Gravitational Differences of a Chemical Nature

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At equal latitude the acceleration due to gravity in not equal in the northern and southern hemispheres. This does not depend only on the bigger or lower concentration of masses of the Earth, but also on the chemical nature of these masses.

1 – Introduction

The solar system moves with a translation motion towards the constellation of Hercules with a velocity of 19.4 km/s. The Earth rotates around the sun with a helicoidal orbit at a mean velocity of 29.8 km/s, with variations every six months. The velocity decreases from perihelion to aphelion and grows from aphelion to perihelion (that is to say that the Earth is not like a spinning top the velocity of which becomes lower and lower). Two equinoxes; 21st March and 23rd September when the sun is directly above the equator. At this time the North and South Poles would be geometrically equidistant from the sun. I have some doubts concerning this and currently I am planning an experiment to verify this. At equal latitudes north and south, the acceleration due to gravity should be equal in the two hemispheres.

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The inclination of the Earth's axis is another question. It is more or less accentuated in the direction of the longitudinal axis of the orbit. In aphelion it is at a maximum value. However, there is also some inclination along the short axis which combines with the other inclination to produce a single result. Something tells me that the inclination of the Earth's axis of rotation depends on the eccentricity of the great oceanic masses of water in the southern hemisphere in relation to the great mass of rock in the northern hemisphere.

The ideal line linking the two magnetic poles is not a diameter, but it is rather a string. Beside it there are two spheroidal vaults, not equal between them. At this point we would have to ask a question: why shouldn't this line coincide with the geographic rotation axis if it weren't for causes of chemical effects that could prevent it?

2 – Experiment with sample masses of equal volume

Those of greater specific weight are hollow by construction so that all have the same nominal mass of 29 grams. I have chosen Campbell River (Canada) 50° latitude north and two days later, Santa Cruz (Argentina) 50° latitude south. Both locations are at sea-level in a flat terrain, on the spring equinox of the year 2000 (sun over the equator). I have an analytical Mettler balance model AE240 sensitivity 0.00001 gr. The balance was at rest for 24 hours, with the electrical connection attached to the mains. The following day, without calibrating the balance, (used as a dynamometer) 105 weighings were carried out (7 samples x 15 weighings each) in the morning and a further 105 in the afternoon. There were insignificant hourly variations in the weight. All seven samples at the corresponding latitude south weighed much more than in Canada in addition to the strong gravitational differences of a chemical nature (already observed in other experiments). At Santa Cruz, Argentina 50° latitude south the greater weight of the

samples measured was on average 0.00414 x 1/7 = 0.00059 gram-weight, (see table below and attached drawing).

3 – Tables of results and graphs

Table of preliminary results

	Campbell R.	Santa Cruz	
Gold	29.65721	29.65750	+ 0.00029 $\pm 5 \times 10^{-5}$
Lead	29.64963	29.64998	+ 0.00035 $\pm 5 \times 10^{-5}$
Silver	29.63637	29.63688	+ 0.00051 $\pm 5 \times 10^{-5}$
Bronze	29.58400	29.58456	+ 0.00056 $\pm 5 \times 10^{-5}$
Aluminium	29.66202	29.66266	+ 0.00064 $\pm 5 \times 10^{-5}$
Sand	39.59510	39.59620	+ 0.00081 $\pm 5 \times 10^{-5}$
Water	36.77835	36.77958	+ 0.00098 $\pm 5 \times 10^{-5}$
			= 0.00414

The weights of the sand and water samples include that of two equal containers in chrome plated brass plate. The total weight of each of the two samples (container plus contents), has been proportioned to the nominal 29 gr. of the other 5 samples; with the same proportion the bigger weight (found in Santa Cruz) of the brass-water sample which was +0,00123 gr. is now of +0,00098 gr. With the same process, the brass-sand sample which originally was +0,00110 gr. has become now +0,00081 gr. In the diagram I have indicated the greater weight of each chemical sample. The first two samples, gold and lead overlap, but each of them is well distanced from the other 5 samples. The bronze sample overlaps the other two samples but all three are well separated from the other four samples. Of these, the silver and aluminium samples are well separated. On the 93 stable elements of Mendeleev's table it is possible to create many other samples having well defined gravitational differences. Many

others, however, overlap because their differences are small but no less significant.

The ratio w (2)/w (1) between the values measured in site 2, Santa Cruz, and site 1, Campbell River, must as a first approximation reflect the variation in gravity at the two locations. I have calculated the values of g using the formula below which gives normal gravity as a function of the latitude (La) in degrees:

$g\ Norm = 978.03 \times (1 + 0.0053 \times \sin^2 La - 0.00006 \times \sin^2 2La)\ cm/s^2$

$g\ Norm\ (50°) = 981.023\ cm/s^2$

and correcting this value at 50° with values of the gravitational anomaly read from an updated map :

Anomaly in the region of Campbell River $g\ An(1) = -0.9 \pm 0.01\ cm/s^2$

Anomaly in the region of Santa Cruz $g\ An(2) = -0.04 \pm 0.01\ cm/s^2$

Hence $g\ (1) = 980.933 \pm 0.010\ cm/s^2$

$g\ (2) = 980.983 \pm 0.010\ cm/s^2$

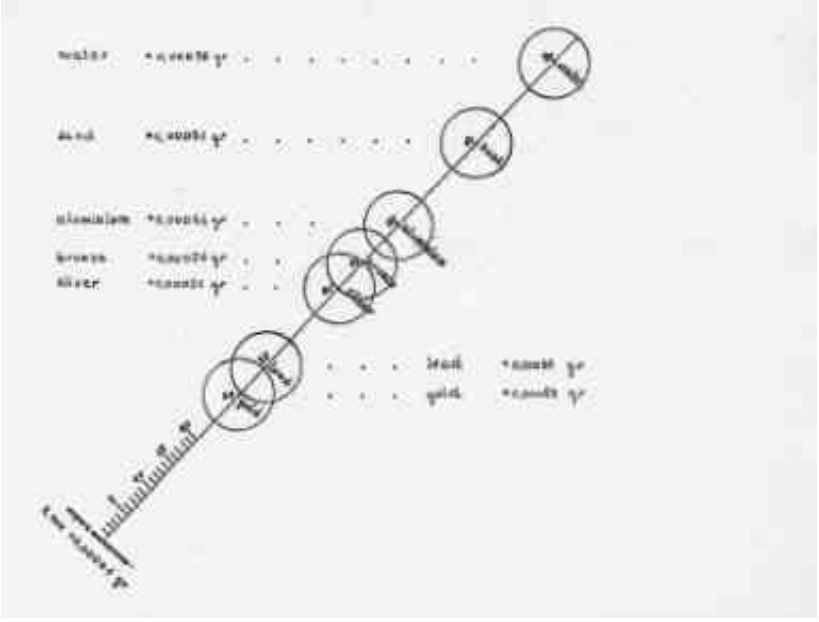
and the ratio $\frac{g\ (2)}{g\ (1)} = 1{,}000051 \pm 0.000014$

The experimental results should *not* be necessary strictly compatible with this ratio table-calculated by these gravitational anomalies, but it gives an idea of the sign and the order of magnitude of the rate.

In this undertaking I was accompanied by the Physicist Dr. Umberto Piva from Bologna. At the end of the experiment (that is after seeing with his own eyes the experimental results) he looked me straight in the eyes and asked me what had lead me into this research, what reasoning. Finally the crux of the matter! I replied that the northern hemisphere attracts and is attracted more by the sun because it is richer in materials that interact more strongly with the sun's attraction. As a result of this generally greater interaction, the samples

under examination turn out to be less heavy. On the other hand, the same samples at the same latitude in the southern hemisphere weigh more because in the south the field of interaction with the sun is surely weaker in which case the samples there undergo a greater attraction towards the centre of the Earth.

Gravitational Differences of a Chemical Nature exist even on a planetary scale, furthermore I would say to a striking degree. In fact the water, which in the South experienced the greatest increase in weight of the 7 samples, it is not by chance that the southern hemisphere has the most extensive oceanic areas. For the same reason, the northern temperate strip of the Earth is taken as by the scruff of the neck by the Sun which drag it along during the motion of translation.



After the experimental results obtained in both locations and a first diagram and calculations made with my own instruments, now, in my laboratory in Ravenna, I elaborated more precise calculations, tables and graphics.

Table 1 – weighs of the samples, averages and standard deviations of the averages (SDA)

Sample	Campbell River Sea level 30 weighs for each sample ***(all weighs are in grams)*** Temp: 18° to 20°C Humidity: 51 to 53% Pressure: 1029 to 1037 hPa		Santa Cruz Sea level 40 weighs for each sample Temp: 21°C Humidity: 51% Pressure: 1002 to 1005 hPa	
	w (average)	**SDA**	**w** (average)	**SDA**
Gold	29.657204	0.000010	29.657481	0.000014
Lead	29.649549	0.000017	29.649985	0.000016
Silver	29.636304	0.000014	29.636874	0.000015
Bronze	29.583952	0.000016	29.584559	0.000015
Aluminium	29.662008	0.000011	29.662654	0.000013
Brass-Sand	39.595059	0.000017	39.596182	0.000017
Brass-Water	36.778351	0.000017	36.779554	0.000017

Table 2 – ratios w(S.Cruz)/w(Campbell R.), associated uncertainties and intervals of confidence with probability of confidence P=0.999

Sample	$w_{S.Cruz}/w_{Campbell\ R.} = g_{S.Cruz}/g_{Campbell\ R.}$	$\mathbf{D}\ (g_{sc}/g_{cr})$	Interval of confidence with P=0.999
gold	1.0000093	0.0000006	0.0000022
lead	1.0000147	0.0000008	0.0000029
silver	1.0000193	0.0000007	0.0000025
bronze	1.0000205	0.0000008	0.0000029
aluminium	1.0000218	0.0000006	0.0000022
brass-sand	1.0000284	0.0000006	0.0000022
brass-water	1.0000327	0.0000007	0.0000025

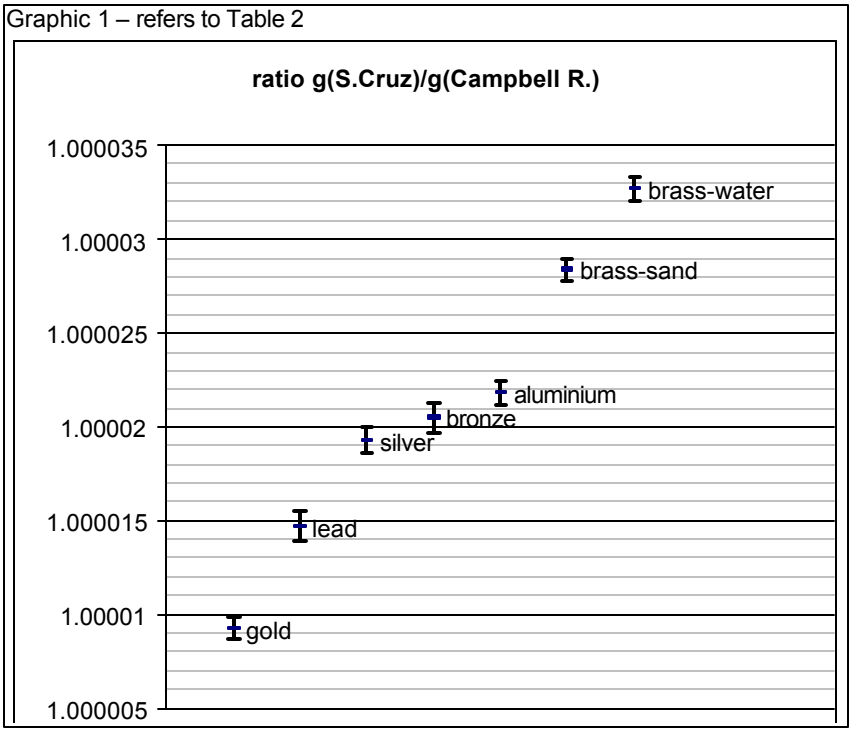
Note that, in accordance with the Weak Equivalence Principle, *it should be*

$$\frac{w_A}{w_B} = \frac{mg_A}{mg_B} = \frac{g_A}{g_B}$$

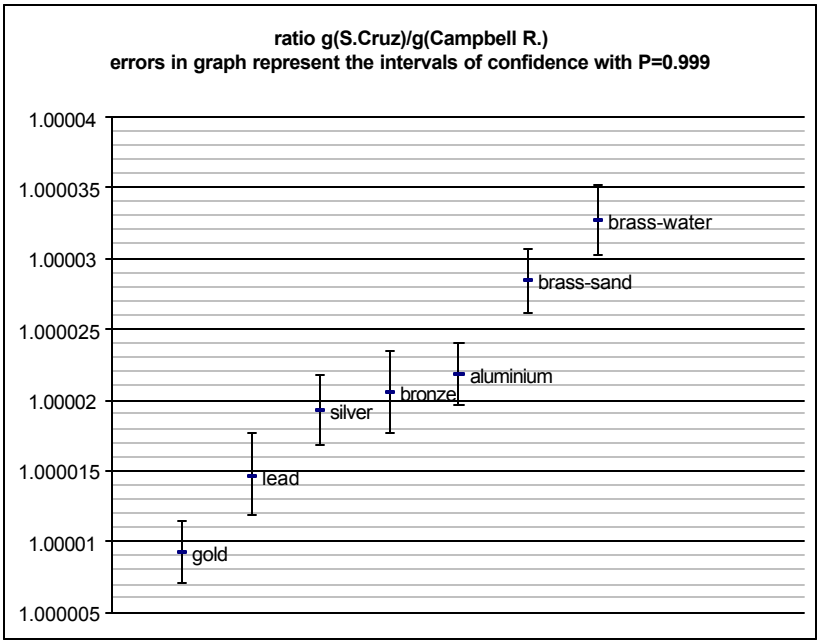
and it should be the same for each sample, naturally. But this experiment (and other ones) shows that *this is not true*.

Appendix

Graphic 1 – refers to Table 2



Graphic 2 – refers to Table 2



About samples: the volumes of the samples in the following table were measured at the Istituto Colonnetti of Torino with a hydrostatic weighing method

Sample	Temp. ± 0.5 °C	Volume (cm^3)	Uncertainty (cm^3)
	20.3	11.562	.004
Gold			
Silver	20.5	11.615	.002
Lead	20.9	11.201	.002
Bronze	20.5	10.958	.003
Aluminium	20.2	10.944	.001
Brass-Water	21.0	23.785	.005
Brass-Sand	21.0	23.547	.005

Statistical treatment of the experimental data:

Average $\overline{w} = \frac{1}{N}\sum_{k=1}^{N} w_k$

Standard Deviation: $s_W = \sqrt{\frac{\sum_{k=1}^{N}\left(w_k - \overline{w}\right)^2}{N-1}}$

Standard Deviation of the Average: $s_{\overline{w}} = \frac{s_w}{\sqrt{N}}$

About interval of confidence: for a probability of confidence P=0.999 and a population=30 the coefficient t=3.65, and for a population=40 t=3.55. I used t=3.6 and the correspondent variation on the interval of confidence is approx. 1%, not significant.

4 -Acknowledgments

Above all I would like to thank Umberto Piva of Bologna for accepting my invitation to accompany me in the long journey from

one side of the equator to the other. He then is a good eye-witness of the Gravitational Differences of a Chemical Nature, and can confirm my previous experiments of this type (already published). He is also a witness to the fact that in the southern hemisphere the same samples weigh more than in the corresponding latitude north of the equator. The cause which motivated me is valid.

The greatest recognition and thanks are reserved for Prof. Silvio Bergia of the Physics Department at Bologna University, who supervised everything. For me he is a significant point of reference. He finds a way to give you some of his time even in his busiest moments. He always knows how and when to help.

Special thanks go to Walter Bich of the CNR Meteorological Institute "Colonnetti" of Turin for the innumerable discussions allowed me for the purpose of achieving a deeper understanding about the concept of mass. He reasons scrupulously and from a broad viewpoint without missing a thing. He is also one of the few to whom you can turn as a friend.

Last but not least I would like to thank the experimenter Prof. F. Palmonari of the Physics Department of Bologna University for his constant enquiry and openness to something new if it exists with exceptional kindness. I have another series of experiments underway which he is monitoring for me. Like Prof. P.G. Bizzeti of Florence, he wants to see the facts. With equal tenacity I try to see the facts and make them tangible. It is a wonderful challenge.

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