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RGU PHOTOMETRY OF EIGHT OPEN CLUSTERS NEAR η CARINAE: NGC 3572, NGC 3590, TR 18, TR 17, RU 92, RU 93, STOCK 13 AND BA 17

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By means of *RGU* three-colour photographic photometry eight open clusters near η Carinae have been investigated. The distances, reddening $E(G-R)$ and earliest spectral types for these clusters are summarized in the following table:

cluster	distance	reddening $E(G-R)$	earliest spectral type
NGC 3572	2700 pc	$0^m.50$	b0.9
NGC 3590	2360 pc	$0^m.62$	b2.5
Tr 18	1100 pc	$0^m.23$	b2.5
Tr 17	2300 pc	$0^m.64$	b3
Ru 92	3100 pc	$0^m.61$	b2.5
Ru 93	1570 pc	$0^m.38$	b7
Stock 13	2650 pc	$0^m.39$	b0.5
Ba 17	1650 pc	$0^m.22$	b4

The last of these, Ba 17, is a previously undetected cluster.

Key words: open clusters

1. INTRODUCTION

This paper continues the programme of the Basel Observatory to determine photometrically the distances, reddening, absorption and earliest spectral-types of open clusters. The present study is an extension of this programme in the region of η Carinae in the Southern Milky Way. The 8 clusters investigated are: NGC 3572, NGC 3590, Tr 18, Tr 17, Ru 92, Ru 93, Stock 13 and a previously undetected cluster, which has been designated by Ba 17.

2. OBSERVATIONS, REDUCTIONS AND THE METHOD

These clusters lie on *RGU* plates taken by Steinlin and Purgathofer in 1974 with the Curtis Schmidt Telescope of the Cerro Tololo Interamerican Observatory in Chile.

In each of the 3 spectral bands 5 plates were measured using an iris photometer.

The plates have been calibrated by photoelectric *UBV* sequences given by Bok *et al.* (1972), Feinstein (1964), Koelbloed (1959) for NGC 3532 and Sher (1964a) for NGC 3496, NGC 3603 and Tr 17 after conversion of the *UBV* standards into the *RGU* system (Steinlin 1968). The limiting photographic magnitudes ($G=16^m.06$, $R=14^m.93$, $U=18^m.29$) exceed the photoelectric ones ($16^m.17$ *(G)*, $15^m.02$ *(R)*, $18^m.17$ *(U)*) only in *U*.

The mean internal errors in the catalogues are:

$$\Delta G = \pm 0^m.03$$
$$\Delta R = \pm 0^m.03$$
$$\Delta U = \pm 0^m.03$$

They are calculated from the accidental deviations of the iris readings from the mean of each colour and transformed into magnitudes by use of the characteristic curve in that colour.

Only for *G* and $U > 16^m.0$ the mean internal errors reach $\pm 0^m.06$.

A comparison of the photoelectrical magnitudes in the references mentioned above – reduced to the *RGU* system – with the same stars reduced photographically using our calibration curves leads to the following standard deviations:

$\pm 0^m.07$ in G for stars with $G < 12^m.0$
$\pm 0^m.11$ in G for stars with $G > 12^m.0$
$\pm 0^m.09$ in R and
$\pm 0^m.12$ in U.

A comparison of the photographic measurements given here (St) with these obtained photoelectrically by Moffat and Vogt (1975) for NGC 3572, NGC 3590, Tr 18 and Stock 13 reduced to the *RGU* system (M+V) leads to a small systematic magnitude difference only in G, i.e.: $G_{St-M+V} = -0^m.08$ for stars with $G < 12^m.0$. An application of this difference has not much effect on the distance modulus and colour excess because the main bulk of stars in the clusters used for these determinations have magnitudes $G > 12^m.0$.

However, when the magnitudes given by Moffat and Vogt are regarded as correct, our determinations of the earliest spectral types for the clusters NGC 3572, NGC 3590, Tr 18, Tr 17, Ru 92 and Ru 93 would have to be changed by one to two subclasses towards later types.

The distances of the clusters have been determined by the well known fitting method based on both colour magnitude diagrams (CMD) in the *RGU* system. Four conditions have to be fullfilled when the observed CMDs are compared with the zero age mean sequence (ZAMS):

a) Both CMDs should coincide with the ZAMS (except the stars showing evolutionary effects).
b) The distance moduli from both CMDs should be equal.
c) The colour excesses from both CMDs should be related to each other according to the wavelength law of interstellar reddening. Relations for the *RGU* system are given by Steinlin (1968):

$$E(U-G) = 0.7E(G-R)$$
$$A(G) \quad = 2.69\, E(G-R)$$

d) All those stars within the cluster area are regarded as physical members which lie sufficiently close to the ZAMS in both CMDs. Certainly this is an arbitrary decision but approximate to the applied method. Only in the case of a small number of stars in a cluster wrong identifications could have an effect on the distance determination. The catalogue of magnitudes and colours is given in table 1 at the end of this paper with serial numbers corresponding to the numbers in the maps (figures 1, 3, 5, 7, 9, 11, 13 and 15).

3. RESULTS AND DISCUSSIONS

NGC 3572

This open cluster (figure 1) is well separated from the background because of its compactness. It is classified as of Trumpler type II 2 p. NGC 3572 is superposed at its northern edge by the southernmost and brightest portion of a ring of nebulosity. There was no possibility to measure these stars lying in this part of the cluster. Its 1950 coordinates are:

RA $= 11^h08^m.3$; $\ell = 290°.7$
Dec. $= -59°58'$; $b = +0°.2$

60 stars in the cluster area have been measured. 41 of them are supposed to be physical members (see figure 2). The following parameters have been determined for NGC 3572:

$m-M$	$= 13^m.49$	angular diameter	$= 7'.5$
$E(G-R)$	$= 0^m.50$	linear diameter	$= 5.9$ pc
$E(U-G)$	$= 0^m.35$	earliest spectral type from $(U-G)_0$	$=$ b0.9
Abs. (G)	$= 1^m.34$		
$(m-M)_0$	$= 12^m.15$		
distance	$= 2700$ pc		

No giant branch is visible in the CMDs. A small evolutionary effect is present only in the $(U-G)$ diagram. According to its earliest spectral type b0.9 the cluster is young enough to be a spiral arm tracer. It lies in the Carina-Sagittarius arm $(-\mathrm{I})$.

Schmidt-Kaler (1961) calls NGC 3572 the II Carina association and his estimated distance of 2.6 kpc agrees quite well with our investigation. Also the results given by Moffat and Vogt (1975) agree quite well with our determinations. Schmidt and Diaz Santanilla (1964) however derived by means of an *UBV* photometry a quite similar earliest spectral type and reddening but a distance of 3.90 kpc.

NGC 3590

NGC 3590 (figure 3) is an open cluster lying about 0°.7 southeast of NGC 3572. It is concentrated and classified to be of Trumpler type II 1 p. Its 1950 coordinates are:

$$\begin{aligned} \mathrm{RA} &= 11^{\mathrm{h}}10^{\mathrm{m}}.8; & \ell &= 291°.2 \\ \mathrm{Dec.} &= -60°31'; & b &= -0°.1 \end{aligned}$$

60 stars with magnitudes down to $G = 15^{\mathrm{m}}.5$ have been measured. 14 of them are blended, mostly in R. Including the blends, 41 probable physical members show a fairly strong concentration around the ZAMS in both CMDs (figure 4). The following values have been obtained for the cluster:

$m-M$	$= 13^{\mathrm{m}}.53$	angular diameter	$= 7'.0$
$E(G-R)$	$= 0^{\mathrm{m}}.62$	linear diameter	$= 4.8$ pc
$E(U-G)$	$= 0^{\mathrm{m}}.43$	earliest spectral type from $(U-G)_0$	$=$ b2.5
Abs. (G)	$= 1^{\mathrm{m}}.67$		
$(m-M)_0$	$= 11^{\mathrm{m}}.86$		
distance	$= 2360$ pc		

Evolutionary effects are clearly visible for stars brighter than $11^{\mathrm{m}}.0$ in the $(U-G)$ diagram, but there is no giant branch. NGC 3590 can still be regarded as a spiral arm indicator located also in the Carina-Sagittarius arm $(-\mathrm{I})$.

Schmidt and Diaz Santanilla (1964) included in their measurements also stars in the surrounding field and had to split up NGC 3590 into 2 groups with $E(B-V) = 0^{\mathrm{m}}.19$ and a distance of 1.82 kpc and $E(B-V) = 0^{\mathrm{m}}.44$ and 3.70 kpc respectively. Moffat and Vogt (1975) found a distance of 2070 pc, differing about 15% from our results, while the colour excess and the earliest spectral type coincide quite well. The difference in distance may be caused by a zero-point error in G or V.

Tr 18

The open cluster Tr 18 (figure 5) classified as III 2 p of Trumpler type, is a loose agglomeration of stars much less separated from the general background of stars than the clusters mentioned before. Its 1950 coordinates are:

$$\begin{aligned} \mathrm{RA} &= 11^{\mathrm{h}}09^{\mathrm{m}}.3; & \ell &= 291°.0 \\ \mathrm{Dec.} &= -60°24'; & b &= -0°.1 \end{aligned}$$

Among the 81 stars within 5'.3 from the centre of the cluster, 51 can be regarded as physical members (see figure 5). There seems to exist an extension of the cluster in the direction to southwest. The stars no. 72 to 92 belong to this extension no. 77 being the Cepheid variable GH Car. Numbers 72 to 76, 78, and 79 are the nearest to the centre of the cluster and fit the ZAMS as good as the other cluster stars. Nevertheless GH Car cannot be regarded as a physical member of the cluster according to Tammann (1969).

The fitting procedure applied to both CMDs (figure 6) yields for Tr 18:

$m-M$	$=10^m.82$	angular diameter	$=10'.6$
$E(G-R)$	$=0^m.23$	linear diameter	$=3.4$ pc
$E(U-G)$	$=0^m.16$	earliest spectral type from $(U-G)_0$	$=$b2.5
Abs. (G)	$=0^m.62$		
$(m-M)_0$	$=10^m.20$		
distance	$=1100$ pc		

There is no giant branch. However, the brightest members in Tr 18 seem to be evolved from the ZAMS. The earliest spectral type of these stars (b2.5) allows Tr 18 to be regarded as a spiral arm indicator, placed at the inner edge of the Carina-Sagittarius arm ($-$I).

Fernie (1960), Schmidt and Diaz Santanilla (1964) and Graham (1967) obtained distances of 2.29, 2.33 and 2.3 kpc and absorption values $A(V)$ of $0^m.93$, $1^m.41$ and $1^m.15$, respectively, in opposition to our results. Moffat and Vogt (1975) found a distance of 1280 pc, 15% larger than our value. While the colour excess differs about $0^m.1$ their earliest spectral type is somewhat later (b5).

Tr 17

According to Sher (1964b) the appearance of the open cluster Tr 17 is enhanced by adjacent absorption (figure 7). Its Trumpler type is II 2 p and its 1950 coordinates are:

RA $=10^h54^m.4$;	$\ell=288°.7$
Dec. $=-58°57'$;	$b=+0°.4$

134 stars within an area of 5'.3 from the centre of the cluster have been measured. 89 of them can be regarded as physical members. The two stars 3 and 39 (crosses in figure 8) could be regarded as highly evolved members due to their positions in the $(U-G)$ CMD (figure 8). We derive the following data by the fitting method for Tr 17:

$m-M$	$=13^m.40$	angular diameter	$=10'.6$
$E(G-R)$	$=0^m.64$	linear diameter	$=6.7$ pc
$E(U-G)$	$=0^m.45$	earliest spectral type from $(U-G)_0$	$=$b3
Abs. (G)	$=1^m.72$		
$(m-M)_0$	$=11^m.68$		
distance	$=2170$ pc		

Both sequences of the CMDs show no red giant branch, however, an evolution effect is evident. The cluster is located in the inner arm $-$I. But with b3 as the earliest spectral type for cluster stars it may be doubtful whether it can still be regarded as a spiral arm tracer. The distance of 1400 pc for Tr 17, given by Sher (1964a) does not agree with our result. The discrepancy can easily be explained by the different reduction method. As has been pointed out by Becker (1971), it is essential to use the short-wave CMD as well as the long-wave CMD for the reduction, instead of replacing one CMD by the (distant-independent) two-colour diagram (TCD). Reducing Sher's observations of Tr 17 by Becker's two-CMD method, indeed, yields a distance of 1880 pc for this cluster which is only 13% smaller than our value.

Ru 92

The appearance of Ru 92 as described by Sher (1964b) is a slight enhancement of the general field by moderately bright stars (figure 9). Ruprecht (1966) classified it – not reliably – as of Trumpler type I 3 p. The 1950 coordinates are:

RA $=10^h51^m.9$;	$\ell=289°.5$
Dec. $=-61°28'$;	$b=-2°.0$

Among the 59 stars within 3′.6 of the centre of the cluster, 32 could be regarded as physical members, due to their positions in both CMDs (figure 10). The sequences in the CMDs lead for Ru 92 to:

$m-M$	$=14^{m}.10$	angular diameter	$=7'.2$
$E(G-R)$	$=0^{m}.61$	linear diameter	$=6.5$ pc
$E(U-G)$	$=0^{m}.43$	earliest spectral type from $(U-G)_0$	$=$ b2.5
Abs. (G)	$=1^{m}.64$		
$(m-M)_0$	$=12^{m}.46$		
distance	$=3100$ pc		

No red giants can be found as physical members of the cluster.

According to its earliest spectral type, the cluster is young enough to be a spiral arm indicator, lying in the Carina-Sagittarius arm (−I).

Ru 93

The open cluster Ru 93 does not appear on the Schmidt plates as a well pronounced enhancement of the surrounding field. To the north and south of the cluster, two half-ringshaped star chains can be seen (figure 11). Ru 93 has a Trumpler type of III 2 p. Its 1950 coordinates are:

RA $=11^{h}09^{m}.3$;	$\ell=290°.5$
Dec. $=-60°24'$;	$b=-0°.1$

In the cluster area 93 stars have been measured: 66 in the core of the cluster (6′.5 in diameter), 13 in the northern and 14 in the southern star-chain. The fitting method applied separately to the core and to the two star-chains yields the result, that both of them can belong physically to the cluster. Some 53 stars are probably members of Ru 93, 25 of them belonging to the core of the cluster. Both CMDs are given in figure 12.

The determined parameters for Ru 93 are:

$m-M$	$=12^{m}.00$	angular diameter of the core	$=6'.5$
$E(G-R)$	$=0^{m}.38$	linear diameter of the core	$=3.0$ pc
$E(U-G)$	$=0^{m}.27$	angular diameter of the cluster	$=10'$
Abs. (G)	$=1^{m}.02$	linear diameter of the cluster	$=4.6$ pc
$(m-M)_0$	$=10^{m}.98$	earliest spectral type from $(U-G)_0$	$=$ b7
distance	$=1570$ pc		

Ru 93 shows a pronounced evolutionary effect, however, no horizontal branch of red giants exists. Though it is doubtful that Ru 93 is young enough to be a spiral arm indicator it lies in the midth of the Carina-Sagittarius arm (−I). The situation is therefore similar to the one for Ru 92.

Stock 13

The open cluster Stock 13 (figure 13) is classified as 12p and its 1950 coordinates are:

RA $=11^{h}10^{m}.9$;	$\ell=290°.5$
Dec. $=-58°39'$;	$b=1°.6$

A loose scattering of stars to the east and northwest of Stock 13 is apparent on the plates. In figure 14 both CMDs are shown for all stars spread over an area of about 22□′. Among 111 stars measured, 52 can be regarded as physical members of the open cluster Stock 13.

To get a coincidence with the ZAMS the G magnitudes had to be corrected by $+0^m.1$. This field error may probably be caused by the distance of about 2° on the plates between Stock 13 and the stars used for the calibration.

The following solution has been received for Stock 13:

$m-m$	$=13^m.16$	angular diameter	$=15'$
$E(G-R)$	$=0^m.39$	linear diameter	$=11.8$ pc
$E(U-G)$	$=0^m.27$	earliest spectral type	$=$b0.5
Abs. (G)	$=1^m.04$		
$(m-M)_0$	$=12^m.12$		
distance	$=2650$ pc		

As a cluster of early spectral type, Stock 13 is a good spiral arm tracer for the Carina Sagittarius arm (−I). The data given here agree quite well with the ones found by Moffat and Vogt (1975).

It is worthwile to notice that among the stars studied in the region of Stock 13 a remarkable number of 20 stars seem to be red giants ($M(G)=1$). 18 of them are concentrated in the CMDs around the mean apparent magnitude of $G=13^m.03$ with an average deviation of only $\pm 0^m.18$. Due to their positions in a TCD a mean colour excess of $E(G-R)=0^m.14$ has been derived for them, leading to the result, that this group of red giants forms a part of a starcloud in a distance of 2140 pc which may extend over a larger area.

Ba 17

This previously undetected cluster is shown in figure 15. It consists of a concentrated group of stars lying around a pronounced axis oriented from north-west to south-east. The 1950 coordinates are:

RA $=11^h08.2$;	$\ell=290°.2$
Dec. $=-58°38'.5$;	$b=1°.4$

Among 17 stars measured, 12 form a clear sequence (figure 16) which can be fitted with the ZAMS, when the same correction as in Stock 13 is applied.

We obtained for Ba 17:

$m-M$	$=11^m.68$	angular diameter	$=5'$
$E(G-R)$	$=0^m.22$	linear diameter	$=2.4$ pc
$E(U-G)$	$=0^m.16$	earliest spectral type from $(U-G)_0=$b4	
Abs. (G)	$=0^m.59$		
$(m-M)_0$	$=11^m.09$		
distance	$=1650$ pc		

Evolutionary effects are clearly visible for the brightest stars in both CMDs. Ba 17 is lying at the outer edge of the Carina-Sagittarius arm (−I), though the cluster is too old to be a good spiral arm tracer.

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Table 1 Catalogue of the stars measured in NGC 3572, NGC 3590, Tr 18, Tr 17, Ru 92, Ru 93, Stock 13 and Ba 17. The physical members are marked by an asterisk after the star number. The missing numbers in the catalogue correspond to "blends" which could not be measured

NGC 3572

No.	G	G-R	U-G
1	7.72	0.23	0.61
4	12.56	0.78	1.50
6*	12.80	0.61	1.05
16	11.50	0.61	1.65
17*	11.45	0.58	0.79
20*	12.28	0.52	0.76
26	12.89	1.07	1.07
33	13.02	1.33	1.30
45*	13.09	0.71	0.84
47*	12.89	0.66	0.88
49	12.91	0.97	0.42
55*	10.83	0.72	0.88
59*	10.34	0.50	0.66
60*	12.76	0.55	1.09
66*	11.31	0.57	0.77
67*	10.24	0.66	0.58
70*	12.05	0.69	0.65
72*	9.37	0.37	0.70
74*	11.92	0.48	0.93
77*	9.58	0.48	0.64
78*	14.60	0.73	1.84
79*	15.29	1.22	1.81
80*	14.05	0.48	1.09
81*	14.74	0.69	1.49
82*	14.92	0.57	1.71
85*	12.56	0.62	0.89
86*	14.32	0.53	1.40
87*	15.15	0.70	1.80
88	14.76	1.24	2.18
89*	12.53	0.78	0.89
48*	9.37	0.39	0.44
90	8.98	0.24	1.50
91	12.44	1.69	3.09
92*	13.67	0.79	1.12
93*	14.13	0.74	1.26
94	15.59	2.48	3.50
95*	10.19	0.60	0.71
96*	12.44	0.67	0.89
97*	14.64	0.75	1.36
100*	14.32	0.97	1.42
101*	13.89	0.74	1.48
102	13.45	1.98	2.64
103*	13.33	0.78	1.04
105	15.55	2.42	3.37
106*	13.79	0.59	1.23
107*	14.88	0.46	1.35
108	14.82	2.18	2.89
109*	14.50	1.04	1.33
110*	15.11	0.66	1.43
111	14.82	1.71	2.02
112*	14.58	0.53	1.42
113	12.00	1.42	2.34
114	11.81	1.91	3.48
115	13.45	1.00	1.71
116	11.86	1.50	2.82
117	11.26	0.53	1.80
118*	15.25	0.87	1.66
119*	14.05	0.96	1.19
122*	12.02	0.71	0.91
123*	14.17	0.91	1.78

NGC 3590

No.	G	G-R	U-G
1*	10.31	0.63	0.84
2	13.27	0.87:	1.87:
3*	11.90	0.91	0.86
4*	13.09	0.93	0.85
5*	13.91	0.78	1.02
6*	15.55	0.80	1.77
7*	15.44	1.41	1.84
8*	14.48	0.61	1.46
9*	15.33	0.66	1.65
11*	12.65	0.87	1.01
12*	14.38	0.99:	1.45
13*	14.26	0.80:	1.43
16*	14.90	0.79	1.54
17*	14.96	0.85	1.45
18*	14.38	0.90	1.39
21	12.82:	1.24:	0.94:
22*	12.28:	0.90:	1.23:
23*	10.06:	0.52:	0.89:
27*	14.46	0.81	1.14
28*	14.76	1.13	1.62
29*	13.82	0.95	1.57
30	13.79	1.22	1.16
31*	10.50	0.63	0.75
32*	13.14	0.75	0.94
33*	14.11	0.92	0.76
34*	13.92	1.11	1.44
35*	15.25	1.07	2.04
36*	12.96	0.75:	1.08
37*	13.96	1.11:	1.64
38*	15.06	1.02	1.78
39	14.64	1.96	2.58
40*	8.96	0.57	0.83
41	11.28	0.50:	1.88
42	11.54	0.64	1.79
44*	13.86	0.94	1.54
45	13.84	1.09	1.91
46	12.09	0.57:	1.44
47*	13.84	0.75:	1.37
49	12.71:	0.93:	1.59:
50*	11.03	0.69	0.82
51*	14.62	0.81:	1.38
52*	14.70	0.81:	1.50
53*	14.08	0.95	1.29
54*	14.84	1.23	1.94
55	12.33	1.32	1.73
56	11.42	0.69	1.78
57	14.18	0.99	1.88
58*	14.26	1.19	1.57
59	13.47	2.24	2.97
60	13.33	1.24	1.04
61*	13.24	1.08	1.45
62*	14.92	1.16	1.46
63	14.60	2.35	1.55
64	13.22	1.26	1.49
65	12.09	1.24	1.12
66*	14.32	0.99	1.34
67*	13.91	0.99	0.99
68	11.03	0.78	1.56
69	11.35	1.70	3.00
71*	13.91	1.20	1.30

Tr 17

No.	G	G-R	U-G
1	10.71	2.09	4.05
2*	12.64	0.87	1.08
3*	11.80	1.26	1.51
4	13.05	1.37	1.80
5*	14.94	0.98	1.75
6*	14.36	0.99	1.50
7	14.84	1.06	2.04
8	14.84	0.86	1.94
9	13.02	1.77	2.53
10*	13.54	0.86	1.48
11*	14.06	0.76	1.60
12*	14.10	0.84	1.09
13*	13.86	1.04	1.59
16	13.16	0.86	1.62
17	12.42	1.57:	2.29
18	11.93	1.58	2.71
19	15.29	1.46	1.22
20	14.34	2.73	3.71
21	12.93	1.88	2.99
22*	15.43	0.98	1.39
23*	15.39	0.99	1.74
24	14.42	1.33:	1.30:
25*	14.64	0.97	1.45
26*	15.13	0.97	1.60
27*	14.94	1.07	1.47
28	13.91	1.32	1.21
29	14.84	1.34	2.16
30*	15.55	1.24	1.83
31*	14.98	0.87	1.34
32*	14.38	0.95	1.51
33	14.42	0.92	1.13
34*	13.42	1.02	1.12
35*	13.09	1.20	0.95
36*	14.03	1.11	1.11
37	15.39	1.51	1.80
38	15.27	2.26	2.55
39*	11.68	0.76	1.61
40	14.50	1.50	1.33
41	13.92	1.45	1.82
42*	14.64	1.16	1.59
43*	14.06	0.93	1.46
44*	15.59	0.99	1.79
45*	15.73	1.00	1.77
46*	15.71	1.35	1.54
47*	15.47	0.87	1.88
48	15.21	1.16	1.74
49*	15.67	1.29	1.80
50	13.20	1.44	1.23
51*	14.18	0.97	1.34
52*	13.87	1.06:	1.22
54	13.79	1.18	1.99
55*	12.87	1.04	1.00
56*	14.54	1.04	1.35
57*	11.52	1.01	1.27
58*	15.55	0.99	1.77
59	14.34	1.55	2.48
60*	15.49	1.15	1.98
61*	15.59	0.93	1.54
62*	14.40	1.05	1.49
63	15.41	1.29	2.16
64*	15.21	1.22	1.70
65*	15.61	1.27	1.89
66	15.81	1.91	2.74
67*	15.85	0.92	1.87
68*	12.12	0.90	1.26
69	14.94	1.29	2.06
70*	14.96	0.85	1.48
71*	16.01	1.04	1.80
72*	11.93	1.02	0.98
73	13.98:	1.27:	1.52:
74*	12.60:	1.13:	1.21:
75	15.23:	1.92:	3.09:
80*	15.57	0.99	1.65
81*	15.91	0.92	1.94
82*	14.32	0.86	1.45
83*	14.92	1.01	1.49
84*	12.16	1.00	1.20
85*	12.21	1.19	1.06
89	13.84	1.24	1.45
90*	12.67	1.06	1.18
91*	16.01:	0.89:	2.00:
92*	15.49	0.89	1.67
93*	13.25	1.11	1.24
94*	13.25	1.15	1.24
95	14.72	1.38:	1.45
96	15.39	2.28	3.20
97*	14.03	1.05	1.37
98	12.19	1.57	2.45
101*	15.08	0.77	1.61
102*	15.13	0.88	1.44
103*	15.59	0.99	1.76
104*	14.32	0.82	1.48
105*	14.10	0.99	1.43
106*	13.02	1.17	1.20
107*	14.90	1.03	1.82
108*	15.77	1.06	1.82
109	12.04	1.42	2.39
110	13.07	2.03	3.28
113*	14.54	1.04	1.72
114*	14.96	1.11	1.57
115*	14.42	1.03	1.30
116	14.82	1.13	1.96
117	14.62	2.92	2.60
118*	15.81	1.10	1.85
119*	15.13	1.10	1.72
120	14.38	1.48	2.34
121	13.25	1.62	2.17
122*	14.42	1.05	1.27
123*	14.20	1.05	1.57
124*	14.56	1.00	1.27
125*	16.27	1.08	2.04
126*	15.71	0.94	1.82
127	16.31	2.07:	2.77
128*	16.17	1.25	1.84
129*	16.03	1.17	1.63
130*	16.03	1.41	1.88
131	16.15	2.04	2.97
132*	15.95	1.13	1.74
133*	15.83	1.08	1.73
134*	16.17	1.18	1.98
135*	15.55:	1.04:	1.64:
136*	16.07	0.99	1.88
137	16.27	1.04	2.08
138	16.57	1.36	2.08
139*	16.01	1.26	1.52
140*	16.37	1.07	1.98
141*	15.67	1.23	1.71
142*	15.79	1.28	1.90
143*	16.01	1.30	1.49
144*	16.09	0.90	1.96
145	16.13	1.03	2.15
146	16.41	1.82	2.57
147*	16.01	1.11	1.94
148	16.45	1.22	2.06

Tr 18

No.	G	G-R	U-G
1*	8.04	0.40	0.69
2	13.68	1.02	1.87
3*	13.96	0.93	1.25
4*	10.81	0.41	0.95
5*	15.49	0.72	1.70
6	11.88	1.40	2.48
7*	12.37	0.64	0.92
8*	12.94	0.88	1.31
9*	13.77	0.87	1.76
10*	14.82	0.69	1.53
11*	13.92	0.53	1.52
12	9.90:	0.45:	1.44:
13	13.77	2.83:	4.04
15	14.86	2.07	2.82
16*	13.67	0.79	1.45
17*	9.55	0.43	0.64
18*	14.32	0.84	1.74
19	13.91	2.44	3.81
20	12.58	1.89	2.89
21	12.37	1.23	1.47
22*	13.74	0.73	1.63
23*	15.15	0.88	1.64
24	14.66	1.66	2.59
25*	12.87	0.73	1.19
26*	14.64	0.70	1.65
27	13.79	1.99	2.72
28	13.38	2.91	3.72
29	12.65	1.85	3.12
30*	13.82	0.69	1.42
31	9.04	0.33	1.05
32*	12.09	0.71	0.95
33*	13.38	0.57	1.43
34*	12.93	0.72	1.50
35*	11.92	0.56	1.15
36	13.34	0.72	0.89
37*	13.92	0.69	1.47
38	9.90	0.69	1.65
39*	12.56	0.86	1.36
40*	13.36	0.82	1.42
41*	12.71	0.75	1.33
42*	9.72:	0.39:	0.90:
43*	14.58	0.91	1.42
44*	11.40	0.50	1.34
47*	11.81	0.77	1.34
48	9.53:	1.31	2.47:
49*	11.99	0.50	0.88
50*	11.18	0.57	1.07
51*	11.97	0.56	1.34
52*	13.70	1.08	1.39
53*	14.13	0.72	1.53
54*	14.44	1.09	1.62
57*	12.18	0.49	1.26
58*	13.86	1.02	1.21
59*	13.84	0.66	1.61
60*	14.48	0.89	1.46
61	13.11	1.81	2.72
62*	12.64	0.57	1.18
63*	12.47	0.73	1.23
68*	12.30	0.63	1.40
69*	12.44	0.53	1.21
70*	13.04	0.75	1.01
71*	11.36	0.54	1.20
72	12.31	1.18	2.07
73*	13.98	0.63	1.39
74*	12.78	0.50	1.33
75*	11.78	0.65	1.06
76*	8.91	0.43	0.62
77	9.51	1.24	2.20
78*	11.36	0.45	1.25
79*	10.39	0.39	0.78
80	11.11	0.31	1.56
81	13.09	1.04	2.03
82	10.52	0.59	0.74
83	10.05	1.67	3.73
84	9.84	0.80	0.88
85	9.44	1.17	2.32
86	12.76	1.06	1.60
87	14.70	0.81	1.13
88	13.98	1.21	1.47
89	11.47	0.74	1.71
90	10.03	0.68	0.84

Ru 92

No.	G	G-R	U-G
1	12.55	0.63	0.81
2	14.13	1.17	1.45
3	10.37	0.99	0.08
4	12.51	2.43	3.84
5	13.53	2.70	4.29
9	14.70	3.07	3.28
10	11.93	0.69	0.77
11	14.40	1.53	1.55
12*	13.41	0.93	1.24
13*	14.58	1.12	1.34
14	14.44	0.81	1.62
15	15.49	0.50	1.61
16	12.97	0.47	1.71
17	15.00	1.74	2.15
18	14.86	2.26	2.14
19	14.88	1.97	2.93
20	15.31	2.09	2.47
21*	14.28	0.45	1.09
22*	13.21	0.76	0.87
23*	13.56	0.73	0.93
24	15.33	1.96	3.36
25*	15.41	1.03	1.53
26*	13.04	0.75	0.96
29*	15.08	1.28:	1.83
30*	12.74	0.55:	0.98
31*	14.64	0.90:	1.36:
32*	14.70	1.16	1.68
33*	14.78	0.89	1.66
36	11.95	1.29	1.71
37	13.86	1.13	1.62
38*	14.66	0.75	1.05
39	14.58	1.41	1.74
40*	14.76	1.09	1.44
41	14.13	1.73	2.38
44*	13.84	0.92	1.32
45	13.11	0.75	1.70
46*	12.13	0.57	1.06
47*	14.86	0.97	1.43
51*	14.26	0.61	1.43
52*	12.49	0.82	1.23
53*	12.51	0.60	0.97
54*	12.81	0.83	0.91
58	14.96	1.81	2.82
59	15.13	1.89	1.88
60*	14.36	0.84	1.59
61*	13.06	0.83	1.07
62	12.44	2.37	3.62
63*	11.06	0.66	0.81
64*	13.82	0.82	1.10
65*	14.68	1.05	1.44
66	14.08	0.78	1.84
67*	14.34	0.93	1.40
68*	13.80	0.59	1.31
69	12.83	2.41	3.80
70*	15.57	0.62	1.44
74*	15.37	1.25	1.48
75*	15.08	0.82	1.27
78	13.58	1.00	1.76
79*	13.99	0.93	1.35

Ru 93

No.	G	G-R	U-G
1*	11.89	0.82:	1.47:
2*	13.96	0.66	1.51
3*	14.46	0.70	1.66
4*	13.70	0.50	1.64
5	12.90	0.87	1.29
6*	13.20	0.78	1.49
7*	14.30	0.65	1.59
8	14.50	0.52	1.59
13	12.57	0.94:	1.67
14*	13.11	0.69:	1.45
17*	13.41	0.66	1.50
18*	13.82	0.65	1.37
19*	12.71	0.64	1.57
20*	13.92	0.55	1.63
21*	13.96	0.83	1.51
22*	14.74	0.89	1.52
23*	13.06	0.58	1.56
24	12.48	0.70	1.11
25*	13.58	0.62	1.49
26*	14.28	0.74	1.75
27	14.52	1.43	1.92
28	13.02	0.88:	1.45
29	12.46	0.87	1.65
30	14.84	0.47	1.51
31	12.95	0.42	1.05
34*	12.92	0.57	1.36
35*	11.99	0.65	1.41
36*	11.42	0.75	1.34
37	14.42	0.53	1.67
39	14.60	1.25:	1.46
40	12.44	1.69	2.43
41*	11.77:	0.64:	1.27:
42*	14.46	0.94:	1.48:
43	13.94	0.68	0.96
44*	13.63*	0.59:	1.44:
45*	11.82:	0.78:	1.46:
46*	14.46:	0.68:	1.40:
47	13.34	0.94	1.07
48	15.19	1.51	2.44
49*	15.91	1.01	1.56
50*	12.69	0.50	1.46
55	14.84	1.54:	1.94
56*	12.64	0.59	1.31
57*	14.30	0.87	1.39
59	12.49	1.05:	1.68
60	13.20	1.06	1.49
61	13.00	1.78	2.86
62	13.53	1.82	2.36
63*	13.99	0.69	1.53
67	13.96	2.31	3.48
68*	14.98	0.91	1.58
69*	12.55	0.77	1.49
70*	13.79	0.71	1.40
71*	14.05	0.68	1.59
72*	11.88	0.79	1.37
73*	13.48	0.77	1.62
74	14.26	0.54	1.60
75	12.83	1.94	3.06
77*	13.39	0.82	1.61
79	14.82	0.60	1.93
80*	14.80	1.00	1.73
81	14.56	1.75	2.78

Table 1 *(continued)*

No.	G	G-R	U-G
82*	14.58	0.86	1.77
83	12.03	1.56	2.50
84	15.06	0.82:	1.94
85*	14.05:	0.74:	1.61:
86*	15.06	0.99:	1.60:
87*	12.15	0.57	1.44
88*	14.86	0.86	1.55
89	14.66	0.59	1.78
92	13.51	1.75	2.69
97*	11.92	0.79	1.48
98*	13.74	0.60:	1.50
101	13.32:	2.54:	3.78:
102	13.56	1.15	1.36
103	14.10	1.90	1.99
104*	13.27	0.70	1.52
105	12.40	2.05:	3.52
106	11.77	1.66:	2.10
107	14.46	1.29:	1.86
108*	14.74	0.69	1.61
109*	12.29:	0.64	1.52:
110	13.11:	1.09:	1.43:
111*	15.04	1.02	1.46
112	13.68:	0.55:	1.87:
113*	14.98:	0.98:	1.40:
114	12.49	0.78	1.68
115	12.32	0.74:	0.76
116*	13.63	0.67	1.22
117*	11.66	0.66	1.35
118*	12.10	0.61	1.47
119*	12.24:	0.75:	1.61:
120	13.06	0.55	1.01
Stock 13			
1*	10.48	0.44	0.46
2	8.79	0.32	1.17
3	8.91	0.39	1.40
4*	11.92	0.43	1.11
5	12.78	1.60	2.96
6	10.64	0.58	0.85
7*	12.14	0.56	0.70
8	10.81	0.40	0.93
9	11.68	0.61	1.66
10*	12.30	0.41	1.07
11*	10.60:	0.55:	0.47:
13*	13.41	0.58	1.25
14*	10.08	0.64	1.50
15	11.70	0.59	1.27
16	11.58	0.51	1.44
17	13.29	1.60	2.24
18	12.66	0.52	1.60
19*	10.60	0.40	0.50
20*	14.14	0.73	1.69
21*	12.76	0.57	1.41
22	11.72	1.37	2.40
23*	12.71	0.46	1.46
24	11.28	0.56	1.51
25	13.08	1.93	3.13
26*	12.54	0.45	1.07
27	12.69	0.99	1.58
29*	13.70	0.83	1.51
30	12.27:	0.45:	1.64:
31*	11.39:	0.67:	0.53:
32*	13.69	0.94	1.45
33	13.46	1.50	2.31
34*	9.48	0.53	0.41
35	12.28	1.44	2.34
36	14.46:	1.35:	3.16:
37	12.20	0.84	1.44
38*	13.41	0.96	1.54
39	11.46	0.55	1.09
40*	10.67	0.48	0.43
41*	11.36	0.49	0.77
43	10.82	0.48	1.23
44*	11.85:	0.38:	1.14:
45*	13.74	0.86	1.55
46	12.00	1.57	2.85
47*	14.40	0.73	1.46
48	13.65	1.35	2.55
49*	13.55	0.91	1.69
50	12.34	0.79	1.39
51*	12.13	0.44	0.86
52	9.94	0.77	0.48
53	12.64	0.73	1.87
54*	11.83	0.43	0.71
55	8.64	0.37	1.28
56	13.25	1.33	2.49
57*	10.19	0.47	0.52
58	12.78	1.57	2.48
59*	8.76	0.29	0.26
60*	10.89	0.37	0.17
61*	10.88	0.68	0.35
62	12.02	0.81	1.65
63*	12.80	0.68:	1.18
64	12.73	0.98	1.83
65	10.82	0.68	1.58
66	12.82	1.45	2.47
67*	14.24	0.48	1.45
68*	14.50	0.76	1.88
69*	13.51	0.85	1.70
70	10.06	0.56	1.38
71	9.16	0.20	0.82
72	13.72	1.58	2.57
73*	14.20	0.28	1.60
74*	14.07	0.78	1.77
75	11.70	0.49:	1.15
76	11.24	0.54:	1.50
77	10.49	1.43	2.44
78*	12.64	0.39	1.23
79	13.96	1.13	1.84
80	12.69	0.66	1.58
81	13.39	1.63	2.44
82*	13.24	0.76	1.38
83	10.95	0.41	0.90
84	9.91	1.63	2.88
85*	13.62	0.59	1.52
86	13.01	0.82	1.50
87*	9.73	0.46	0.55
88	10.92	0.55	1.24
89	11.71	1.62	2.18
90*	13.89	0.74	1.25
91*	14.38	1.03	1.17
92*	14.32	0.95	1.57
93*	13.86	1.01	1.46
105*	13.20	0.50	1.25
106	12.27	0.83	1.51
107	12.55	0.77	0.90
108*	13.24	0.63	1.34
109*	12.47	0.60	0.74
110*	14.07	0.52	1.03
111	12.64	0.86	0.82
112	11.45	0.79	0.36
113	12.66	1.63	2.46
114	12.13	0.55	1.52
1	12.32:	0.31:	1.62:
2*	13.09	0.62	1.44
3	11.66	0.81	1.54
4	13.70	1.62	2.65
5*	11.77	0.65	0.74
6	12.19	1.11	1.54
7*	12.95	0.68	1.31
8*	12.30	0.58	1.12
10*	11.89	0.70	0.95
11	9.90:	1.23:	1.30:
12*	12.71	0.48	1.22
13*	10.08	0.66	0.43
14*	9.75	0.58:	0.77
15*	10.47	0.72	0.70
16*	11.55	0.60	0.83
17*	11.37	0.41:	0.83
18*	11.73	0.65	0.94
Ba 17			
94*	9.77:	0.52:	0.41:
95*	13.86	1.05	1.11
96*	10.63	0.70	0.15
97	11.72	0.69:	1.36
98	11.97	1.28	1.48
99*	13.45	0.95	1.24
100	14.38	1.14	0.99
101	11.60	1.06	0.62
102	13.95	1.55	2.14
103	13.60	2.08	3.15
104*	13.55	0.57	1.54

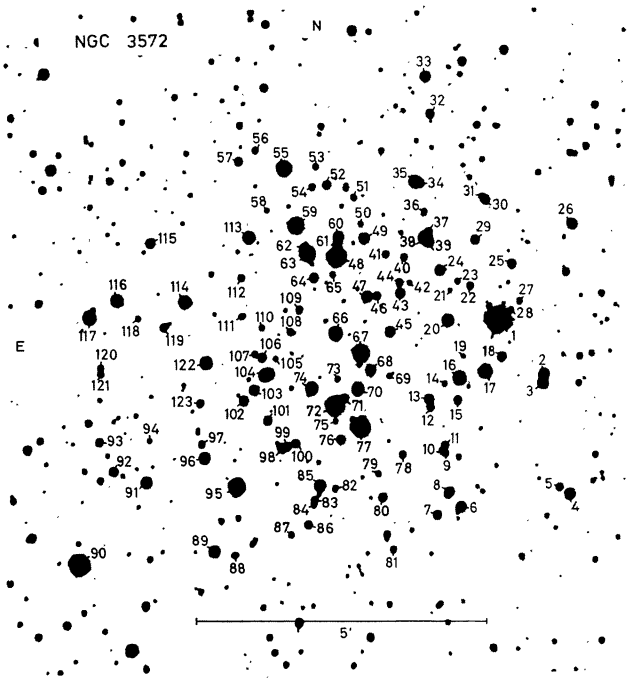

Figure 1 The open cluster NGC 3572.

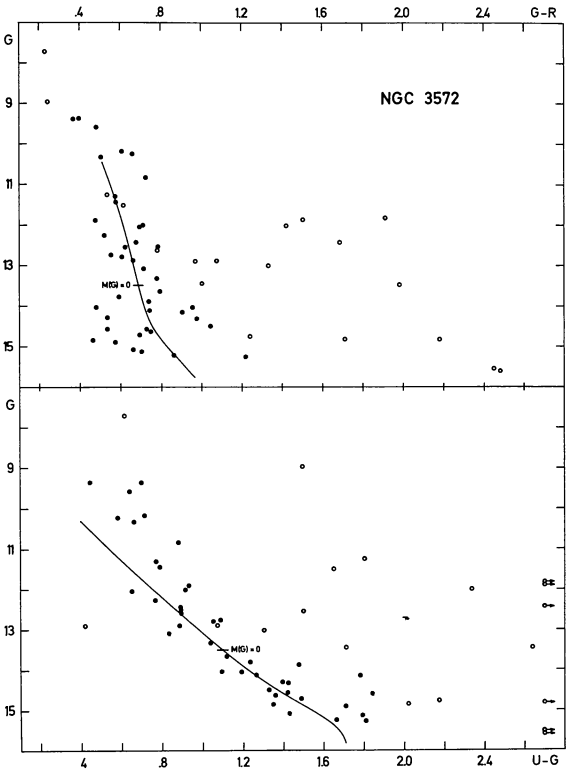

Figure 2 CMDs for NGC 3572. Points are physical members, circles are field stars.

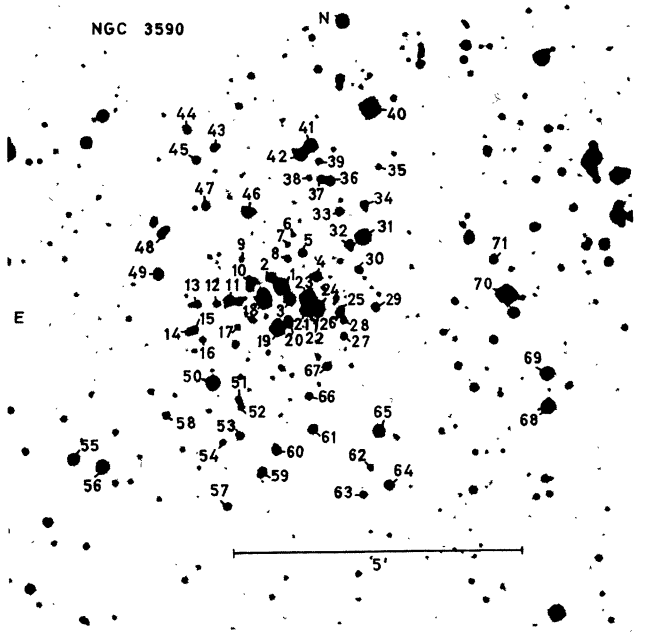

Figure 3 The open cluster NGC 3590.

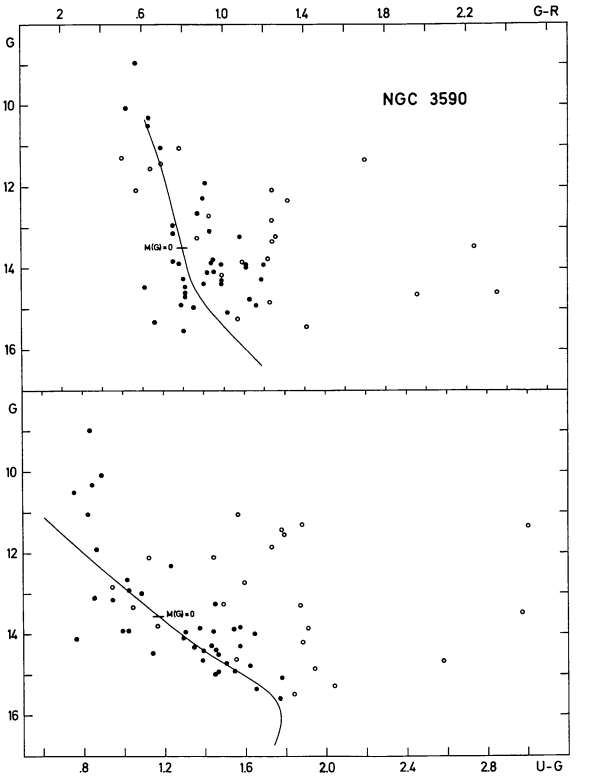

Figure 4 CMDs for NGC 3590. Same symbols as in figure 2.

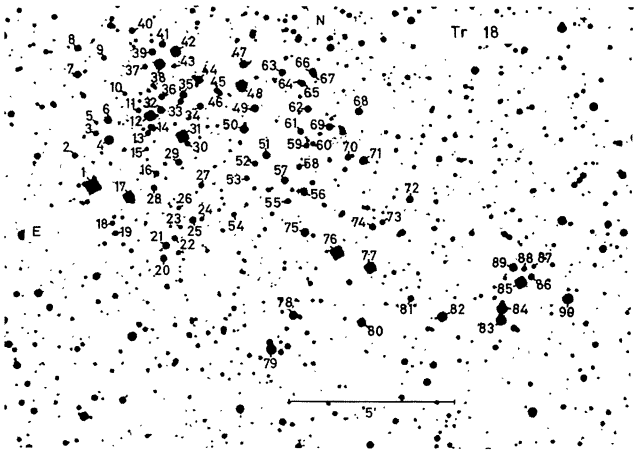

Figure 5 The open cluster Tr 18.

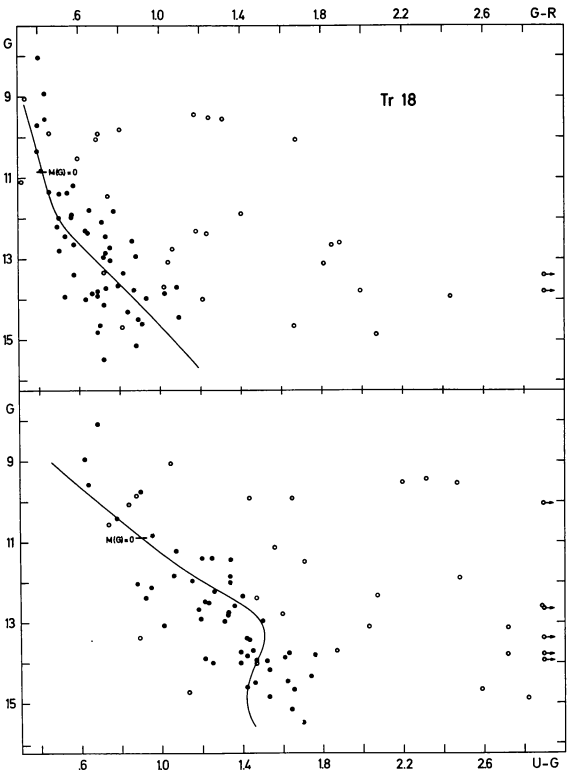

Figure 6 CMDs for Tr 18. Same symbols as in figure 2.

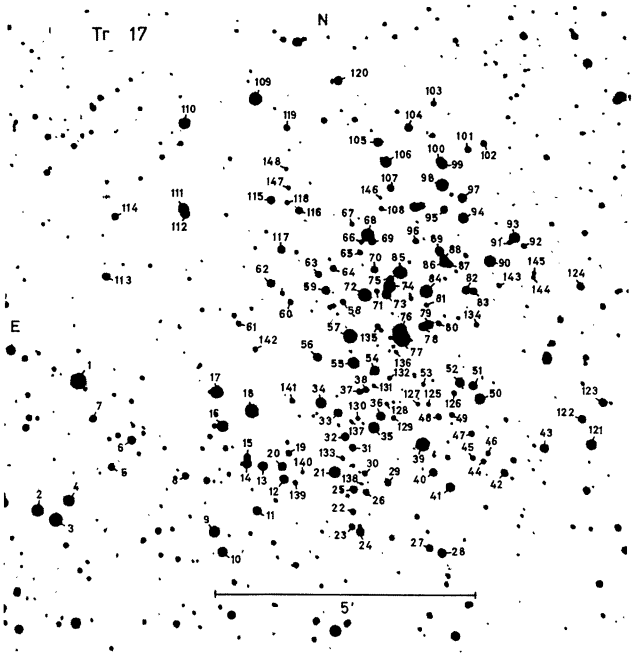

Figure 7 The open cluster Tr. 17.

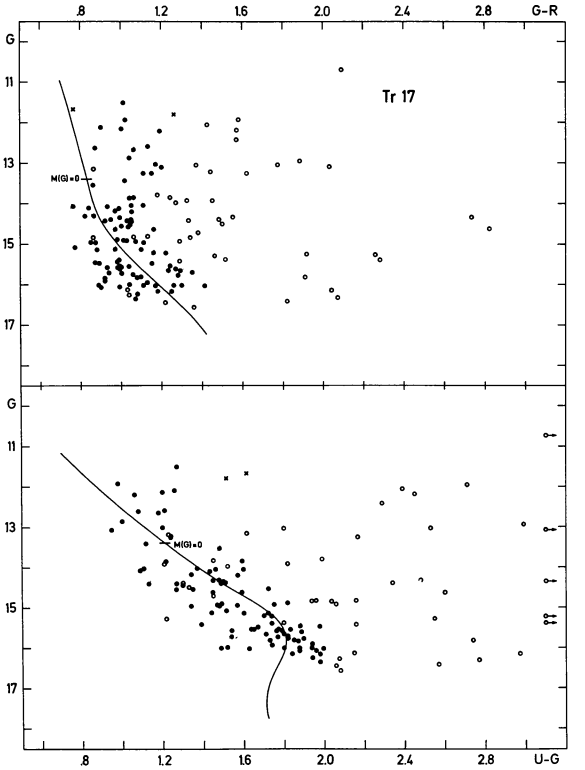

Figure 8 CMDs for Tr 17. Points are physical members, crosses highly evolved probable members and circles are field stars.

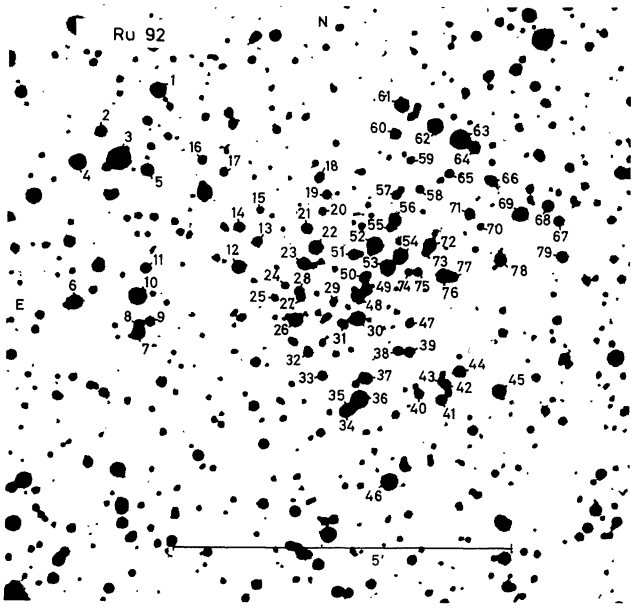

Figure 9 The open cluster Ru 92.

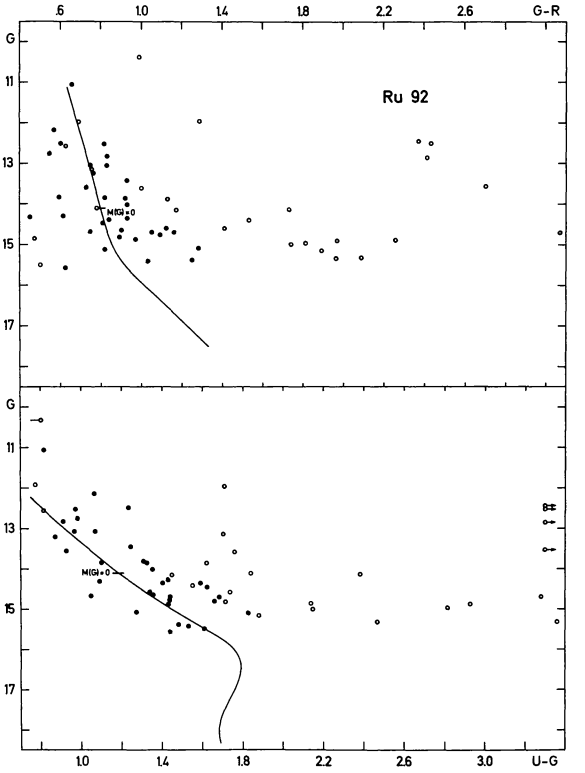

Figure 10 CMDs for Ru 92. Same symbols as in figure 2.

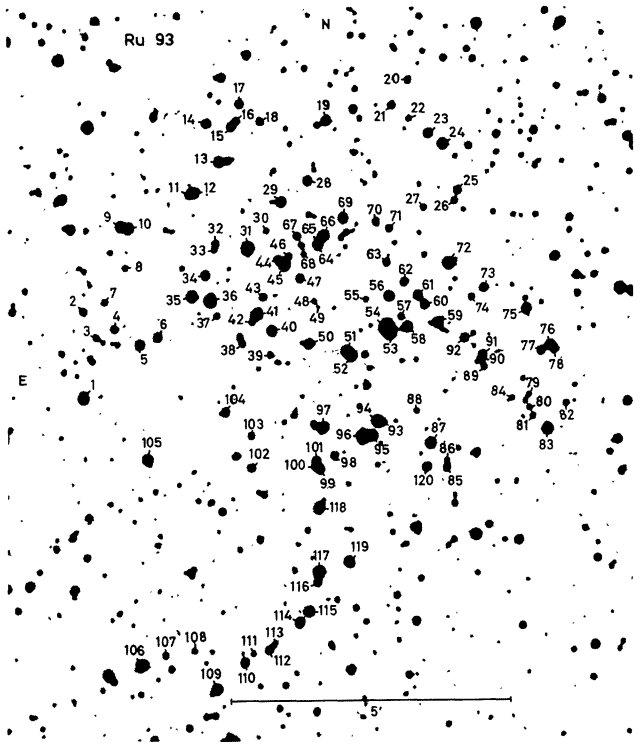

Figure 11 The open cluster Ru 93.

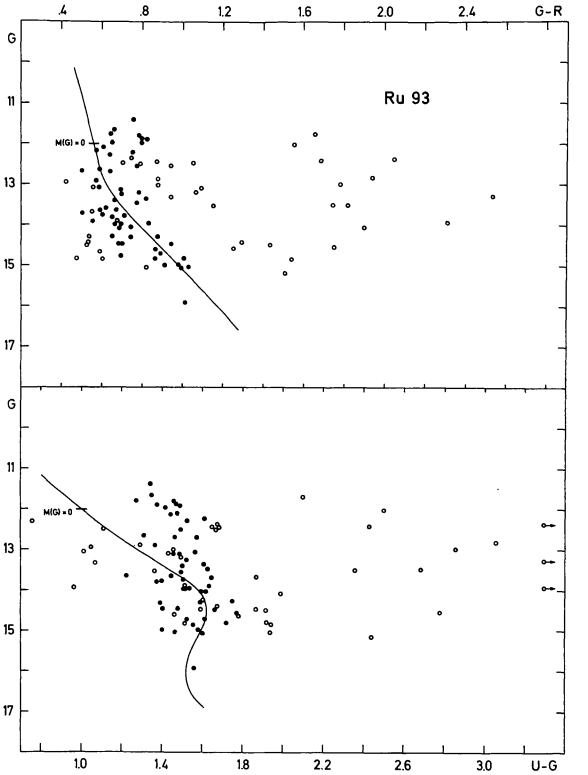

Figure 12 CMDs for Ru 93. Same symbols as in figure 2.

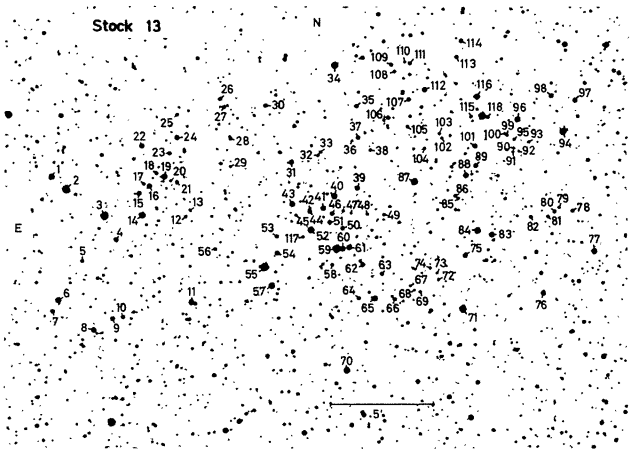

Figure 13 The open cluster Stock 13.

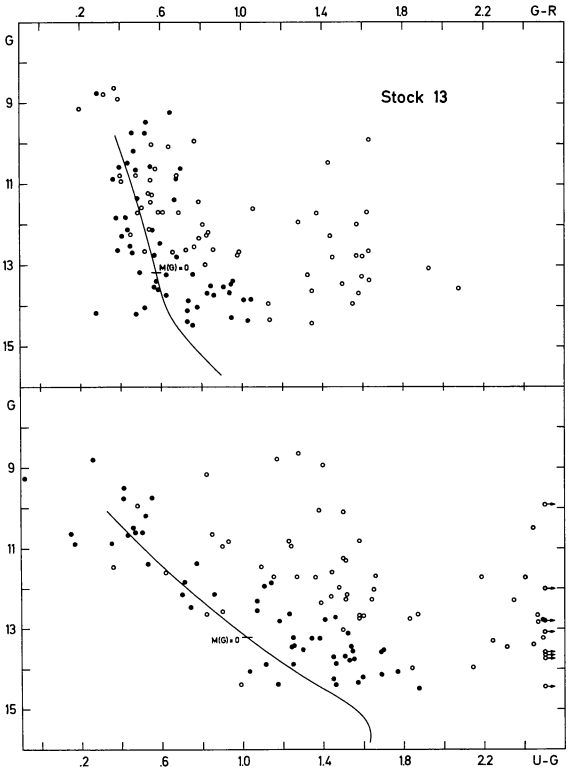

Figure 14 CMDs for Stock 13. Same symbols as in figure 2.

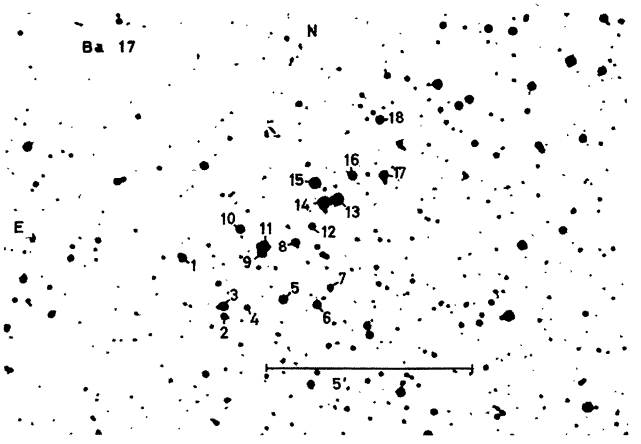

Figure 15 The open cluster Ba 17.

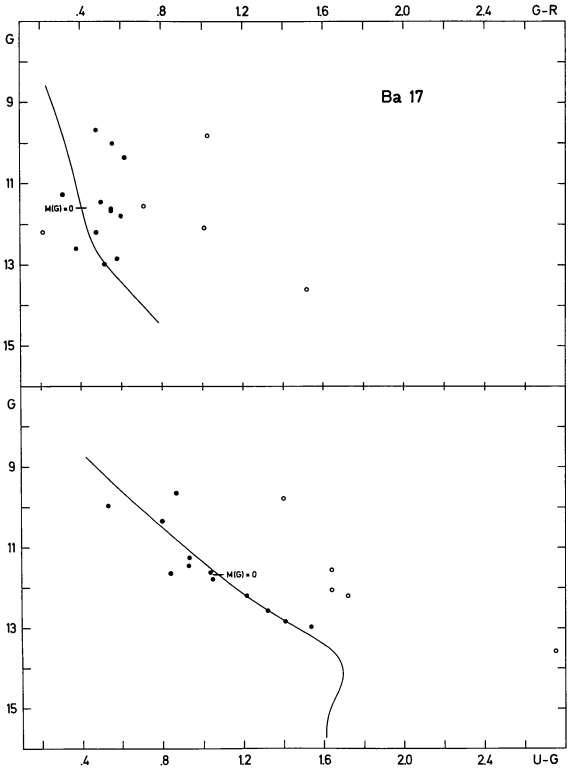

Figure 16 CMDs for Ba 17. Same symbols as in figure 2.