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CALÁN-TOLOLO SURVEY. IV. SEYFERT 1 GALAXIES

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RESUMEN

Se presenta la cuarta lista de la Exploración Calán-Tololo. Contiene información sobre 50 galaxias Seyfert tipo 1, en el hemisferio austral. Los objetos fueron encontrados en placas de prisma objetivo tomadas con el telescopio Curtis-Schmidt del Observatorio Interamericano de Cerro Tololo; se utilizaron placas IIIaJ y el prisma *UV*. La presente lista sólo contiene galaxias Seyferts confirmadas, obtenidas de una larga lista de candidatos. La naturaleza Seyfert de estas galaxias fue establecida con espectrofotometría de rendija realizada en el Observatorio Carnegie Austral de Cerro Las Campanas, utilizando el telescopio du Pont de 2.5-m, así como también en el Observatorio Inter-Americano de Cerro Tololo utilizando el telescopio de 4-m; la espectrofotometría será publicada posteriormente.

ABSTRACT

The fourth list of the Calán-Tololo Survey is presented. It contains information for 50 new type 1 Seyfert galaxies in the southern hemisphere. The objects were found searching objective prism plates from the Curtis-Schmidt telescope at Cerro Tololo Inter-American Observatory, using the thin *UV* prism and IIIaJ plates. The present list contains only confirmed Seyfert galaxies, drawn from a larger unpublished list of Seyfert galaxy candidates. The Seyfert nature of these objects was established through slit spectrophotometry performed at Las Campanas Observatory using the du Pont 2.5-m telescope and also at CTIO using the 4-m telescope; the spectrophotometry will be published elsewhere.

Key Words: **GALAXIES–SEYFERTS — QUASARS**

1. INTRODUCTION

In 1984 we started at Cerro Calán a survey of the southern sky using the Curtis-Schmidt telescope at Cerro Tololo Inter-American Observatory (CTIO). In order to discover galaxies with an ultraviolet excess, quasars and emission line galaxies, we used the thin *UV* objective prism on the Curtis-Schmidt and IIIaJ plates. The present survey (hereafter Calán-Tololo Survey or CTS) follows similar surveys by Smith (1975), Smith, Aguirre, & Zemelman (1976), MacAlpine, Lewis, & Smith (1977), MacAlpine, Smith, & Lewis (1977a,b), MacAlpine & Lewis (1978), and MacAlpine & Williams (1981). The Calán Tololo Survey has been described by Maza et al. (1988a, 1988b, 1989, 1991, 1992, 1993). The first list published by Maza et al. (1989) (hereafter List 1) reports the discovery of 30 Seyfert galaxies of type 1, their spectroscopic follow up was done by Maza & Ruiz (1989). In a second list 40 new Seyfert 1 galaxies were reported (Maza et al. 1992). Here we present a third list containing 50 Seyfert galaxies, all of which have been checked through slit spectrophotometry at the Las Campanas Observatory 2.5-m du Pont telescope and/or at the CTIO 4-m telescope. The spectroscopic information will be presented elsewhere (Maza & Ruiz 1995).

2. OBSERVATIONS

We have obtained plates exposed to the sky limit (90 minutes) for 163 fields at galactic latitude b such that $|b| \geq 20°$, covering 3400 deg^2 on the southern sky (see Figure 1 in List 1). We have used the Curtis

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Schmidt telescope at CTIO, the thin *UV* prism (Blanco 1974), and unfiltered Eastman Kodak IIIaJ plates baked in formic gas. The spectra cover the range from the atmospheric cutoff (3300 A) to the red limit of the IIIaJ plate sensitivity (5350 A) at a reciprocal dispersion of 1740 A mm^{-1} at Hβ, 1360 A mm^{-1} at Hγ, and 1100 A mm^{-1} at 3727 A. Unwidened spectra have a resolution of 35 A at Hβ and 22 A at 3727 A, under typical seeing conditions (2″).

Each photographic plate is searched using a binocular microscope at 12×, usually by one of us (L.E.G., M.W., or R.A.). A final selection is made checking each candidate against the ESO Quick Blue Charts or against our own direct plates taken with the Curtis Schmidt telescope at CTIO or with the Maksutov camera (70/100/210 cm, 5° × 5° on 18 cm × 18 cm plates at 99″ mm^{-1}) at the Cerro El Roble Astronomical Station of the Universidad de Chile. The selection criteria for Seyfert galaxy candidates have been described in List 1 and by Maza & Ruiz (1989). Only galaxies with an ultraviolet excess are selected as candidates. Sometimes the Hβ line is seen in emission; very seldom more than two lines are detectable on the objective prism spectrum of a Seyfert galaxy. The limiting magnitude for candidate selection depends strongly on plate quality; for Seyfert galaxies we estimate the limiting magnitude of our survey to be $B \sim 18$ mag, but incompleteness occurs for galaxies fainter than 17th mag (Barrientos 1993).

We have performed slit spectrophotometry of each candidate using the 2.5-m du Pont telescope at Las Campanas Observatory and/or using the 4-m telescope at CTIO. On the average one out of three Seyfert galaxy candidates turns out to be a new Seyfert galaxy of type 1. Our good candidates (those with a very bright nucleus and a strong ultraviolet excess) almost always turn out to be Seyfert galaxies while our poor candidates (fainter nucleus with a moderate ultraviolet excess) are more often Seyfert 2's, liners or galaxies with a starburst in their nucleus. In this list we present only the successful Seyfert 1 galaxy candidates.

3. LIST 4

Table 1 presents the data for this new group of Seyfert 1 galaxies. Preliminary equatorial coordinates for each Seyfert galaxy candidate were obtained by measuring the objective prism Curtis Schmidt plate, using the X-Y measuring engine at Cerro Calán (ASCORECORD by Zeiss Jena). Using those coordinates we extracted a 10′ × 10′ image of the corresponding area of the sky, using the "Digitized Sky Survey" (DSS). On those images we computed the final coordinates relative to the plate solution contained in the header of each image supplied by the DSS. We used IRAF and STSDAS software pack-

TABLE 1

CALAN-TOLOLO SURVEY LIST 4

CT	Object[a]	α (1950.0)	δ	B_J	D	ESO field	x (mm)	y (mm)	DSS disk
71	A18.10	$1^h\ 5^m\ 54.7^s$	−35° 56′ 4″	16.4	14″	352	234.2	81.2	24
72	H21.01	1 28 47.6	−54 21 26	16.5	24	152	236.0	171.5	11
73	H22.02	1 43 50.4	−53 24 1	16.4	18	152	118.6	224.5	11
74	H23.01*	2 38 19.7	−52 11 32	15.4	37	198	86.5	23.5	14
75	A25.01	3 8 51.3	−34 58 9	17.1	12	357	203.0	134.7	24
76	A25.05	3 13 24.9	−35 6 27	16.5	22	357	153.0	127.8	24
77	A26.02*	3 33 40.2	−37 6 55	16.6	14	358	189.8	11.5	24
78	A26.03	3 41 16.8	−37 1 31	16.8	15	358	108.8	16.7	24
79	C29.07	4 11 18.4	−44 45 51	17.0	16	250	165.9	138.6	17
80	H29.01*	4 30 40.0	−53 36 56	16.2	18	157	101.2	213.5	11
81	A30.14	4 47 27.5	−33 9 6	16.2	24	361	173.5	243.7	25
82	A30.23	5 0 32.3	−36 4 22	17.3	12	361	31.1	87.2	25
83	H34.03	5 57 14.7	−53 57 14	15.8	41	160	198.2	201.2	11
84	B31.01*	5 58 2.0	−38 20 5	15.4	43	307	226.6	226.0	21
85	H34.06	6 9 17.5	−56 6 59	16.2	27	160	105.2	86.8	11
86	M98.14	9 22 39.7	−22 19 6	16.3	21	565	225.2	28.3	38
87	M99.21	9 39 8.8	−25 15 50	17.0	15	498	88.9	149.2	34
88	J01.12	9 45 54.2	−21 25 29	17.0	15	566	200.3	74.2	38
89	R04.08	10 14 11.6	−12 40 42	16.7	22	...	...	...	48
90	J03.19	10 15 56.6	−20 2 27	15.7	33	567	85.7	151.7	39

TABLE 1 (CONTINUED)

CT	Object[a]	α (1950.0)	δ	B_J	D	ESO field	x (mm)	y (mm)	DSS disk
91	R04.05	10 26 37.6	−15 46 20	17.1	17	...	...	...	43
92	J04.08	10 31 57.3	−18 46 35	15.5	25	568	151.4	225.3	39
93	M02.30	10 32 57.0	−27 7 30	16.2	27	501	232.1	50.4	34
94	J04.13	10 33 56.8	−21 11 6	17.1	12	568	126.3	96.9	39
95	R08.47	11 42 19.0	−14 22 45	17.4	10	...	...	...	44
96	R10.15	12 16 18.8	−16 50 40	16.7	15	...	...	...	44
97	R10.08	12 19 35.0	−13 57 15	16.6	16	...	...	...	44
98	J10.07	12 30 28.0	−19 12 25	16.8	15	574	249.3	197.1	39
99	J10.09	12 33 51.5	−21 3 45	16.2	17	574	205.8	98.5	39
100	M10.15	12 42 37.1	−24 42 40	16.0	21	507	265.2	174.7	34
101	R12.15*	12 51 32.3	−14 13 17	14.2	66	...	...	...	44
102	M14.12	13 35 3.2	−25 22 24	16.9	14	509	165.3	138.0	35
103	J13.12	13 51 29.4	−18 13 47	15.5	28	577	22.7	252.4	39
104	J14.05*	13 56 36.7	−19 31 44	15.2	82	578	223.2	186.0	39
105	J15.22*	14 19 49.7	−19 28 25	16.5	19	579	198.5	193.4	39
106	M17.17*	14 44 56.9	−23 47 40	14.5	74	512	119.8	219.1	35
107	J17.17	15 2 47.3	−19 7 28	15.9	42	581	184.3	199.9	39
108	A06.16	21 3 48.0	−36 6 17	16.6	28	402	266.3	73.4	27
109	A08.12	21 32 2.2	−33 42 54	15.7	30	403	221.4	194.5	27
110	A09.64	21 56 3.0	−36 15 15	17.0	17	404	217.8	66.7	28
111	A11.37	22 34 39.9	−37 43 0	17.3	14	345	148.2	255.0	28
112	A11.32	22 39 5.3	−36 5 53	17.2	11	406	271.8	68.0	28
113	A11.22	22 41 6.3	−33 57 47	16.9	14	406	252.8	182.3	28
114	F10.01	22 55 51.9	−29 44 16	15.6	27	469	223.8	152.8	32
115	A12.24*	22 57 38.9	−36 56 7	16.1	23	406	72.7	24.4	28
116	C14.39	23 6 16.0	−42 34 32	17.5	12	290	37.5	261.2	20
117	A12.17	23 7 40.0	−34 27 53	16.2	25	407	221.0	157.2	28
118	C14.46*	23 17 30.2	−42 47 6	15.2	60	291	200.3	262.0	20
119	A13.13	23 27 15.9	−34 16 34	16.2	22	408	272.1	170.0	28
120	A14.12	23 49 7.3	−33 11 46	16.9	15	408	30.0	228.1	28

[a] Alternate designations:

CT 74 = PGC 9998; ESO198−G24; z = 0.045; $V = 14.17, B-V = 0.24, U-B = -0.97$ (V&V)[b];
CT 77 = PGC 13176; 0331−373; z = 0.064; $V = 16.1$; $B-V = 0.3$ (V&V)[b];
CT 80 = PGC 15336; Fairall 303; z = 0.040; $V = 15.6$; $B-V = 0.4$; $U-B = -0.8$ (V&V)[b];
CT 84 = EXO 055620; z = 0.034; $V = 14.98$; $B-V = 1.07$; $U-B = 0.16$ (V&V)[b];
CT 101 = PGC 43559; NGC 4726; NGC 4740; MCG -2-33-30 (Paturel et al. 1989).
CT 104 = PGC 49581; ES 578-G9 (Paturel et al. 1989).
CT 105 = PGC 51213; PKS 1417−19; z = 0.119; $V = 16.66$; $B-V = 0.94$; $U-B = -0.48$ (V&V)[b];
CT 106 = PGC 52666; ESO512−G20; MCG-4-35-8; z = 0.011; $V = 14.5$ (V&V)[b];
CT 115 = MS 22549−37; z = 0.039; $V = 16.0$ (V&V)[b].
CT 118 = PGC 70956; Fairall 1041; z = 0.035 (Paturel et al. 1989).

[b] (V&V): Véron-Cetty & Véron (1993).

ages on a SUN computer. These coordinates are in the system of the "Guide Star Catalogue" of the Space Telescope Science Institute. The precision in right ascension and declination is better than ±2″; probably of the order of ±1″. Column 9 of Table 1 presents a B_J magnitude estimated from the DSS version of the IIIaJ southern survey by the UK Schmidt telescope, UK Science and Engineering Research Council. From those digitized images an angular size for each object was determined by mea-

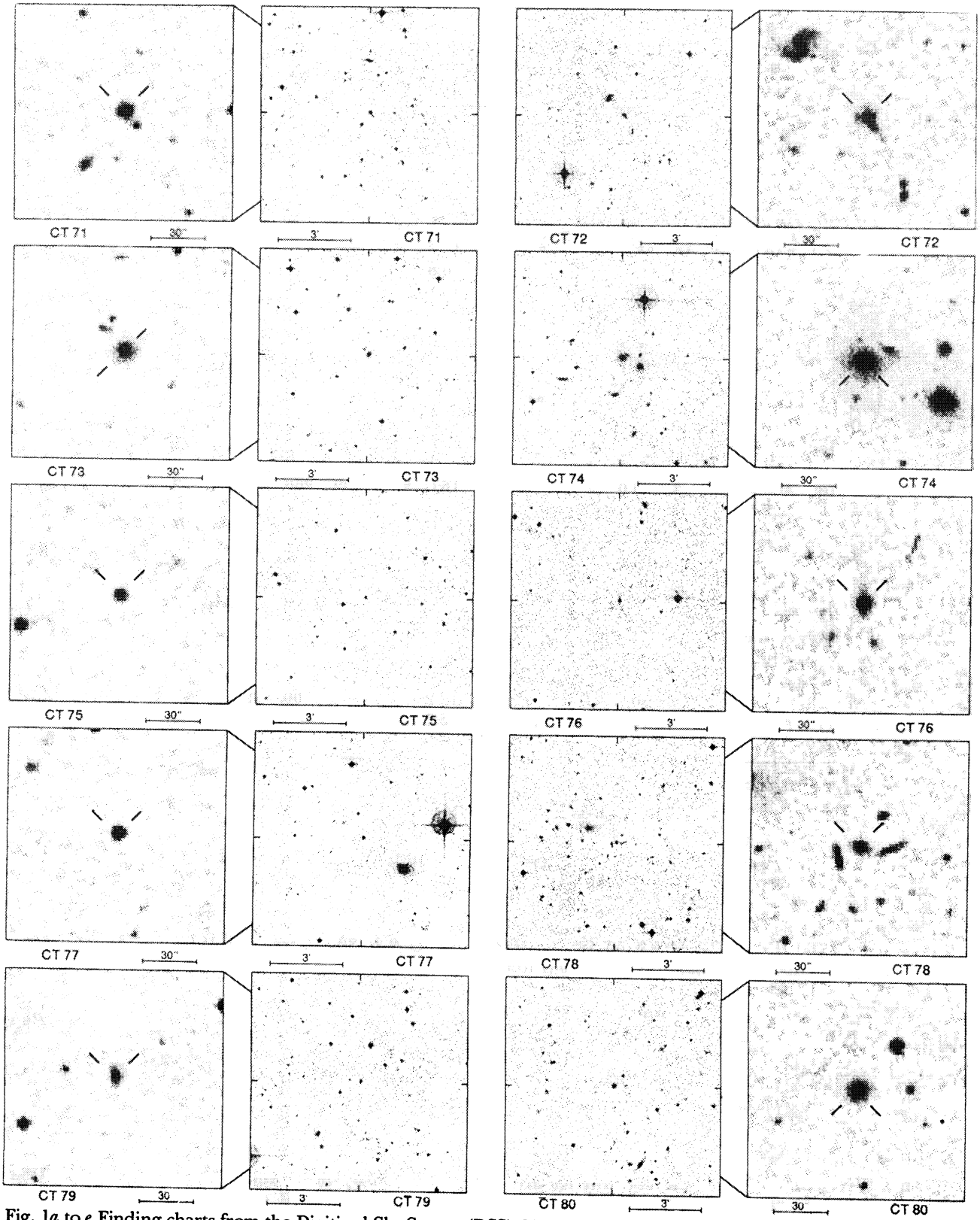

Fig. 1*a* to *e* Finding charts from the Digitized Sky Survey (DSS). North is to the top and east to the left. The second and third columns present $9' \times 9'$ finding charts; the first and fourth columns give $2' \times 2'$ enlargements of the objects on the second and third columns, respectively.

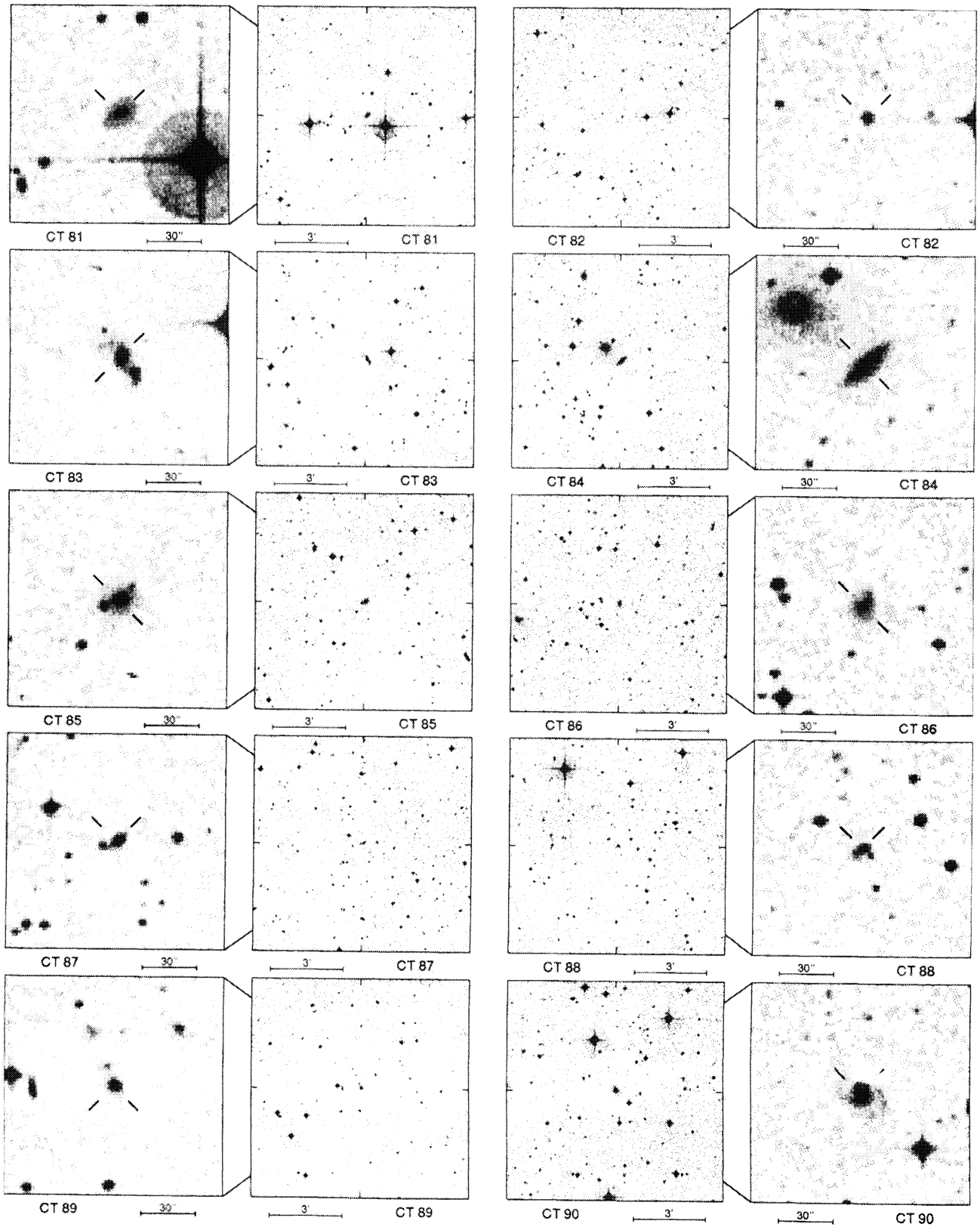

Fig 1*b*. Finding charts from the (DSS).

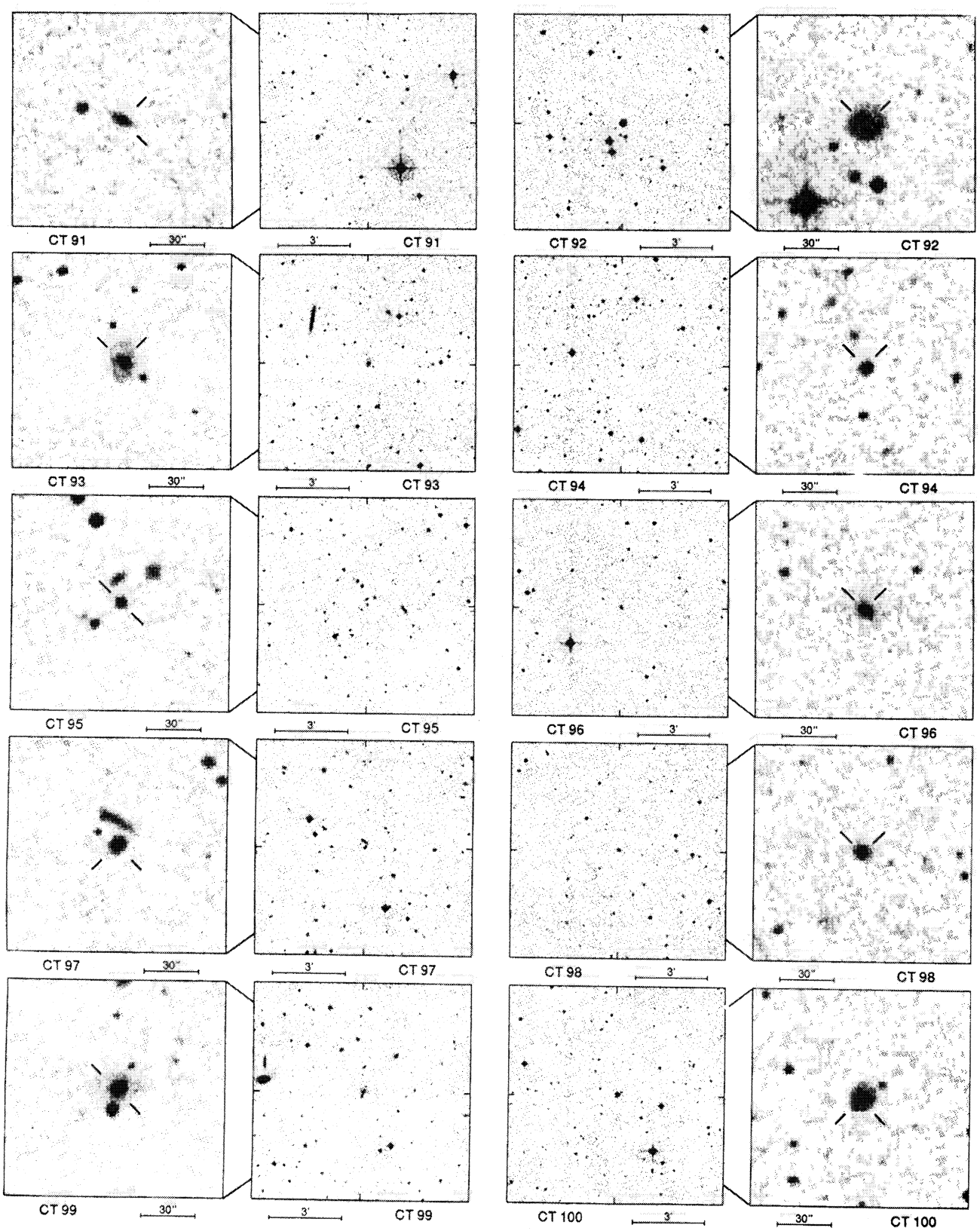

Fig. 1*c*. Finding charts from the (DSS).

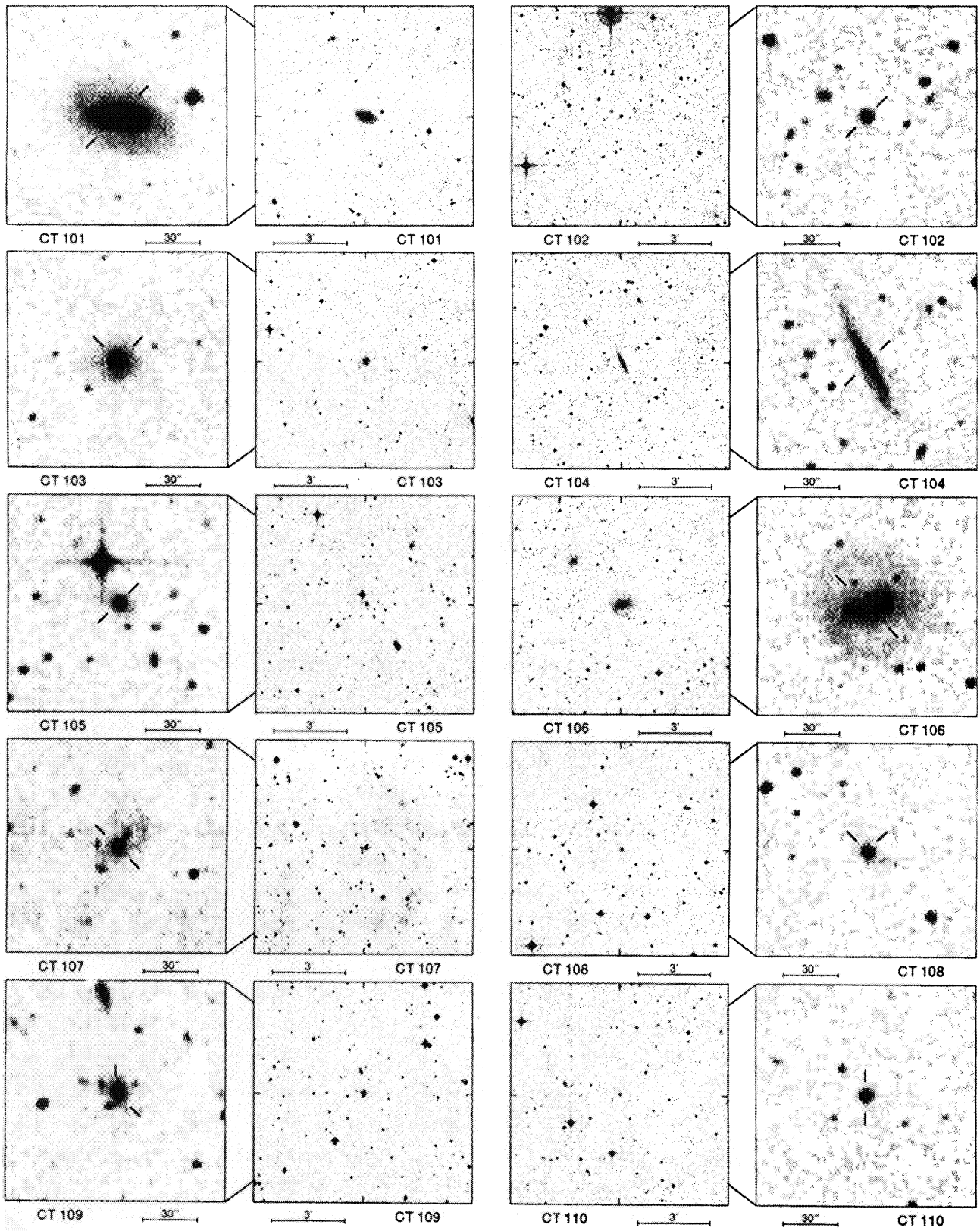

Fig. 1*d*. Finding charts from the (DSS).

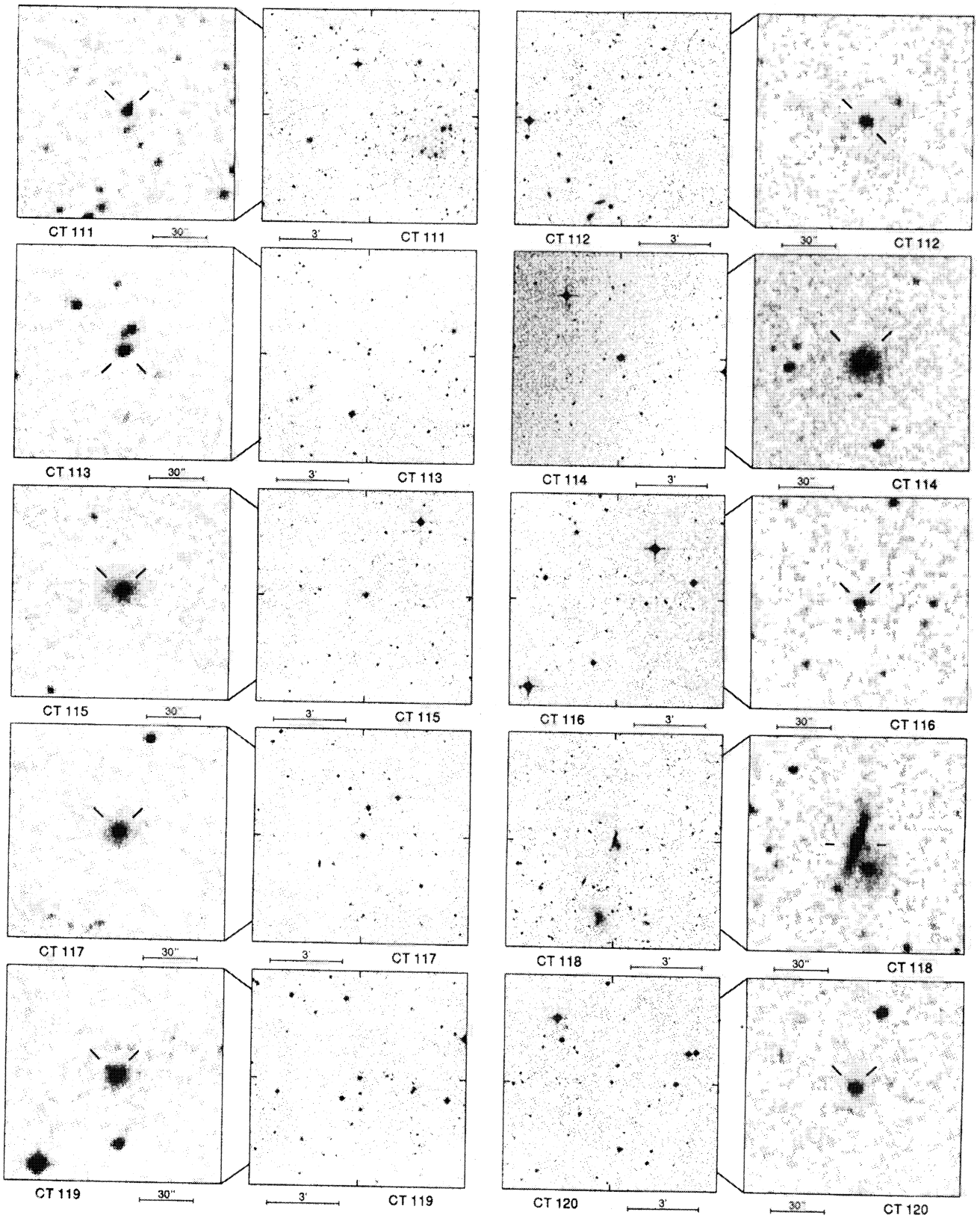

Fig. 1*e*. Finding charts from the (DSS).

suring isophotes at the sky limit; it is presented in column 10. The last four columns of Table 1 give the ESO field number of the chart where the galaxy can be found, the (x,y) coordinates in millimeters from the lower left corner of each chart, and the DSS disk number where the object is contained. Figures 1*a* to *e* present finding charts for each galaxy.

Seven objects in Table 1 are listed in the latest edition of the catalogue of Seyfert galaxies by Véron-Cetty & Véron (1993). They were rediscovered by our survey independently of their previous identification. In addition three galaxies are also listed in the "Catalogue of Principal Galaxies" by Paturel et al. (1989). One of them, CT 101, is NGC 4726; CT 104 is an ESO galaxy (ESO 578-G9) and CT 118 is Fairall 1041. Data quoted for those ten galaxies in the footnote to Table 1 are taken from Véron-Cetty & Véron (1993) or from Paturel el al. (1989).

The spectrophotometric observations of these galaxies will be presented in a forthcoming paper (Maza & Ruiz 1995). *UBVRI* CCD data for these galaxies is in the process of being obtained by Gómez & Maza (1995).

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