GDF DATA BANKS BULLETIN

VOL. 14 , No. 4

SYDNEY July 2010

AUSTRALIA

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ISSN 1453-1674

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GDF DATABANKS BULLETIN, NO. 14, VOL. 4, 2010
ISSN 1453 - 1674

Cancer as an erosion process of human society

1. Summary

The ratio between incidence rate (IR) of all cancer types in male population (MP) to female population (FP) as a function of age is thoroughly analyzed taking into account the statistical data officially issued in 8 geographic regions. Following main conclusions are revealed:

(i) cancer appears like an erosion process in the human society revealing five important steps during human development from birth to death;
(ii) these steps are located at approximately the same age no matter the regions are considered, namely 9, 22, 39, 55 and 77 age years (ay);
(iii) these steps appear as a resonance between the development processes specific to individuals in MP and FP, respectively, when some forms of cancer develop, namely: maximum rate of blood and brain cancers (MP at 9), onset of breast cancer (FP at 22), maximum rate of breast cancer (FP at 39); onset of prostate cancer (MP at 57) and maximum rate of prostate cancer (MP at 77);
(iv) these steps can be perfectly fitted by the UNIVERSAL representation establishing the nature and amplitude of the erosion process in each considered region;
(v) cancer appears more clear as a social process involving groups of individuals of both sexes responsible for cancer development, but not all developing themselves cancer.

2. Statistical data

Statistical data of IR for all cancers in MP and FP for specific groups of 5 ay expressed by annual new cases of cancer reported to 100,000 individuals in the same group of sex and age. These data made the object of previous studies [1-4] and are taken from the websites of national offices for statistics. The following regions are considered:

Table 1.

region	calendar period
England	1992 - 2007
Australia	1982 - 2006
Scotland	1980 - 2004
NY state	2000 - 2004
Mumbai	1999
Japan	1998, 1999
USA all races	1999
Canada	2005, 2006

3. Retrieval of statistical data

Figure 1 shows all considered data expressed by the ratio

$$R(t) = IR(MP)/IR(FP) \quad (1),$$

where t is the age. IR data are averaged for each age group over the calendar period considered. Error bars are shown were is the case. In the present study uncertainties for 68.3 % confidence level (standard deviations) are considered only.
It can observe that the age development of cancers has the same shape for all considered regions and it appears like a sinusoidal variation around the line R=1.
Figure 2 represents the typical R(t) variation according to the function which perfectly fit this variation, namely:

$$R(t) = (a*t^b)*\sin(c*t^d) \quad (2),$$

where a, b, c, d are parameters determined by non-linear regression.
Table 2 gives these parameters and associated uncertainties for each region with correlation coefficients (correl) better than 0.999.
As it was expected, not all these parameters are independent. For instance, there is a clear linear relationship L(ln(a), b) (Figure 3). Parameters c and d have small range of variation, namely approximately c=0.3 and d=0.75, but giving a smaller correlation coefficient (Figure 4).
It can observe in Figures 1 and 2 that there are 2 points in which R(t) intersects the line R=1 named as to1 and to2 (in addition with the birth point of too =0) and three points in which R(t) has extreme values, namely te1, te2 and te3.
These two groups of age points are calculated by different procedures, namely for toi with condition R(toi)=1 turning in a trivial equation, while the equation for tei comes from the first derivative of R(t) which can be solved by numerical procedure with increments up to 0.01 ay. It is important to observe that toi depend only on parameters c and d while tei depend only on parameters b, c, d. Parameter a having the highest uncertainties does not affect these age points. All these five age points, ti, are given in Table 3 for each considered region and average values <ti> for overall ones mentioned also in Figure 3.
The amplitude of this overall erosion process produced by cancer development in human society in each region can be estimated by the peak-to-peak amplitude of R(t) as

$$A = R(te3) – R(te1) \quad (3)$$

with values in the following table:

ISSN 1453 - 1674

Table 4.

England	Australia	Scotland	NY state	Japan	Canada	Mumbai	USA
0.58	0.96	0.65	0.65	1.24	0.50	0.042	0.63

We can observe the clear difference between Japan and Mumbai as two regions with different lifestyles and social organizations. On the other hand, countries in the Commonwealth (including NY state and USA all races, but excepting Canada) has an average value of A = 0.58 ± 0.3.

4. Universal representation

As we mentioned already in the previous studies [1-4], cancer occurs as a process in a human community as a result of stepwise experiment starting at birth date. For a homogeneous population like MP and FP, respectively, having the same age transitions during the life of each individual, the development of overall cancers and each type of cancer as well, can be described by a sigmoidal function, IR(t), defined by an induction period (estimated by the half time) towards a saturation value, both these values defining the type of cancer specific to each sex population.

Taking into account these values for each type of cancer and separately for MP and FP, respectively, it can observe that each age point, ti corresponds to a specific age transition in R(t) as superposition of MP and FP age transitions as it is shown in the following table:

Table 5.

i	ti , ay	type and stage of cancer
1	8.9±0.8	maximum rate of blood (especially lymphoma) & brain cancers in MP
2	22.7±1.6	onset of breast cancer in FP
3	39.1±1.3	maximum rate of breast cancer in FP
4	57.5±3	onset of prostate cancer in MP
5	77.7±4	maximum rate of prostate cancer in MP

In fact, these processes appears a little delayed in R(t) than in IR(t).

R(t) shows a sequence of 5 processes occurring in the overall human society as a result also of the above mentioned stepwise experiment triggered by birth event. In a recent study on similar experiments on a large number of systems revealing processes with different nature and amplitude, it was established that these can be described by the UNIVERSAL representation as well [5], so

$$\ln (ti) = N*\ln (i) + M \quad (4)$$

where (N, M) have the same general significances established on a large number and variety of transformation processes [6]. In a future paper these will be resumed in a condensed and clearer manner. It is important to mention that in this study [5] it was described as an example of this model the development of human individual during his life in 7 stages with the general age points (transitions) at

2; 7; 15; 25; 40; 55; 77 ay (5)

with

$$N = 1.863 \pm 0.014, M = 0.672 \pm 0.02, \text{correl} = 0.9999 \quad (6).$$

The age points in the series (5) were established by taking into account hormonal and mental changes in human individuals. At least 4 of age points revealed by cancer development are also in this series. Taking into account the age evolution of an individual it is possible to establish his specific series of age points (5) defining his own pattern.
Table 6 gives the values of (N, M) parameters with associated uncertainties and correlation coefficients for each region and the overall values for <ti> and Figure 5 presents these data graphically as first phylogenic relationship L(N, M). The error bars are smaller than individual dots. The open dot represents the average values of (N, M) over the above mentioned Commonwealth countries denoted as <CW>. In this way, three regions remained on the phylogeny and the average <ti> associated with A value for each one (Figure 5). It can observe that the amplitude of erosion process given by general significance of ontogenic parameter M is in good agreement with A values.
Figure 6 shows the dependence of kinetic entity (ctr) and coupling strength (CS) between inert and transforming components as a function of process amplitude. The following relationships result:

Ctr, CS: Japan > Canada > <ti> > <CW> (7)
ctr: <CW> > <ti> > Canada > Japan (8).

In other words, these relationships show that cancer is a social process involving groups of people of both sexes (ctr) whose size is in reverse relationship with their number in society (Ctr) and also with the coupling strength with people not participating to cancer process (Cin). Kinetic entity or group of people involved in cancer process include also people not developing themselves cancer disease, but are responsible for cancer development like the catalyst in a chemical reaction. For instance, for the above series, Japan are the smallest such groups of individuals, but most numerous and they are strongly coupled with the rest of society not participating to cancer development. We may think about the human society as a suspension of solid particles of mass ctr in a fluid of mass Cin. The smaller are ctr the more numerous they are and stronger is their interaction with the fluid due by the overall active (contact) surface between Ctr = sum(ctr) and Cin.

It is important to compare the amplitude of process R2(te2) driven by breast cancer (C50) and process R3(te3) driven by prostate cancer (C61).Their amplitude as peak height relative to the line R(t) = 1 (Figures 1 and 2) are

$$r2 = 1 - R(te2) \quad \text{and} \quad r3 = R(te3) - 1 \qquad (9).$$

Table 7.

	England	Australia	Scotland	NY state	Japan	Canada	Mumbai	USA	average
r2	0.54	0.42	0.52	0.41	0.67	0.52	0.48	0.46	0.502 ± 0.08
r3	0.81	1.02	0.84	0.76	1.38	0.74	0.50	0.77	0.85 ± 0.26
r3/r2	1.50	2.42	1.60	1.87	2.07	1.43	1.03	1.69	1.70 ± 0.42

From these values (Table 7 and Figure 7) it results once again that:

a. the ratio between amplitude of C61 and C50 tends to the golden ratio (1.618…);
b. amplitude of C50 has a small variation in different regions, while C61 show big differences depending on the region and calendar time;
c. C50 triggers C61 so that the coupling strength between them and MP and FP as well, can be estimated by the ratio r3/r2. This ratio defines the erosion process of human society and can be correlated with particularities of people, region and their lifestyle in different regions of the world (history, religion, food, climate, etc). These overall particularities define the specific mentality or social pattern of the stable population in the region.

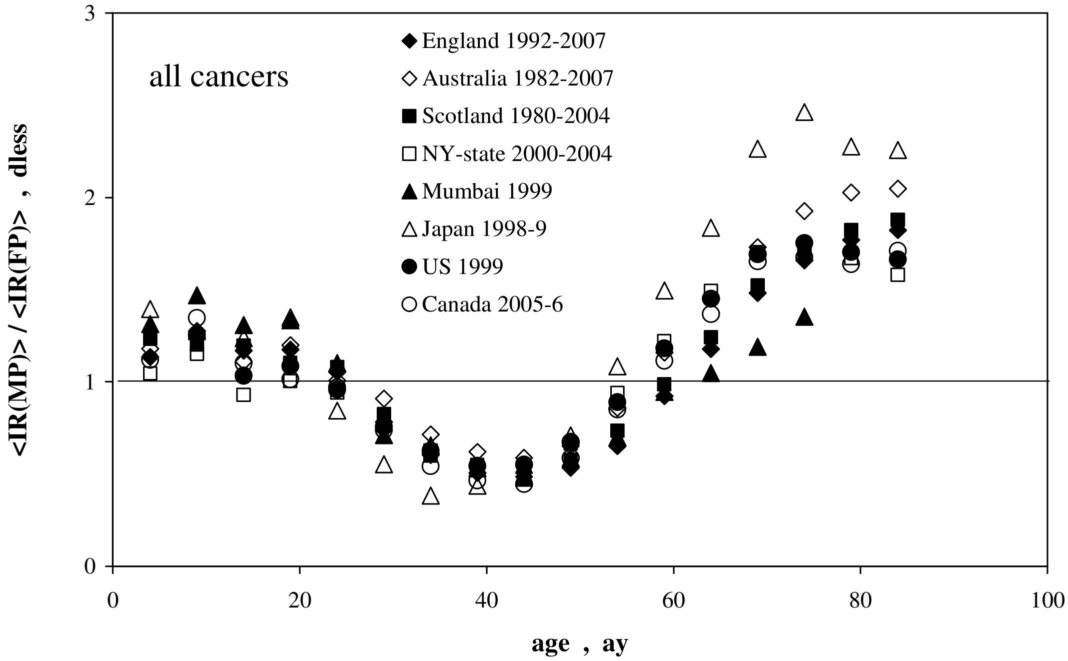

Figure 1.

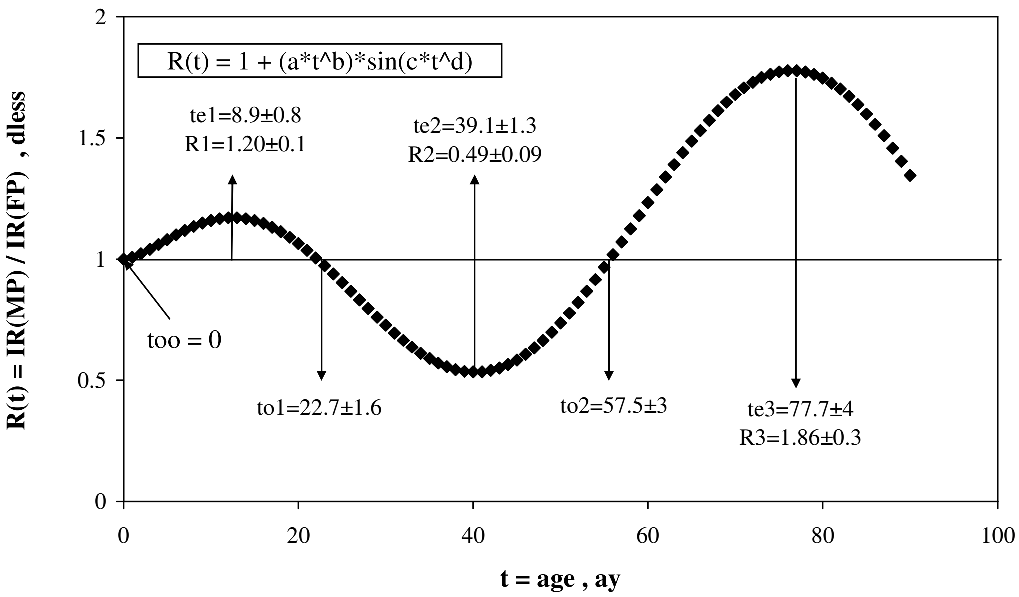

Figure 2.

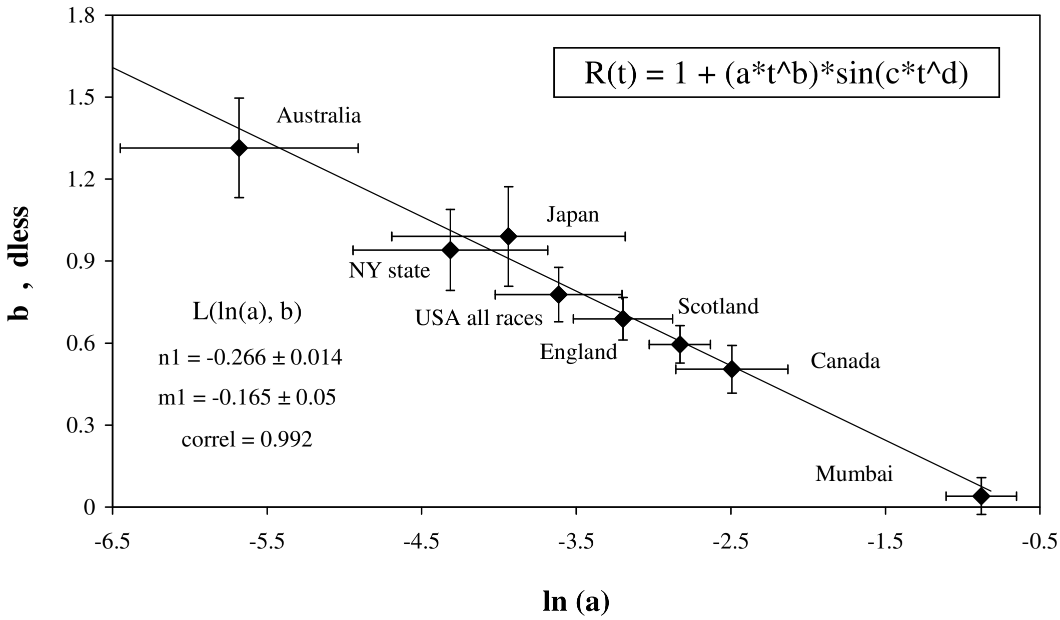

Figure 3.

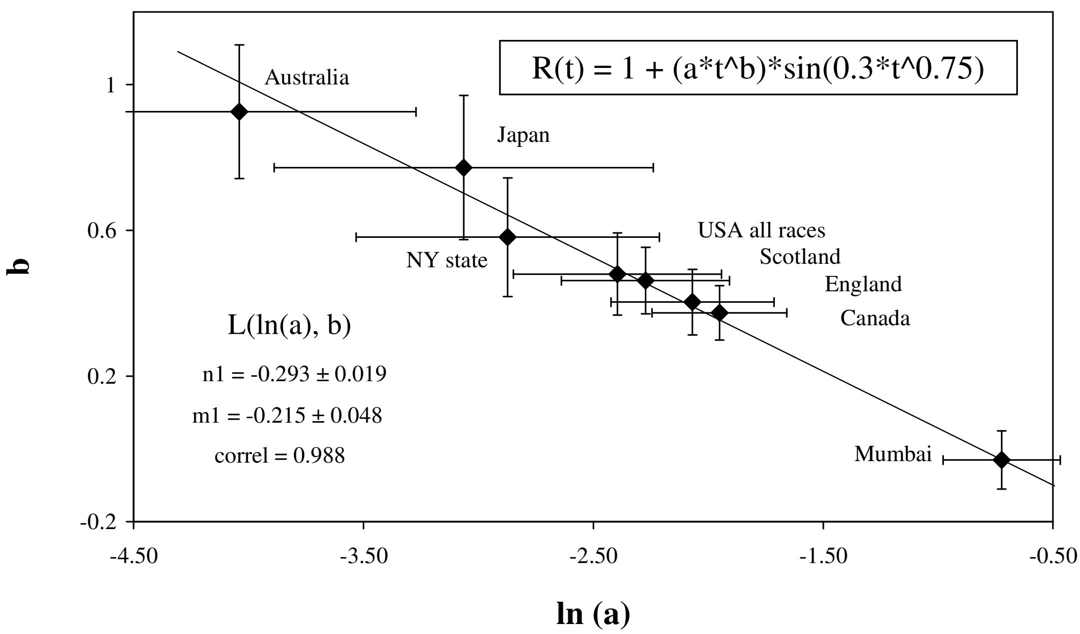

Figure 4.

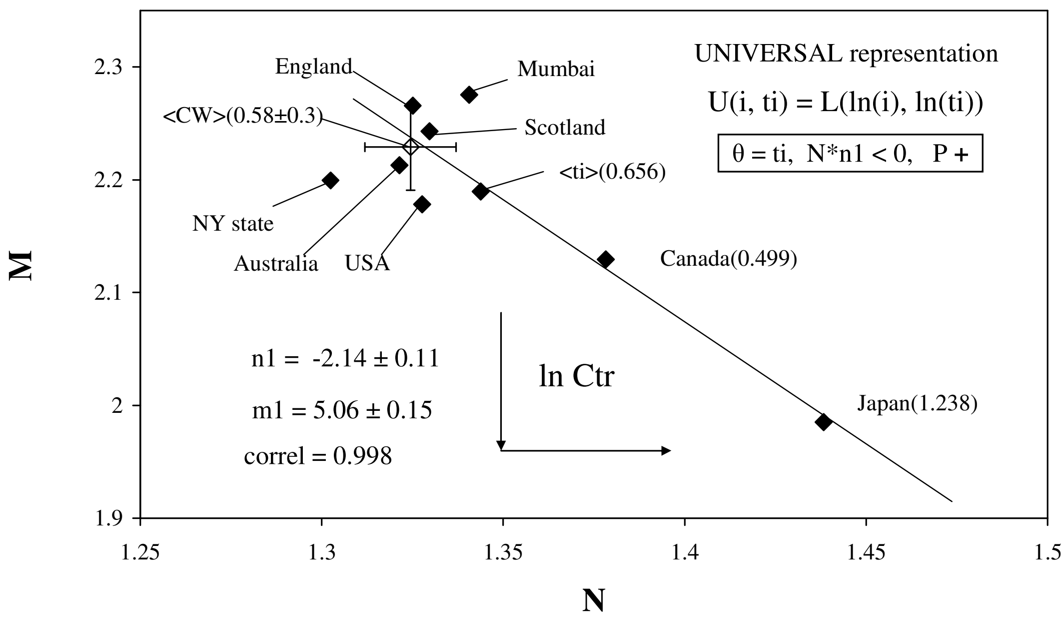

Figure 5.

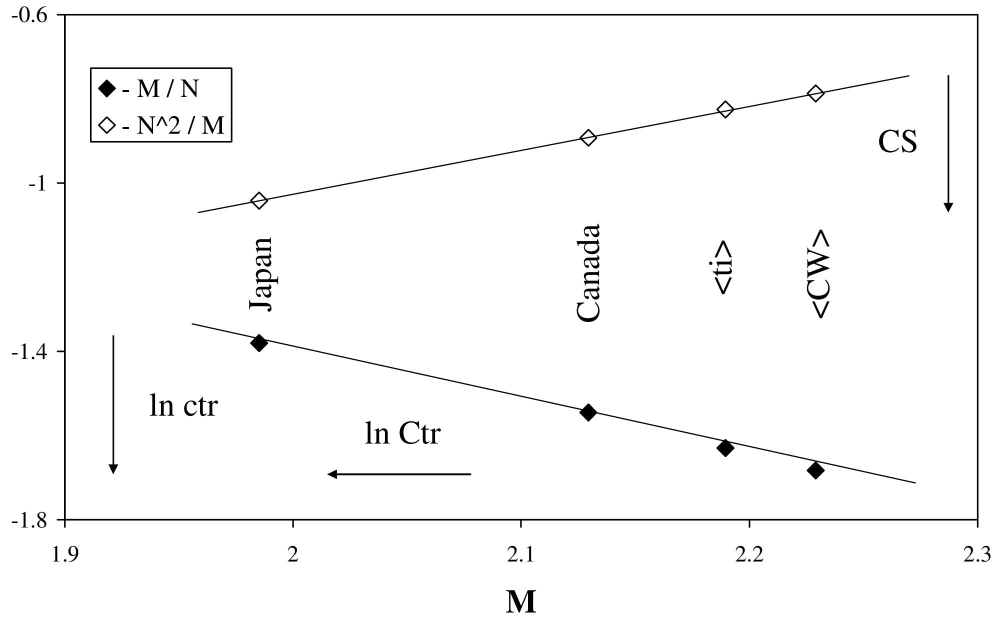

Figure 6.

Table 2.

	England	Australia	Scotland	NY state	Japan	Canada	Mumbai	USA
a	0.059±0.02	0.0034±0.006	0.041±0.02	0.013±0.01	0.020±0.03	0.083±0.06	0.42±0.2	0.027±0.02
b	0.60±0.1	1.31±0.3	0.69±0.3	0.94±0.3	0.99±0.4	0.51±0.2	0.041±0.1	0.78±0.2
c	0.28±0.04	0.30±0.1	0.29±0.06	0.29±0.08	0.40±0.1	0.34±0.08	0.29±0.06	0.30±0.06
d	0.76±0.03	0.76±0.09	0.75±0.06	0.77±0.07	0.70±0.08	0.73±0.06	0.75±0.06	0.75±0.5

Table 3.

ti, ay	i	England	Australia	Scotland	NY state	Japan	Canada	Mumbai	USA	<ti>, ay
te1	1	9.64	9.14	9.42	9.02	7.28	8.41	9.73	8.83	8.9±0.8
to1	2	24.1±3	22.9±7	23.7±4	22.3±5	19.7±6	21.9±5	24.6±5	22.2±4	22.7±1.6
te2	3	41.33	39.08	40.61	37.76	35.36	38.24	42.45	37.98	39.1±1.3
to2	4	60.5±8	57.1±19	59.8±12	54.9±14	53.4±16	56.8±13	62.4±13	55.6±11	57.5±3
te3	5	81.34	76.61	80.08	73.38	73.72	77.31	84.18	74.83	77.7±4

Table 6.

UNIVERSAL: ln(ti) = N*ln (i) + M

	England	Australia	Scotland	NY state	Japan	Canada	Mumbai	USA	<ti>, ay
N	1.3251	1.32145	1.3297	1.30245	1.4383	1.3783	1.3406	1.3277	1.3438
M	2.2656	2.213	2.2429	2.1995	1.9852	2.1294	2.2752	2.1781	2.1896
correl	0.9(7)	0.9(6)	0.9(7)	0.9(6)	0.9(7)	0.9(7)	0.9(7)	0.9(7)	0.9(7)
u(N)	0.0004	0.00068	0.00019	0.00044	0.00028	0.00026	0.00022	0.00024	0.00029
u(M)	0.00045	0.00076	0.00022	0.00049	0.00031	0.00029	0.00024	0.00026	0.00032

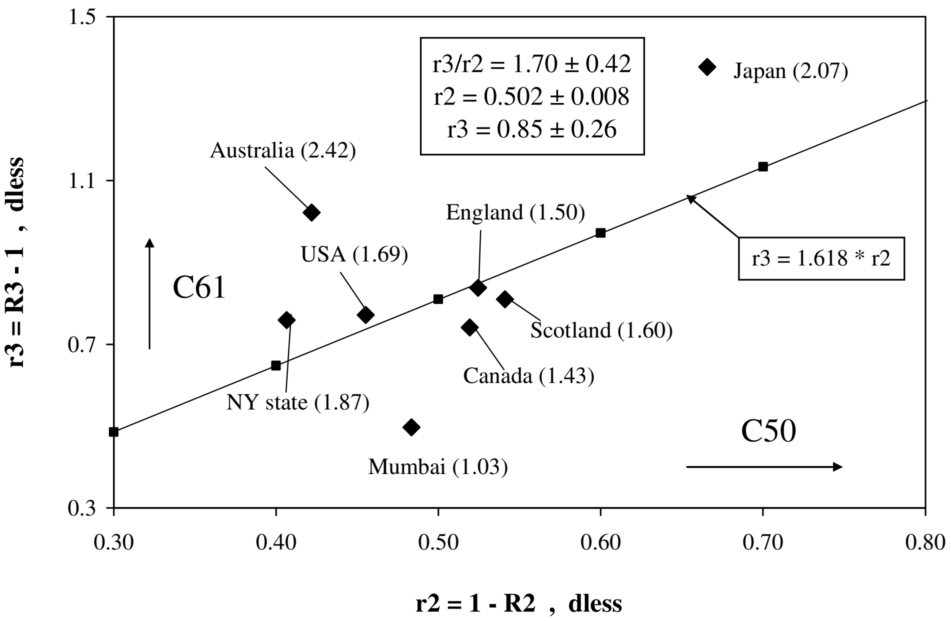

Figure 7.

5. References

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About the author:

First name	Gheorghe
Last name	Dragan
Born	1 September 1945, Ploiesti, Prahova (Romania)
Studies	Faculty of Physics, University of Bucharest, Romania (1963-1968) Ph.D.in Physics, University of Bucharest, Romania (1980)
experience	● Head of material testing laboratory, ICECHIM, Polymer Department, Bucharest (1969-1979); ● Initiator and leader of the research project on new forms and sources of energy; ICECHIM, Center of Physical Chemistry (1979-1988); ● Head of laboratory of analytical devices and measuring instruments, AMCO-SA, Bucharest (1988-1993); ● Technical manager of GDF-DATA BANKS, Bucharest (1993-2008); ● Expert metrologist, Romanian Bureau of Legal Metrology, Bucharest, Romania (1997-2000).
publications	● 90 scientific papers ● 70 scientific communications ● 17 patents ● 5 books
Addresses:	Str. Abrud 25, Bucharest 011315, Romania 0733-854-148 c/o 19 Weaver Place Minchinbury, NSW 2770, Australia (+61/0415-674-742) dragan_gdf@yahoo.com

ISSN 1453 - 1674

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1998	2	1	Editorial: socio-psychological implications in creation and utilization of a databank (Ioan-Bradu Iamandescu); Behavior in vapor-liquid equilibria (VLE): I. Structural aspects; Behavior in vapor-liquid equilibria: II. Several structures in databanks; Symposium on VDC-4 held on 30 October 1997 at Lubrifin-SA, Brasov (Romania).	F
1998	2	2	Practical course of metrology (Romanian)	AFI
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