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A bibliography of colour magnitude diagram studies of star clusters in the Magellanic Clouds

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Summary. — Published literature has been surveyed to compile a bibliography of colour magnitude diagram studies of Magellanic Clouds' star clusters. Morphological parameters of colour magnitude diagram, e.g. location of main sequence turn off etc. are tabulated together with other parameters which are indicative of intrinsic cluster properties as well as limiting magnitude to which a given study has been carried out. Sixty four colour magnitude diagram studies are available for 44 star clusters in Small Magellanic Cloud while 191 such studies exist for 121 clusters in Large Magellanic Cloud. Relations between age, metallicity and other structural parameters of star clusters have been studied and compared with those of star clusters of our galaxy.

Key words: Magellanic Cloud star clusters — properties; colour magnitude diagram — bibliography; structural parameters.

1. Introduction.

Star clusters have always been the most important tools to test stellar evolution theories and to study structure, evolution and star formation history of a galaxy. When star clusters belong to other galaxies, then our knowledge on such studies can be extended for initial conditions different from those in our galaxy. The Magellanic Clouds (MCs), being our nearest neighbour galaxies, offer ideal conditions for such studies because :

(i) all clusters are at nearly the same distance from us ; there is relatively little interstellar absorption ; and the clouds are near enough that we can see virtually all clusters that have a significant number of stellar members.

(ii) Star clusters in MCs exhibits some significant differences mainly in metallicities, stellar contents and ages from those in our galaxy e.g. young MCs' star clusters are similar to those of galactic open clusters in stellar contents, but they have appearance and masses like galactic globular clusters. Consequently, their studies can provide insight into the differing evolutionary histories e.g. it is possible to test the influence of metal abundances on the late stages of stellar evolution by comparing galactic and MCs' star clusters of the same age.

One important way to study the above mentioned problems is to obtain colour magnitude diagrams (CMDs) of the MCs' star clusters, because they offer a direct and practicable means not only of probing them but also of determining the distances to the MCs. They also provide a necessary calibration and a check on more indirect age determinations (Elson and Fall, 1988 and references therein). CMDs of MCs' star clusters have therefore been obtained since the introduction of the photometric system in astrophysical research, i.e. since the beginning of the sixties (see Tab. I). With the recent technological development of astronomical detectors particularly CCDs, interest in securing observations to very faint magnitudes ($V \approx$ 24-25 mag) at and below the main sequence turn off point, has been greatly spurred (cf. Mateo, 1988a).

Alcaino (1975) for the first time compiled the widely dispersed observational results of MC's star clusters and also prepared an atlas of 36 objects with CMDs. Since then the number of publications involving CMD studies has increased greatly which has made increasingly difficult for investigators to keep track of the literature. The purpose of this work is (i) to compile all the literature at one place so that it can serve as a comprehensive guide to the readers (ii) to study the relation of cluster age with its metallicity and structural parameter namely tidal radii. The relations thus obtained have also been compared with those present in star clusters of our galaxy.

2. The catalogue.

The catalogue of CMD parameters and their literature

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source is given in table I for the star clusters in Small Magellanic Cloud (SMC) and Large Magellanic Cloud (LMC). As far as possible only published literature has been surveyed. If the same CMD study has been first presented in a scientific meeting e.g. Symposium or Colloquium and latter on it has been published in a scientific journal, then only the latter has been given in the table. The present catalogue includes almost all the CMD studies published up to October 1988.

2.1 Description of the catalogue. — The successive columns of the catalogue are described below.

Cluster name : In addition to commonly used designations NGC or IC, sequence number in the catalogues of Kron (1956), Lindsay (1958), Hodge and Wright (1974) and Edinburgh (Brück, 1976) are listed for SMC star clusters ; and those in the catalogues of Shapley and Lindsay (1963), Lyngå and Westerlund (1963) and Hodge and Sexton (1966) are given for LMC clusters. Identification charts for most of the SMC and LMC star clusters have been given by Hodge and Wright (1977) and (1967) respectively.

Limiting magnitude : This column gives the limiting V magnitude to which a given study surveys the distribution of stars in V, $(B-V)$ CMD. In case of BR or GR photometric studies, it gives limiting magnitude in R band. In such cases, a value precedes the letter 'R'.

The next four columns list respectively the metallicity [Fe/H] ; cluster age ; apparent V and $(B-V)$ value at the turn off point. Apparent R and $(B-R)$ or $(G-R)$ values for the turn off point are given if the study is in BR or GR photometric system. Cluster ages reported in the literature have been estimated using variety of ways and theoretical models which make them difficult to intercompare. In order to put the age data on a more uniform basis, Hodge (1983) and Elson and Fall (1988) have estimated the clusters' age using their published CMD. These values have also been listed in Table I.

The last two columns of the catalogue tell us respectively about the type of photometry, and the source from which parameters were obtrained. The correspondence between number and type of photometry is given in the foot note to table I. The first author and year of publication is given. A '+' after first author's name indicates one or more co-authors. The complete citation is given in the list of reference to table I.

3. The annual rate of publication of CMD studies.

Histogram in figure 1 shows the annual rate of publication from 1958-1987. The rate has increased considerably after mid-seventies but still it is slower than the CMD studies of galactic globular clusters as observed by Peterson (1986). As Peterson (1986) suggests, the trend in MCs' star clusters can be correlated with the introduction of the large, 4 meter class telescopes into the southern hemisphere in mid-seventies and the recent technological developments of high quantum efficiency light detectors like CCDs, vidicon cameras etc. There are several peaks in the histogram. They are mainly due to the fact that CMD studies for a large number of stars clusters have been carried out by a single person or group in those years. More specifically, the studies by Westerlund (1961), Gascoigne (1966), Hodge (1971), Robertson (1974), Hesser *et al.* (1976), Kontizas (1980) and Alcaino and Liller (1987) are mainly responsible for the peaks in the corresponding years of publication.

4. Properties of the MCs' star clusters.

In order to study the properties of MCs' star clusters the values of cluster age and [Fe/H] are taken from table I. The values given by Hodge (1983) and Elson and Fall (1988) for age estimates are preferred, wherever possible. The cluster radius and its distance from the rotation center of SMC are taken from Hodge (1980) and Kontizas (1984).

4.1 The relation between age and radius. — The dynamical evolution of a star cluster of a given mass depends on its linear size (Wielen, 1971, 1975). Encounters among cluster members are the main cause of dissolution of massive but smaller size clusters ; while large size clusters with same masses may be unstable due to galactic tidal fields. To verify these ideas, we plotted cluster radius as a function of its age in figure 2, which manifests that a clear relation exists in the case of SMC clusters in the sense that older clusters have larger radii than the middle aged clusters. Contrary to this, LMC clusters show no such dependence on age and resemble the open clusters of our galaxy having ages $5\times10^7-10^9$ yr (Janes *et al.*, 1988 and references therein). This difference, if real, probably indicates different type of evolution in the two clouds. However, to derive any firm conclusion more data based on accurate CMD studies are required.

4.2 The metallicity and age relation. — Mateo (1988b) and Smith *et al.* (1988) have recently studied the age-metallicity relation in MC. The relation given by Mateo (1988b) is based on a sample of clusters located in a small and remote region of LMC. Both found that the chemical enrichment in LMC is quite different than in our galaxy. In figure 3, we have plotted [Fe/H] against log of age which shows a rather week dependence between them ; however, oldest clusters are certainly metal-poor in comparison to middle aged clusters where the spread in metallicity is quite large. The trend disappears if we exclude oldest ($>10^{10}$ yr) LMC clusters. The age-metallicity relation for the entire LMC may be complicated since star formation seems to appear in a place for a while then disappears (Hodge, 1973). Consequently, the spread in figure 3 for LMC clusters may be due to the presence of galactocentric gradient of metallicity, as it is in the case of our galaxy star clusters (Janes *et al.*, 1988 ; Lyngå, 1982). This statement can be verified only when accurate CMD studies for a statistically significant number of MCs' star clusters become avilable.

4.3 Age distribution in SMC. — We have plotted log of cluster age against its distance from the rotation center of SMC in figure 4. The distances have been taken from Kontizas (1984). Figure 4 shows that older clusters (>

10^9 yr) lie preferably in the outer regions while relatively younger clusters are located in the inner side of the SMC. A similar trend has been observed in the case of open clusters of our galaxy by Janes *et al.* (1988).

Such studies have not been possible in the LMC clusters because of non-availability of sufficient data.

5. Discussions and conclusions.

Study of the structural parameter radius with age indicates that old SMC clusters seem to have larger radii (see Fig. 2) which could be due to either dynamical expansion of the cluster with age or a combination of dynamical evolution and physical conditions in the cloud. If large and small size clusters form with equal probability, then the lack of small size older ($> 2 \times 10^9$ yr) clusters may be due to their disruption because of encounters amongst cluster members (Wielen, 1971, 1975) while the absence of large sized relatively younger ($< 10^8$ yr) clusters may be due to the fact that physical conditions have changed with time in SMC and the present conditions favour the formation of small size clusters.

The content of the catalogue indicates the following :

(i) The number of CMD studies for a cluster as shown in table II, implies that most of the clusters have been studied only once. As the ages given by Hodge (1983) and Elson and Fall (1988) are based on the compilation of CMD studies, they have not been counted here.

(ii) Accurate deep ($V \sim$ 24-25 mag) photometric studies of the CMD of MCs' star clusters have started only recently. Most of the studies prior to 1984 are photographic. Recent accurate observations have proved that most of the old photographic data can be in large systematic error particularly close to the plate limit (cf. Hesser, 1988 and references therein).

One can therefore conclude that though total detectable cluster population in the MCs is ~ 7200 (Hodge, 1988 ; Olzewski *et al.*, 1988 ; Bhatia and MacGillivray, 1989), reliable CMD studies are available only for very few of them ($\sim$ 15-20).

Present work should serve as a comprehensive guide to the literature of CMD studies of MCs' star clusters and can be used in a number of ways. However, it must be emphasized that any summary of this type cannot replace direct use of the original references for specific and detailed information on the methodology of observation, the techniques of reduction etc., and assessments of the internal and external accuracy of the results.

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TABLE I. — *Bibliography of the CMD studies of MC star clusters.*

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
E60	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
E60	-	-	6±3(7)	-	-		Hodge(1983)
E102	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
E102	-	-	1.2±.6(8)	-	-		Hodge(1983)
E107	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
E107	-	-	1.3±.7(8)	-	-		Hodge(1983)
E133	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
E133	-	-	3.0±1.5(8)	-	-		Hodge(1983)
E164 N602b	20.0	-	1(7)	-	-	3	Westerlund(1964)
E164 N602b	-	-	6±1(7)	-	-		Hodge(1983)
HW22	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
HW22	-	-	3±2(8)	-	-		Hodge(1983)
HW32	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
HW32	-	-	7±2(7)	-	-		Hodge(1983)
HW40	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
HW40	-	-	2.8±.9(7)	-	-		Hodge(1983)
HW43	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
HW43	-	-	8.2±.3(7)	-	-		Hodge(1983)
HW62	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
HW62	-	-	2.5±.9(8)	-	-		Hodge(1983)
HW64	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
HW64	-	-	1.2±.3(8)	-	-		Hodge(1983)
L1	20.0	-	-	-	-	3	Gascoigne(1966)
L1	21.0	-1.5	8(9)	-	-	3	Gascoigne(1980)
L1	22.5	-1.0	8(9)	22.6	-	1	Gascoigne+(1981)
L1	-	-	9(9)	-	-		Hodge(1983)
L1	24.0	-1.3	10(9)	22.3±.2	-	5	Olszewski+(1987)
L3	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L3	-	-	0.4±.1(9)	-	-		Hodge(1983)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
L8 K3	22.5	-	-	-	-	6	Walker(1970)
L8 K3	20.0	-	-	-	-	3	Gascoigne(1966)
L8 K3	21.0	-1.5	3(9)	-	-	3	Gascoigne(1980)
L8 K3	22.0	-1.0	4(9)	21.8	-	1	Gascoigne+(1981)
L8 K3	24.0R	-1.2	8(9)	-	-	2	Rich+(1984)
L10 K2 N121	21.0	-	-	-	-	3	Tifft(1963)
L10 K2 N121	-	-	13±5(9)	-	-		Hodge(1983)
L10 K2 N121	24.0R	-1.4±.1	12±2(9)	-	-	2	Stryker+(1985)
L11 K7	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L11 K7	-	-	3±1(8)	-	-		Hodge(1983)
L11 K7	20.0	-	-	-	-	2,5	Buttress+(1988)
L13 K9	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L13 K9	-	-	2±1(8)	-	-		Hodge(1983)
L14	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L14	-	-	7±6(8)	-	-		Hodge(1983)
L15 K10 N152	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L15 K10 N152	22.0	-	0.8(9)	-	-	3	Dickson+(1981)
L15 K10 N152	-	-	6.1±.9(8)	-	-		Hodge(1983)
L16 K12 N176	22.0	-	-	19.8	-	3	Dickson+(1981)
L16 K12 N176	21.0	-	0.4±.2(9)	-	-	3	Hodge+(1987)
L16 K12 N176	-	-	4.6±.1(8)	-	-		Hodge(1983)
L20 K11	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L20 K11	-	-	7±3(8)	-	-		Hodge(1983)
L26 K17	21.0	-	0.3±.1(9)	-	-	3	Hodge+(1987)
L48	21.6	-	1-70(6)	-	-	3	Kontizas(1980)
L48	-	-	1.5±.4(8)	-	-		Hodge(1983)
L54 K35 N330	16.0	-	-	-	-	3	Arp(1959b)
L54 K35 N330	15.9	-	-	-	-	3	Robertson(1974a)
L54 K35 N330	-	-	7±1(6)	-	-		Hodge(1983)
L54 K35 N330	-	-1.8±.2	-	-	-	14	Richtler+(1983)
L54 K35 N330	20.0	-	12(6)	-	-	9	Carney+(1985)
L54 K35 N330	22.2	-1.3	10(6)	-	-	5	Mateo(1988)
L58 K37	19.0	-	-	-	-	3	Gascoigne(1966)
L59 K36 N339	19.0	-	-	-	-	3	Gascoigne(1966)
L59 K36 N339	-	-	3(9)	-	-		Olszewski(1988)
L60 K39 N346	17.4	-	-	-	-	10	Niemela+(1986)
L67 K46 N361	19.5	-	-	-	-	3	Arp(1958b)
L67 K46 N361	-	-	>5(8)	-	-		Hodge(1983)
L71 K48 N371	14.3	-	-	-	-	3	Andrews(1971)
L71 K48 N371	-	-	4±1(6)	-	-		Hodge(1983)
L74 K50	17.5	-	-	-	-	3	Andrews(1971)
L75 K51 N395	17.5	-	-	-	-	3	Andrews(1971)
L76 K52 I1624	17.5	-	-	-	-	3	Andrews(1971)
L82 K60 N411	21.6	-	0.5-1(9)	-	-	3	Kontizas(1980)
L82 K60 N411	-	-	2±1(8)	-	-		Hodge(1983)
L82 K60 N411	22.0R	-0.9±.3	1.5±.5(9)	-	-	2	Da Costa+(1986)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
L83 K59 N416	20.0	-1.0±.2	–	–	–	3	Hardy+(1980)
L83 K59 N416	–	–	6±2(8)	–	–		Hodge(1983)
L83 K59 N416	21.0	>-1.0	1.2±.5(9)	20.5	0.5	3	Durand+(1984)
L85 K58 N419	19.5	–	–	–	–	3	Arp(1958a)
L85 K58 N419	21.0	–	–	20.2	0.25	6	Walker(1972b)
L85 K58 N419	20.0	-1.2	–	–	–	3	Hardy+(1980)
L85 K58 N419	–	–	6.7±.5(8)	–	–		Hodge(1983)
L85 K58 N419	21.0	>-1.0	2.5±.7(9)	20.0	0.3	3	Durand+(1984)
L87 K62 N422	21.6	–	1-70(6)	–	–	3	Kontizas(1980)
L87 K62 N422	–	–	1.8±.1(8)	–	–		Hodge(1983)
L90 I1665	21.6	–	1-70(6)	–	–	3	Kontizas(1980)
L90 I1665	–	–	2.1±.2(8)	–	–		Hodge(1983)
L94 K65 N456	19.0	–	1(7)	–	–	3	Westerlund(1961b)
L94 K65 N456	–	–	1.0±.4(7)	–	–		Hodge(1983)
L94 K65 N456	23.0	-0.23	3(8)	–	–	5	Papenhausen+(1988)
L96 K69 N458	20.0	–	2(7)	–	–	3	Arp(1959a)
L96 K69 N458	–	–	5±1(7)	–	–		Hodge(1983)
L97 K66 N460	19.0	–	1(7)	–	–	3	Westerlund(1961b)
L97 K66 N460	–	–	2±1.4(7)	–	–		Hodge(1983)
L99 K67 N465	19.0	–	1(7)	–	–	3	Westerlund(1961b)
L105 N602a	20.0	–	1(7)	–	–	3	Westerlund(1964)
L105 N602a	–	–	1.6±.5(7)	–	–		Hodge(1983)
L107 K602c	20.0	–	1(7)	–	–	3	Westerlund(1964)
L107 N602c	–	–	1.0±.2(7)	–	–		Hodge(1983)
L113	23.0R	-1.4±.2	4-5(9)	–	–	2	Mould+(1984)

(b) Large Magellanic Cloud

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
Anon.\`b1'	16.0	–	–	–	–	4	Westerlund(1961a)
Anon.\`b2'	16.0	–	–	–	–	4	Westerlund(1961a)
Anon.\`b3'	16.0	–	–	–	–	4	Westerlund(1961a)
Anon.\`b4'	16.0	–	2.5-4.4(9)	–	–	4	Westerlund(1961a)
Anon.	18.0	–	1(8)	–	–	3	Baird+(1974)
Anon. 4	18.2	–	–	–	–	3	Hodge(1960)
E2(C0535-618)	23.0	-0.23	1.5(9)	19.8	0.30	5	Schommer+(1986)
E2(C0535-618)	23.0	-0.23	2±1(9)	20.75±.2	0.38±.06	5	Gratton+(1987a)
ESO 121-SCO	24.0	-0.9±.2	10(9)	21.5	0.5	5	Mateo+(1986b)
ESO 121-SCO	–	–	8±2(9)	–	–		Elson+(1988)
ESO 121-SCO	24.0	-0.7	10(9)	–	–	5	Papenhausen+(1988)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
GIC0435-59	24.4	-2.0±.2	16-18(9)	22.45±.1	0.35±.05	5	Gratton+(1987b)
HS314 N1962	16.0	-	2-3.6(6)	12.0	-	4	Westerlund(1961a)
HS314 N1962	-	-	1.6±.5(7)	-	-		Hodge(1983)
LW4	23.0	-	2(9)	-	-	5	Hesser+(1984)
LW47	24.0	-0.3	2(9)	-	-	5	Olszewski(1988)
LW79	24.0	-0.2±.3	1.8+.3(9)	20.25	0.43	5	Mateo+(1987)
LW127	21.0	-	0.8±.2(9)	-	-	3	Hodge+(1987)
LW134	21.0	-	0.6±.2(9)	-	-	3	Hodge+(1987)
LW177	24.0	-0.3	2-2.5(9)	-	-	5	Olszewski(1988)
LW195	24.0	-0.3	2(9)	-	-	5	Olszewski(1988)
LW207	22.0	-0.3	2(9)	-	-	5	Olszewski(1988)
LW376	22.0	-	8(8)	-	-	3	Hardy+(1980)
LW376	-	-	7.0±.1(8)	-	-		Hodge(1983)
LW399	23.0	-0.5	3(9)	-	-	5	Olszewski(1988)
LW405	22.0	-	8(8)	-	-	3	Hardy+(1980)
LW405	-	-	6.0±2(8)	-	-		Hodge(1983)
LW441	20.0	-	-	-	-	3	Gascoigne(1966)
LW467	20.0	-	-	-	-	3	Gascoigne(1966)
N1466	20.0	-	-	-	-	3	Gascoigne(1966)
N1466	21.0	-	-	-	-	11	Penny(1975)
N1466	21.0	-2.0	-	-	-	1	Harris+(1983)
N1466	21.5	-	-	-	-	1	Hesser+(1984)
N1644	21.5	-	-	-	-	12	Hesser+(1976)
N1651	21.5	-	-	-	-	12	Hesser+(1976)
N1651	23.0R	-0.5±.3	2±.8(9)	-	-	2	Mould+(1986a)
N1651	-	-	1.6±.4(9)	-	-		Elson+(1988)
N1652	21.5	-	-	-	-	12	Hesser+(1976)
N1711	22.4	0.0	21-50(6)	-	-	5	Mateo(1988)
N1718	-	-	2.5±.5(9)	-	-		Elson+(1988)
N1751	21.5	-	-	-	-	12	Hesser+(1976)
N1754	22.0R	-	0.8-1.2(9)	-	-	13	Jensen+(1988)
N1756	-	-	<3(9)	-	-	5	Buonanno+(1988)
N1777	21.5	-0.7±.5	0.9(9)	-	-	2,3	Mateo+(1985)
N1777	-	-	0.9±.2(9)	-	-		Elson+(1988)
N1783	17.0	-	-	-	-	3	Sandage+(1960)
N1783	20.0	-	-	-	-	6	Gascoigne(1962)
N1783	-	-	>0.2(9)	-	-		Hodge(1983)
N1783	-	-0.5	46(7)	-	-		Flower(1984)
N1783	21.5R	-0.45±.3	9±4(8)	-	-	13	Mould+(1989)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
N1786	21.5	-	-	-	-	12	Hesser+(1976)
N1795	22.0R	-	0.8-1(9)	-	-	13	Jensen+(1988)
N1806	21.5	-	-	-	-	12	Hesser+(1976)
N1806	20.0	-	-	-	-	3	Geyer+(1982)
N1810	16.0	-	-	-	-	3	Woolley(1960)
N1810	-	-	5±4(7)	-	-		Hodge(1983)
N1818	16.0	-	-	-	-	3	Woolley(1960)
N1818	16.6	-	-	-	-	3	Robertson(1974a)
N1818	-	-	1.7±.1(7)	-	-		Hodge(1983)
N1818	-	-1.6	-	-	-	14	Richtler+(1983)
N1818	-	-1.6	-	-	-		Nelles+(1984)
N1831	19.0	-	-	-	-	3	Hodge(1963)
N1831	21.5	-1.0±.5	4±1.1(8)	18.5	-	3	Hodge(1984)
N1831	-	-	3-5(8)	-	-	5	Buonanno+(1988)
N1831	24.0	-0.1	5-7(8)	-	-	5	Mateo(1988)
N1834	19.0	-	48±15(6)	-	-	4	Alcaino+(1987)
N1834	-	-	5.2±2(7)	-	-		Elson+(1988)
N1836	19.0	-	38±10(6)	-	-	4	Alcaino+(1987)
N1839	19.0	-	33±8(6)	-	-	4	Alcaino+(1987)
N1841	20.0	-	-	-	-	3	Gascoigne(1966)
N1841	21.5	-	-	-	-	12	Hesser+(1976)
N1841	22.5	-2.2	7-13	-	-	6	Anderson+(1987)
N1841	-	-	12(9)	-	-		Elson+(1988)
N1844	18.0	-	-	-	-	3	Hodge(1961)
N1844	-	-	5.1±.4(7)	-	-		Hodge(1983)
N1846	18.0	-	-	-	-	3	Hodge(1960)
N1846	21.5	-	-	-	-	12	Hesser+(1976)
N1847	-	-	1.6±.4(7)	-	-		Hodge(1983)
N1847	20.0	-0.3	2.5(7)	-	-	3	Nelson+(1983)
N1847	19.0	-	24±10(6)	-	-	4	Alcaino+(1987)
N1850	18.0	-	2(7)	-	-	3	Tifft+(1973)
N1850	16.6	-	2.1(7)	-	-	3	Robertson(1974a,b)
N1850	-	-	4±1(7)	-	-		Hodge(1983)
N1850	19.0	-	21±5(6)	-	-	4	Alcaino+(1987)
N1850	-	-0.3±.1	-	-	-	7	Schommer+(1988)
N1854	17.5	-	-	-	-	3	Connally+(1977)
N1854	16.7	-	2.1(7)	-	-	3	Robertson(1974a,b)
N1854	-	-	3±1(7)	-	-		Hodge(1983)
N1854	19.0	-	25±6(6)	-	-	4	Alcaino+(1987)
N1856	20.0	-1.0	80±30(6)	-	-	3	Hodge+(1984)
N1856	19.0	-	73±20(6)	-	-	4	Alcaino+(1987)
N1858	19.0	-	17±6(6)	-	-	4	Alcaino+(1987)
N1858	-	-	10±15(6)	-	-		Elson+(1988)
N1860	19.0	-	90±30(6)	-	-	4	Alcaino+(1987)
N1860	-	-	11.5±5.6(7)	-	-		Elson+(1988)
N1863	19.0	-	58±17(6)	-	-	4	Alcaino+(1987)
N1863	-	-	5.7±2(7)	-	-		Elson+(1988)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
N1866	18.0	-	1(7)	-	-	3	Arp(1967),Arp+(1967)
N1866	18.0	-	7(7)	-	-	3	Robertson(1974a,b)
N1866	22.5	-	-	-	-	6	Walker(1974)
N1866	-	-0.1	86±5(6)	-	-		Becker+(1983)
N1866	-	-	8±3(7)	-	-		Hodge(1983)
N1866	-	-1.2±.2	-	-	-	14	Richtler+(1983)
N1866	-	-1.2	-	-	-		Nelles+(1984)
N1866	21.5	-	-	-	-	5	Walker(1985)
N1866	-	-0.4±.1	-	-	-	7	Schommer+(1988)
N1868	20.0	-	7(8)	19.6	-	3	Flower+(1980)
N1868	-	-	3.3±.3(7)	-	-		Hodge(1983)
N1868	-	-1.2	75(7)	-	-		Flower(1984)
N1870	19.0	-	72±30(6)	-	-	4	Alcaino+(1987)
N1870	-	-	5.5±4.2(7)	-	-		Elson+(1988)
N1978	18.0	-	-	-	-	3	Hodge(1960)
N1978	21.5	-	-	-	-	12	Hesser+(1976)
N1978	-	-0.5	4.5(8)	-	-		Flower(1984)
N1978	22.0	-0.5	2(9)	20.5	0.5	3	Olszewski(1984)
N1978	-	-	2.5±.5(9)	-	-		Elson+(1988)
N1983	16.0	-	3.2(6)	-	-	4	Westerlund(1961a)
N1983	-	-	8±1(6)	-	-		Hodge(1983)
N1984	16.0	-	2.2(6)	-	-	4	Westerlund(1961a)
N1984	-	-	7±2(6)	-	-		Hodge(1983)
N1987	-	-	0.4-1(9)	-	-	5	Buonanno+(1988)
N1994	16.0	-	2.4(6)	-	-	4	Westerlund(1961a)
N1994	-	-	7.3±.7(6)	-	-		Hodge(1983)
N2004	16.0	-	-	-	-	3	Woolley(1960)
N2004	16.0	-	-	-	-	3	Robertson(1974a)
N2004	-	-	8±1(6)	-	-		Hodge(1983)
N2010	18.0	-	-	17.0	-	3	Gascoigne+(1969)
N2010	23.0	0.0	6.3-17(7)	-	-	5	Mateo(1988)
N2011	16.0	-	2.8(6)	-	-	4	Westerlund(1961a)
N2011	-	-	6±1(6)	-	-		Hodge(1983)
N2014	16.0	-	3.4(6)	-	-	4	Westerlund(1961a)
N2014	-	-	6±1(6)	-	-		Hodge(1983)
N2021	16.0	-	3.4-4.8(6)	-	-	4	Westerlund(1961a)
N2058	20.0	-	1(8)	-	-	3	Flower(1982)
N2058	-	-	7±2(7)	-	-		Hodge(1983)
N2065	20.0	-	1(8)	-	-	3	Flower(1982)
N2065	-	-	7±2(7)	-	-		Hodge(1983)
N2074	16.0	-	2.3-4.8(6)	-	-	4	Westerlund(1961a)
N2074	-	-	4±2(6)	-	-		Hodge(1983)
N2081	16.0	-	3.6-6(6)	-	-	4	Westerlund(1961a)
N2092	16.0	-	10(6)	-	-	4	Westerlund(1961a)
N2092	-	-	4±2(6)	-	-		Hodge(1983)
N2100	16.0	-	2.8-7(6)	-	-	4	Westerlund(1961a)
N2100	16.0	-	-	-	-	3	Robertson(1974a)
N2100	-	-	1±.2(7)	-	-		Hodge(1983)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
N2102	-	-	7±2(6)	-	-		Hodge(1983)
N2121	21.5	-	-	-	-	12	Hesser+(1976)
N2121	21.0	-1.1±.2	4±2(8)	20.0±.4	0.4	3	Flower+(1983)
N2121	-	-	7±2(8)	-	-		Hodge(1983)
N2121	-	-1.0	3.9(8)	-	-		Flower(1984)
N2133	21.5	-	-	-	-	12	Hesser+(1976)
N2133	20.0	-1.0	1.3(8)	-	-	3	Hodge+(1984)
N2134	21.5	-	-	-	-	12	Hesser+(1976)
N2134	20.0	-1.0	1.1(8)	-	-	3	Hodge+(1984)
N2136	18.0	-	-	17.0	-	3	Gascoigne+(1969)
N2136	17.7	-	2.7(7)	-	-	3	Robertson(1974a,b)
N2136	-	-	4±1(7)	-	-		Hodge(1983)
N2136	-	-1.2	-	-	-		Nelles+(1984)
N2154	21.5	-	-	-	-	12	Hesser+(1976)
N2155	21.5	-	-	-	-	12	Hesser+(1976)
N2155	-	-	2.5±.6(9)	-	-		Elson+(1988)
N2156	18.5	-	3(7)	-	-	3	Flower+(1975)
N2156	-	-	6±3(7)	-	-		Hodge(1983)
N2157	16.0	-	2.4(7)	-	-	3	Robertson(1974a,b)
N2157	-	-0.6±.3	-	-	-	14	Richtler+(1983)
N2157	-	-0.6	-	-	-		Nelles+(1984)
N2159	19.0	-	3(7)	-	-	3	Flower+(1975)
N2159	-	-	6±3(7)	-	-		Hodge(1983)
N2160	18.0	-	5(7)	-	-	3	Baird+(1974)
N2160	-	-	8±3(7)	-	-		Hodge(1983)
N2162	21.5	-	-	-	-	12	Hesser+(1976)
N2162	23.8	-0.23	7(8)	19.5±.1	0.2±.05	5	Schommer+(1984)
N2162	-	-	1(9)	-	-		Elson+(1988)
N2164	17.5	-	5(7)	-	-	3	Hodge+(1973)
N2164	16.7	-	2.8(7)	-	-	3	Robertson(1974a,b)
N2164	18.0	-	3(7)	-	-	3	Flower+(1975)
N2164	-	-	5±3(7)	-	-		Hodge(1983)
N2164	-	-0.6±.2	-	-	-	7	Schommer+(1988)
N2172	18.0	-	3(7)	-	-	3	Flower+(1975)
N2172	-	-	6±2(7)	-	-		Hodge(1983)
N2173	21.5	-	-	-	-	12	Hesser+(1976)
N2173	22.5R	-0.8±.1	1.8(9)	-	-	2	Mould+(1986b)
N2173	-	-	2.1±.4(9)	-	-		Elson+(1988)
N2190	21.5	-	-	-	-	12	Hesser+(1976)
N2190	22.8	-0.23	7(8)	19.3±.1	0.2±.05	5	Schommer+(1984)
N2193	21.5	-	-	-	-	12	Hesser+(1976)
N2193	23.5	-0.5±.3	2.2±.6(9)	20.1±.15	-	2	Da costa+(1987)
N2193	-	-	1.8±.4(9)	-	-		Elson+(1988)
N2203	22.0	-	1(9)	-	-	1	Harris+(1983)
N2203	23.0	-	-	-	-	1,5	Hesser+(1984)
N2209 LW408	20.0	-	-	-	-	3	Gascoigne(1966)
N2209 LW408	21.9	-	-	-	-	6	Walker(1971)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
N2209 LW408	22.0	-1.2	8(8)	19.8	0.15	3	Gascoigne+(1976)
N2209 LW408	21.5	-	-	-	-	12	Hesser+(1976)
N2209 LW408	22.0	-0.6±.15	8(8)	-	-	3	Hardy+(1980)
N2209 LW408	-	-	7±1(8)	-	-		Hodge(1983)
N2209 LW408	-	-1.1	8(8)	-	-		Flower(1984)
N2209 LW408	21.5	-0.6	1.2±.2(9)	-	-	5	Dottori+(1987)
N2209 LW408	-	-	8(8)	-	-	5	Buonanno+(1988)
N2210 SL858	21.5	-	-	-	-	12	Hesser+(1976)
N2210 SL858	21.5	-	-	-	-	1	Harris+(1983)
N2210 SL858	21.5	-	-	-	-	1	Hesser+(1984)
N2210 SL858	21.5	-	-	-	-	5	Walker(1984)
N2210 SL858	23.1	-2.2	-	-	-	6	Anderson+(1986)
N2210 SL858	-	-	12(9)	-	-		Elson+(1988)
N2213	21.5	-	-	-	-	12	Hesser+(1976)
N2213	22.3	-0.5±.3	1.3±.5(9)	-	-	2	Da Costa+(1985)
N2213	20.0	-0.4±.15	1.5(9)	-	-	7	Geisler(1987)
N2213	-	-	9±4(8)	-	-		Elson+(1988)
N2214	18.0	-	2.8(7)	-	-	3	Robertson(1974a,b)
N2214	-	-	4±1(7)	-	-		Hodge(1983)
N2214	-	-1.2±.2	-	-	-	14	Richtler+(1983)
N2231 LW466	20.0	-	-	-	-	3	Gascoigne(1966)
N2231 LW466	21.5	-	-	-	-	12	Hesser+(1976)
N2231 LW466	22.2	-0.5	1.3±.2(9)	20.2	0.38	6	Walker(1979b)
N2231 LW466	-	-	1.2±.1(9)	-	-		Hodge(1983)
N2231 LW466	-	-1.3	5.6(8)	-	-		Flower(1984)
N2241	21.5	-	6(8)	-	-	3,5	Jones(1987)
N2249	21.5	-	-	-	-	12	Hesser+(1976)
N2249	21.5	-	6.25(8)	-	-	3,5	Jones(1987)
N2249	-	-	3-5(8)	-	-	5	Buonanno+(1988)
N2249	-	-	5.5(8)	-	-		Elson+(1988)
N2257 LW481	20.0	-	-	-	-	3	Gascoigne(1966)
N2257 LW481	22.3	-	-	-	-	6	Walker(1972a)
N2257 LW481	21.5	-	-	-	-	12	Hesser+(1976)
N2257 LW481	23.0	-2.0	10-18(9)	22.4±.2	0.4±.04	1	Harris+(1983)
N2257 LW481	-	-	14±2(9)	-	-		Hodge(1983)
N2257 LW481	22.5	-2.0	12-16(9)	22.4	-	3	Stryker(1983)
N2257 LW481	-	-	15(9)	22.4	-	1,5	Hesser+(1984)
NC1	21.0	-	1.6±.4(9)	-	-	3	Hodge+(1987)
SL4 (C0433-724)	21.2	-	1.4±.5(9)	-	-	3	Hodge+(1987)
SL204	18.0	-	-	-	-	3	Hodge(1971)
SL205	18.0	-	-	-	-	3	Hodge(1971)
SL234	19.0	-	48±20(6)	-	-	4	Alcaino+(1987)
SL237	19.0	-	27±9(6)	-	-	4	Alcaino+(1987)
SL258	21.0	-	0.3±.1(9)	-	-	3	Hodge+(1987)
SL298	18.0	-	-	-	-	3	Hodge(1971)
SL304	19.0	-	42±15(6)	-	-	4	Alcaino+(1987)
SL315	18.0	-	-	-	-	3	Hodge(1971)
SL333	18.0	-	-	-	-	3	Hodge(1971)
SL495	-	-	1.7±.1(7)	-	-		Hodge(1983)

TABLE I (*continued*).

Cluster name	V_{limit}	[Fe/H]	Age	V_{to}	$(B-V)_{to}$	Note	Reference
SL506 H14	-	-	2±.3(9)	-	-		Elson+(1988)
SL506 H14	22.0R	-	2-3(9)	-	-	13	Jensen+(1988)
SL556 H4 LW237	24.0	-0.7±.3	2(9)	20.5±.3	0.42±.05	8	Mateo+(1986a)
SL556 H4 LW237	-	-	1.5±.3(9)	-	-		Elson+(1988)
SL639	-	-	1.8(7)	-	-		Hodge(1983)
SL663 LW237	-	-	2.2±.4(9)	-	-		Elson+(1988)
SL782	18.0	-	7(7)	-	-	3	Baird+(1974)
SL782	-	-	1.5±.3(7)	-	-		Hodge(1983)
SL791	18.0	-	5(7)	-	-	3	Baird+(1974)
SL791	-	-	9±2(7)	-	-		Hodge(1983)
SL810	18.0	-	7(7)	-	-	3	Baird+(1974)
SL810	-	-	1.9±.3(8)	-	-		Hodge(1983)
SL822	18.0	-	7(7)	-	-	3	Baird+(1974)
SL822	-	-	1.0±.4(8)	-	-		Hodge(1983)
SL842	-	-	2.8±.6(9)	-	-		Elson+(1988)
SL855 LW420	-	-	1.7±.3(9)	-	-		Elson+(1988)
SL868 H11 LW437	19.6	-	-	-	-	3	Gascoigne(1966)
SL868 H11 LW437	19.0	-	-	-	-	3	Freeman+(1977)
SL868 H11 LW437	21.5	-2.4	6(8)	18.9	-0.04	6	Walker(1979a)
SL868 H11 LW437	22.0	-2.2	-	-	-	6	Anderson+(1984)
SL868 H11 LW437	22.5	-	-	-	-	5	Hesser+(1984)
SL868 H11 LW437	23.5	-	-	-	-	5	Stryker+(1984)
SL868 H11 LW437	-	-	12(9)	-	-		Elson+(1988)

Notes:

(a) Number inside the parenthesis denotes the power of ten in the column of cluster age.

(b) In the colomn of photometry type number means the following:

1 := BV Sit Vidicon; 2 := BR CCD; 3 := BV pg; 4 := BVRI pg; 5 := BV CCD; 6 := BV Electronographic; 7 := CCD in Washington system; 8 := UBVR CCD; 9 := UBV,JHK,DDO; 10 := VRI CCD 11 := UBV Electronographic; 12 := Instrumental magnitudes 13:= Thun-Gunn GR CCD; 14:= Four colour Strömgren

(c) References to Table 1

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TABLE II. — *Distributions of numbers of studies in clusters.*

Clusters in	Number of studied clusters	Number of studies per cluster 1	2	3	4	5	6	7
SMC	44	33	7	0	3	1	0	0
LMC	121	85	20	7	4	2	2	1

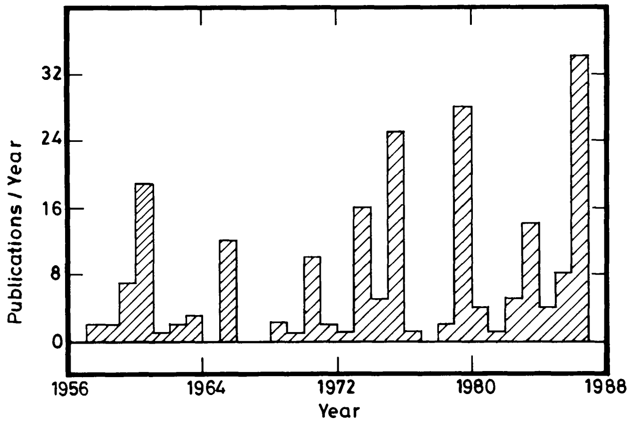

FIGURE 1. — Distribution of the annual rate of publication of the CMD studies of MCs' star clusters.

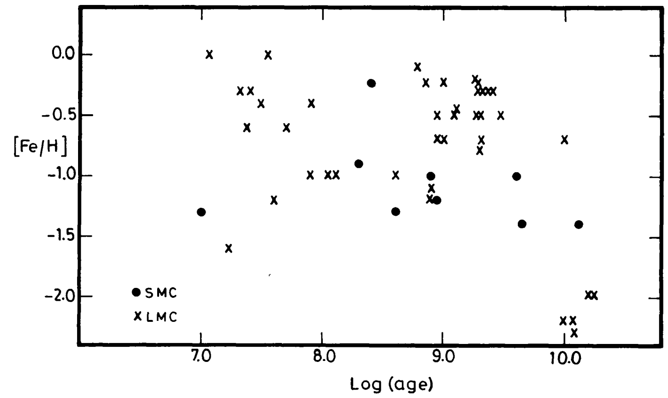

FIGURE 3. — The plot of [Fe/H] against log of age.

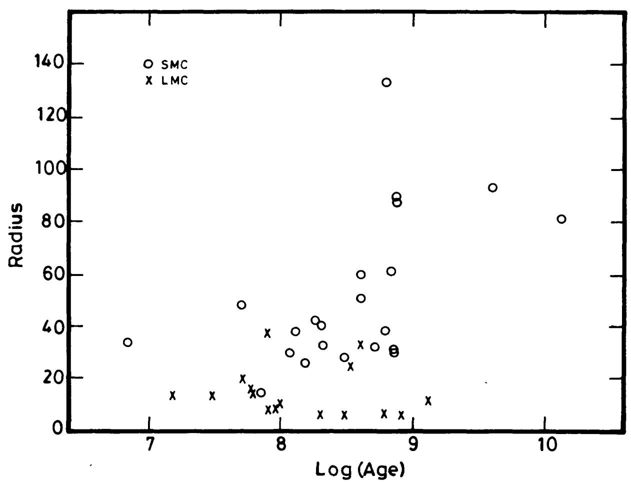

FIGURE 2. — The plot between radius and age of the clusters. Radii for SMC and LMC are taken from Kontizas (1984) and Hodge (1980) respectively

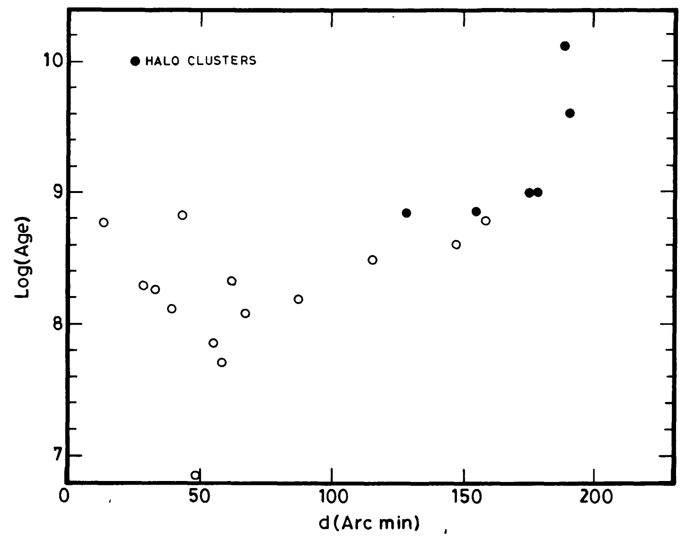

FIGURE 4. — Cluster age of SMC has been plotted against its distance from the SMC rotation center which is taken from Kontizas (1984).