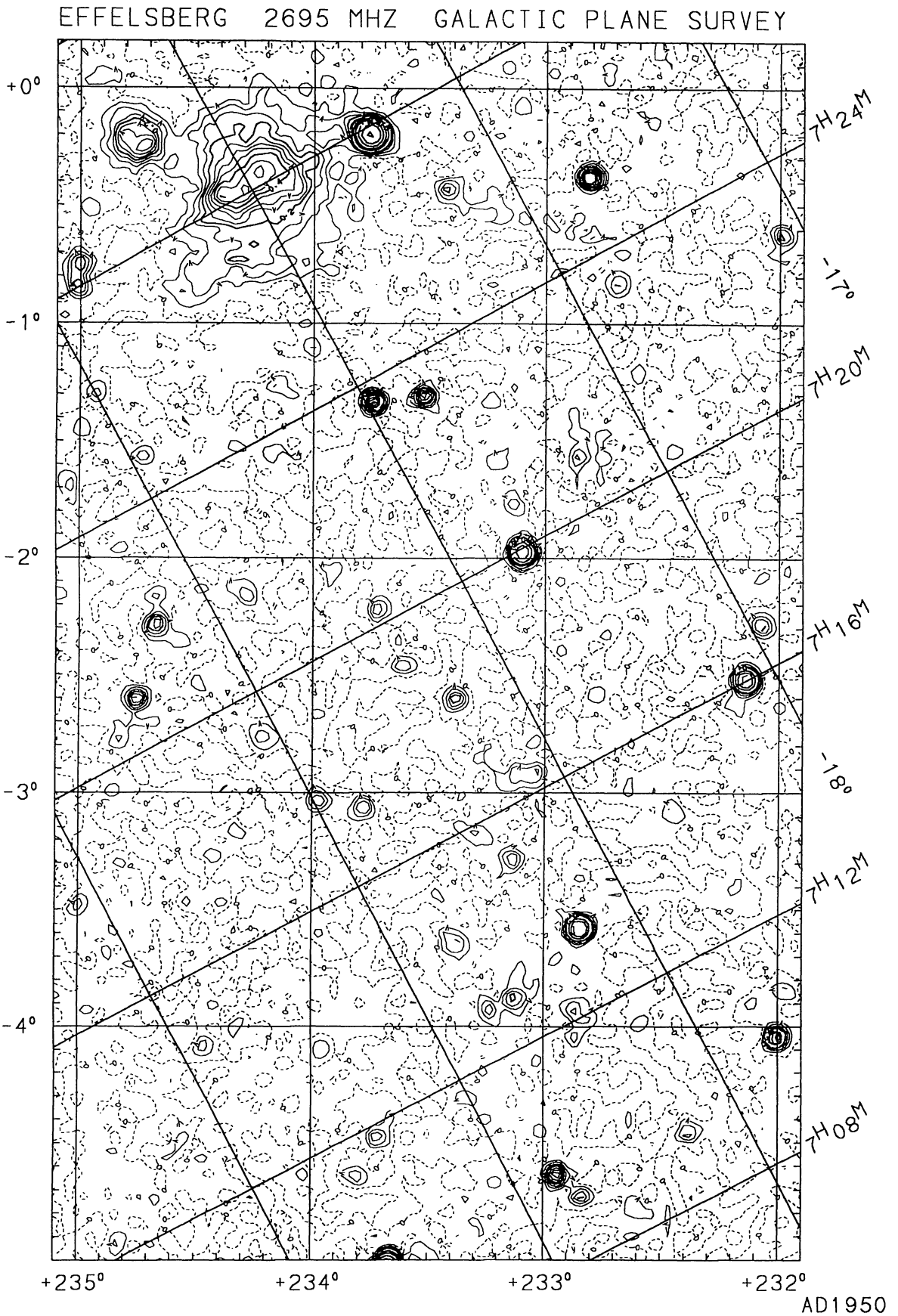

FIGURE 105

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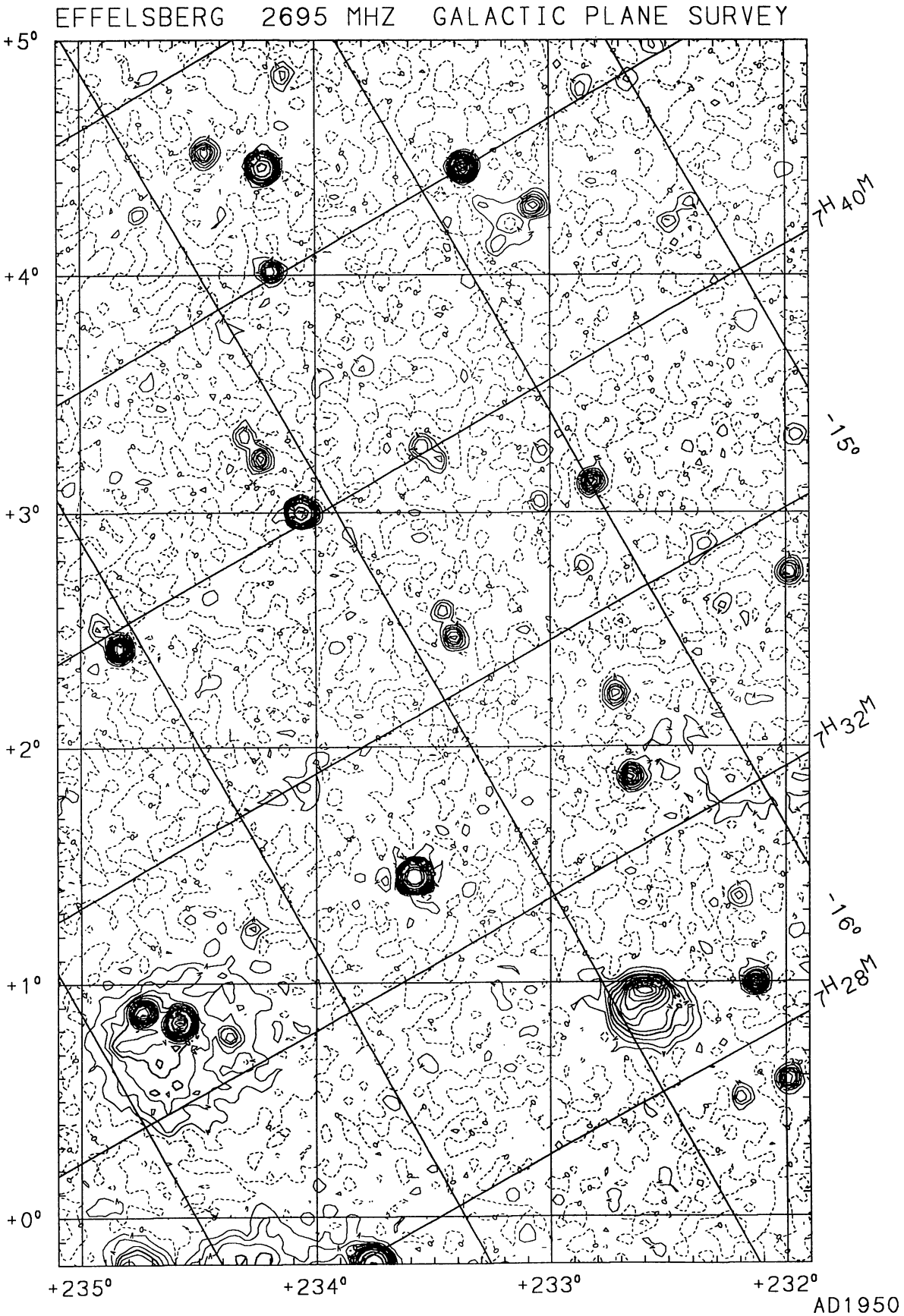

FIGURE 106

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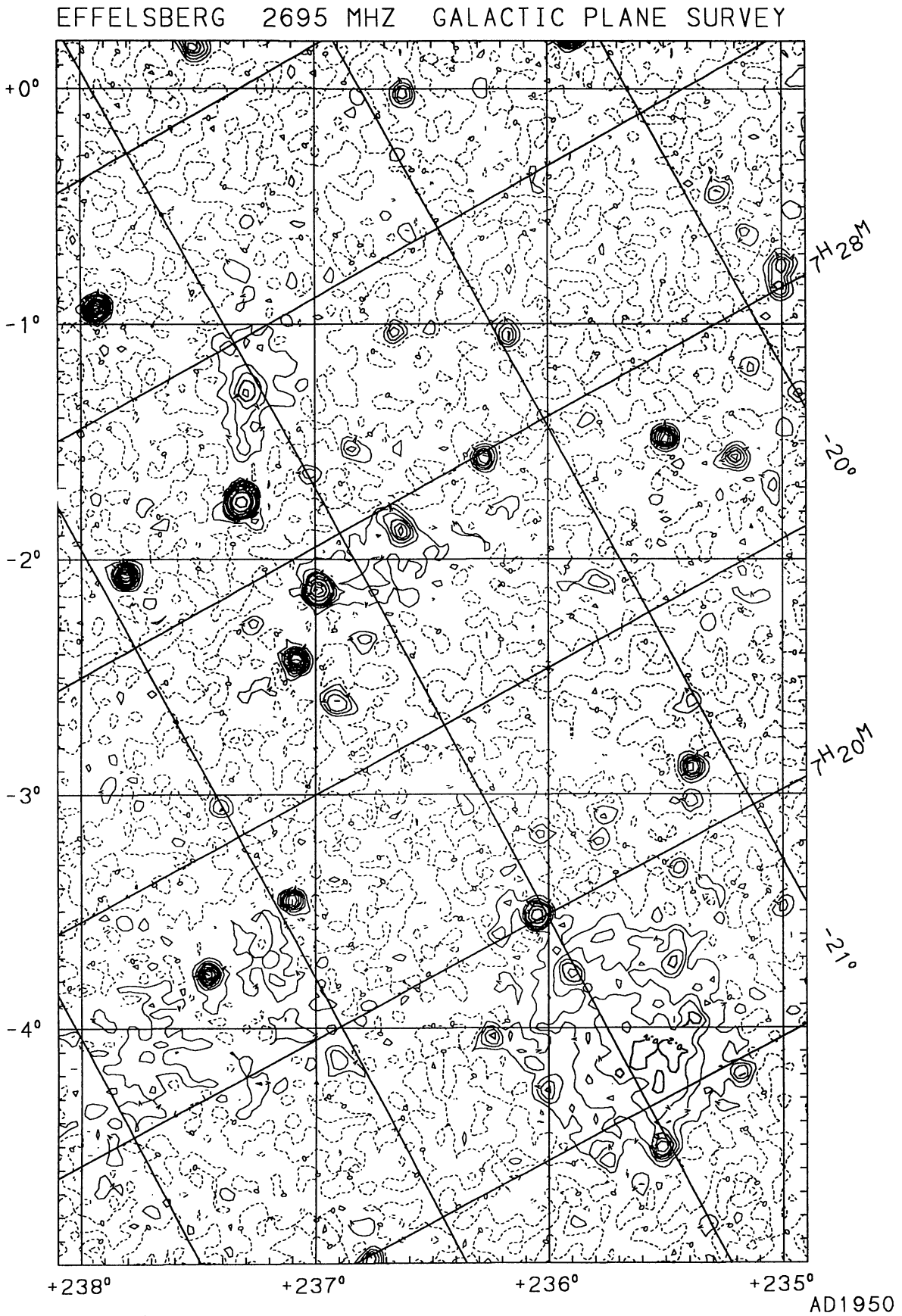

FIGURE 107

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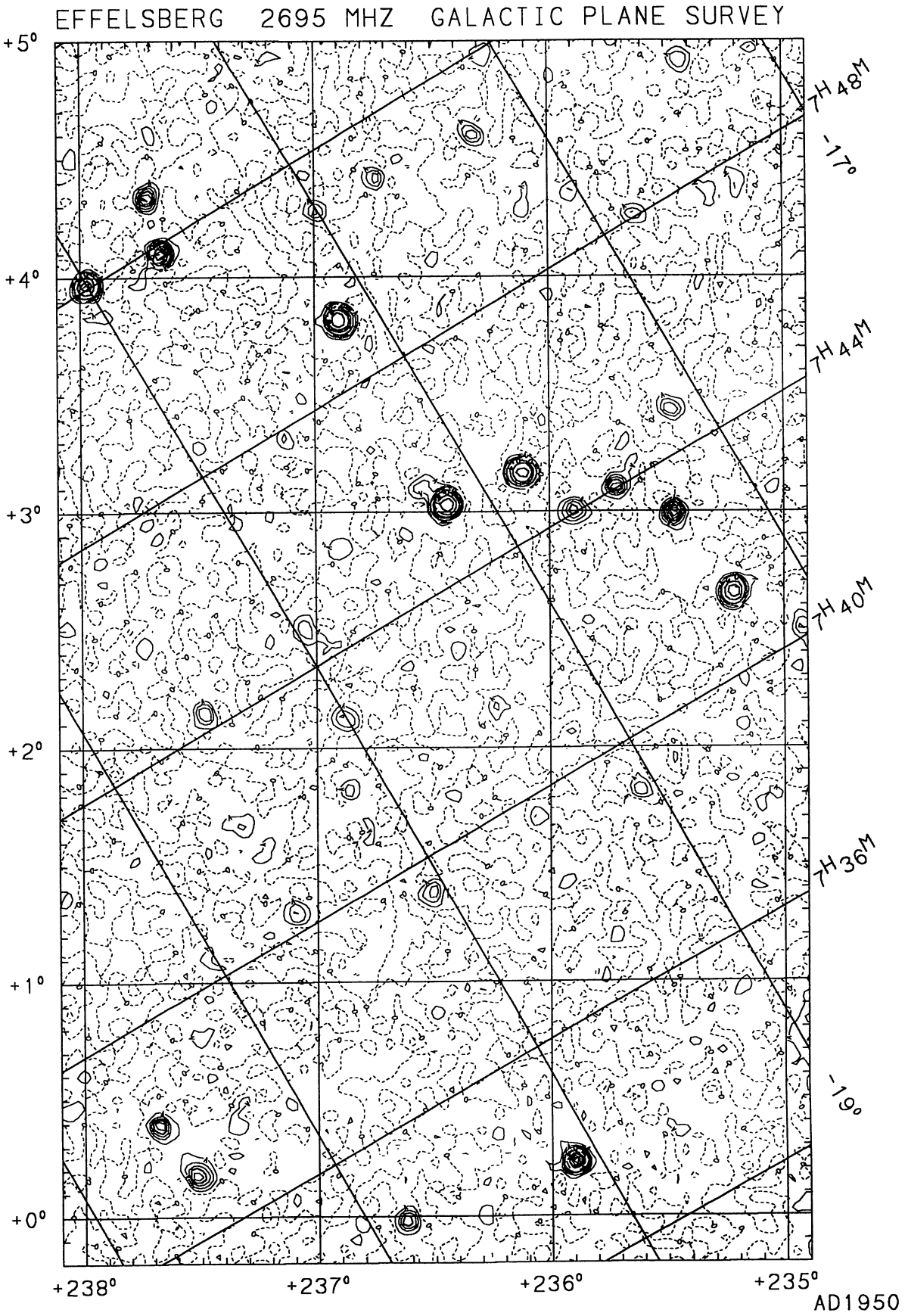

FIGURE 108

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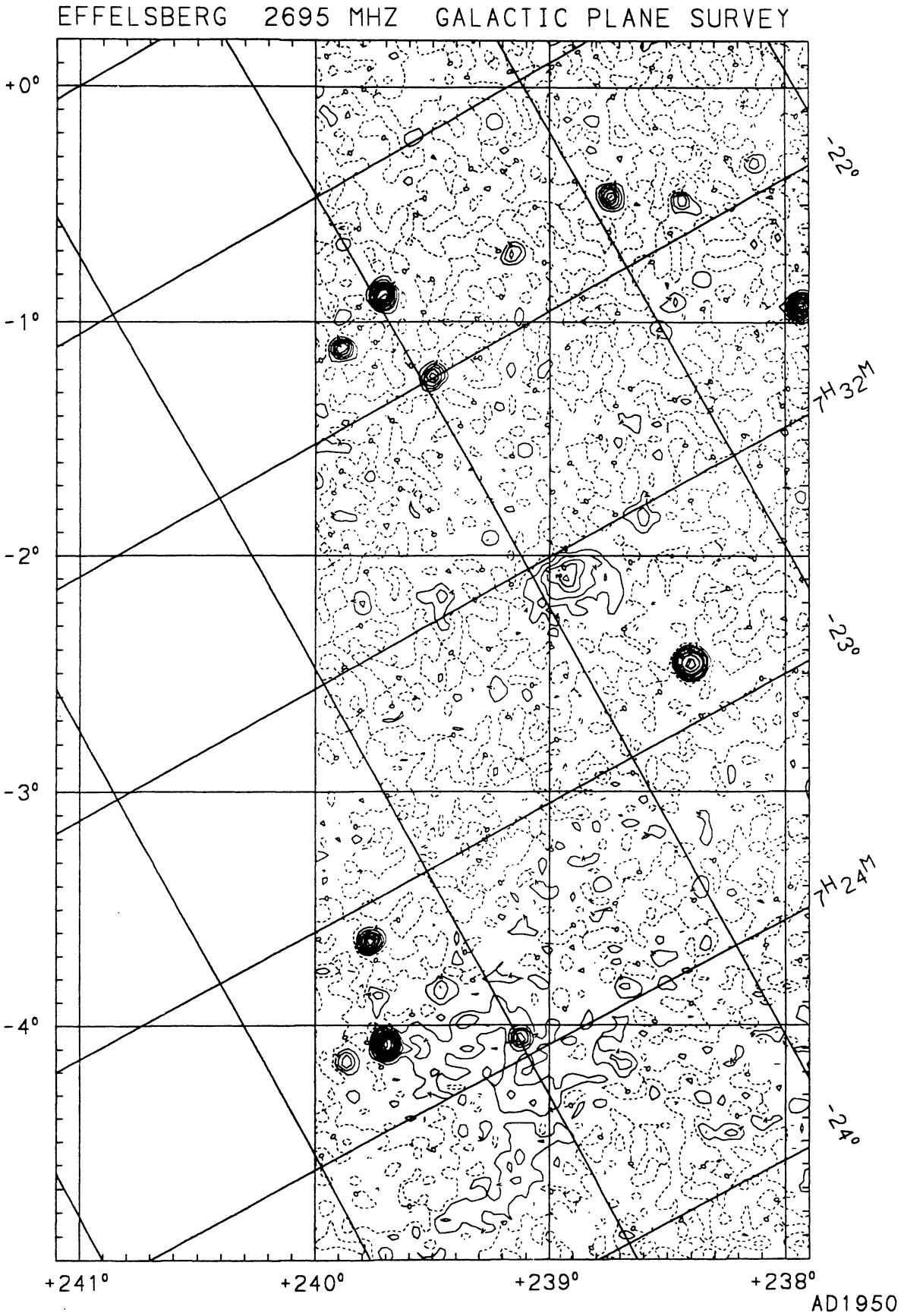

FIGURE 109

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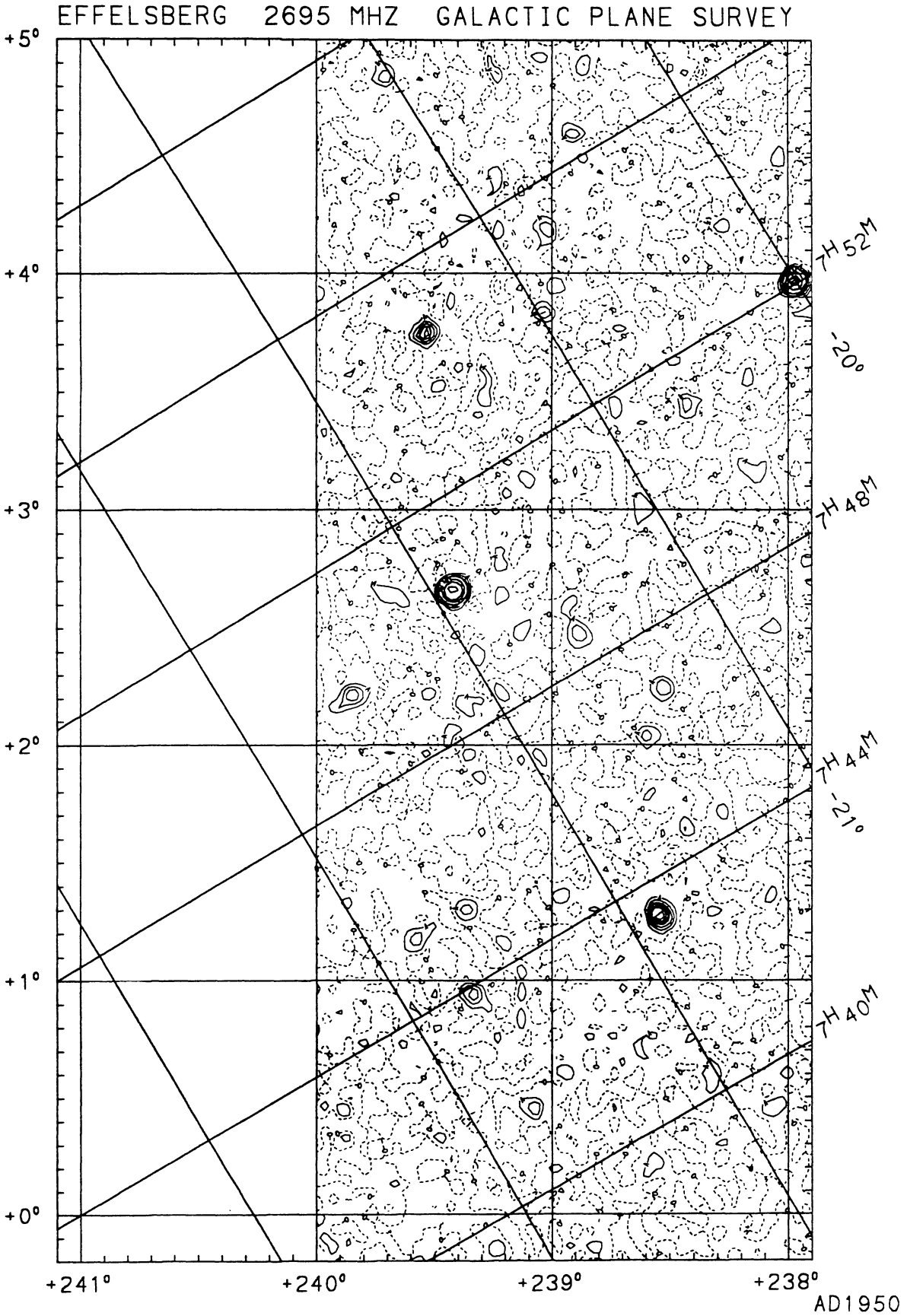

FIGURE 110

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