

ANDYSEZ 46

DABBLING WITH DATUMS

– AGD/NZGD and GDA/NZGD

- Andy Spate

Andy Spate in the wilds of Undara,
surveying the scenery – Conference 2003



I am writing this ANDYSEZ sitting beside the Broken River, about 20 km west of Townsville, following the 15th ACKMA Conference. The conference was wonderfully successful.

Thanks and congratulations to Lana, Val and Dave for a well-executed affair. The Broken River karst looks particularly interesting and has some very beautiful features (see article elsewhere in this issue).

But, I have some worries...

New Zealand and Australia adopted two new geodetic systems a few years ago and maps are becoming available using the new systems. A geodetic system is a mathematical representation of the shape of our Earth in our part of the world. Most of you will know that the Earth is not spherical but is a knobbly pear shape.

There are also the problems with papering a 'sphere' with rectangular sheets of paper. We won't discuss this aspect in this ANDYSEZ.

The new Geocentric Datum of Australia (GDA94) and the New Zealand Geodetic Datum (NZGD2000) are essentially the same and are virtually identical to the

World Geodetic System (WGS84) adopted by the USA in 1984. This latter is the system with which Global Positioning Systems (GPS) "think" – although they can be adjusted to the bewildering array of geodetic systems used around the world. Examples (which we will never use!) include:

- Afgooye
- Anna 1 Ast '65
- Astro B4 Soral
- Astro Ben "E"
- Bellevue (IGN)
- Campo Inchspe
- CH-1903
- Chua Astro
- Corrego Alger
- Gandajika Base
- Gux 1 Astra
- Hjorsey 1955
- Hu-Tzu-Shan
- ISTS 073 Astro
- L.C. 5 Astro
- Mahe 1971
- Merchich
- Nhrwn Masirah
- Qornog
- Sapper Hill '43
- Schwarzeck
- Zanderij

There will be a prize for whoever can fit all these to their correct countries or purpose.

And a slightly smaller prize to those who can provide correct UTM grid references for Jersey Cave in each of the datums above.

Entries to <speleothem1@bigpond.com> by the closing date for the September Journal (15 August 2003).

Why should this worry us? New topographic and geological maps are increasingly replacing older maps based on the new systems in New South Wales at least, and from the Commonwealth's Geoscience Australia (a new department made up of the former Australian Geological Survey Office and the Australian Land Information Group... both formerly other names... sigh...).

This will have happened – or will happen in New Zealand and other Australian states. Almost all of the maps we are used to in Australia are based on either the Australian Geodetic Datum 66 (AGD66) or its twin brother AGD84.

These are identical for all usual purposes. New Zealand used NZGD49 in the past. So what's the worry about this?

An Important Warning !

THERE ARE MAJOR DIFFERENCES BETWEEN GDA94 AND AGD66/84 COORDINATE SYSTEMS.

Remember!

- The AGD coordinates use a local datum, while the GDA coordinates use a geocentric datum,
- The two datums use different shaped ellipsoids.

As a result, the AGD and GDA coordinates for the same point differ by approximately 200 metres (between 120 and 180 metres in both the easterly and northerly directions).

Note that this is the case for map grid coordinates as well as geodetic coordinates. The map grid coordinates for a point are directly related to the geodetic coordinates of the same point. If the geodetic coordinates change due to the adoption of a different datum and/or spheroid, the map grid coordinates will also change. THE ADOPTION OF A NEW DATUM CHANGES EVERYTHING.

Note both UTM and latitudes and longitudes are affected. Boundaries will not change and the position of a point will not change – only the numbers that reference them. Maps using different datums will not adjoin perfectly.

A geocentric datum has its origin at the centre of mass of the Earth. Until now Australia and New Zealand used different datums with their origin about 200 metres from the Earth's centre. Thus the new systems are based on an origin about 200 metres northeasterly of the earlier datums so the cave whose location you have located using AGD66 will appear to be located about 200 metres northwest when plotted on a map based upon GDA94 or NZGD2000.

Thus it becomes necessary to keep track of which system you are using so that your records are specific records – and not frustrating clues for future generations. You will need to state which datum you are using on maps and all records of grid references or latitudes and longitudes that you use. Managers and speleologists may need to inquire of each other the datums used if these are not explicitly stated.

Conversion to the GDA will be most noticeable on mapping products. With the geocentric datum, the map projection and mapping grid zones will remain the same. The borders of maps will have the same latitude and longitude but will be in slightly different positions on the ground. **This means detail on existing maps cannot be joined with corresponding detail on maps under the new system.** The impact of this 'displacement' will be greater on large scale maps (e.g. 1:5,000) compared with small scale maps (e.g. 1:100,000). The 'displacement' across Australia will be up to 210 metres - northeasterly.

In the January 2002 and January 2003 bushfires in New South Wales, perfectly usable maps were available using AGD66/84 on one hand and GDA94

on the other. One AGD66 map had a sticker stating it was GDA94 when it wasn't!

The consequences of such an apparently trivial 200 metre "error" meant that fires were falsely reported on the wrong side of control lines, real-time fire maps were confused and, in, at least one case, a helicopter sent to uplift an injured firefighter was not able to find the victim for an unnecessarily long time. It was not critical - but it could have been.

I had a personal experience a month or two ago when I and a few other Canberra cavers were walking along river with many topographic features easily recognisable on both the ground and map... But my GPS locations didn't fit! I was using the wrong datum on my GPS. On one occasion we were standing by a river but the GPS put us on top of a hill! Your users manual will tell you how to change your machine to fit the maps you are using. The GPS will easily convert for you as well. Remember that AGD66 and AGD84 are identical for our purposes as are GDA94 and WGS84 – but the latter are about 200 metres approximately northeasterly of the older datums.

Why were these expensive and potentially confusing changes made? Globalisation is the short answer. With the speed of movement around the world, multitude of datums, increasing use of GPS units by very many sectors of the community and a number of other, more technical reasons, it becomes necessary to standardise geographic datums. See the various websites for further information.

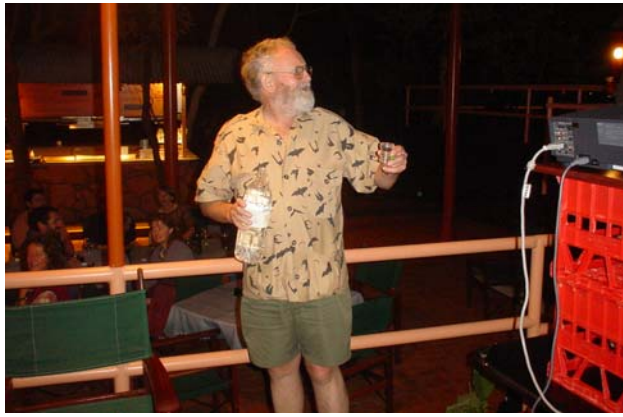
There is much more information about these changes and the geodetic systems available on the web through the home pages of your state mapping agency. The two main agencies in Australia and New Zealand provide vital information *via*:

- <http://www.linz.govt.nz/rcc/linz/pub/web/root/core/Topography/ProjectsAndProgrammes/nzgd2000/index.jsp> (or go to: <http://www.linz.govt.nz> and hunt around through the links)
- <http://www.icsm.gov.au/icsm/gda/index.html>

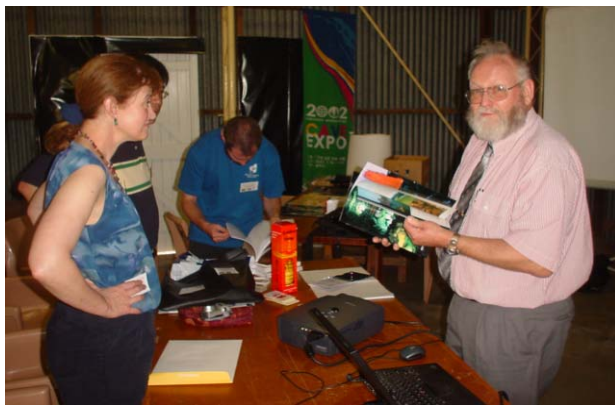
An informative (and free!) CD is available from Geoscience Australia and, I presume, from Land Information New Zealand (addresses below). The CD contains a video, information sheets and conversion methodologies. Rules and methods for conversions are also available *via* the websites but these can be very daunting – better let your GPS or mapping program do the job.

Speaking of mapping have a look at www.ozexplorer.com for a very useful and inexpensive Australian-created mapping/plotting package. It is not a Geographic Information System (GIS) but has some very useful features. These include the ability to georectify (precisely relate a map to a grid system) scanned plans, maps and aerial photos. Beware of radial and other distortion with the latter. Maps produced with Oziexplorer can be exported to ArcView and other GIS programs.

Andy in full flight! – Conference 2003



Andy Spate in his finery, talks to Cathie Plowman – Conference 2003



So, in summary. Geographic datums **have** changed and we need to take account of this in day-to-day operations involving map reading and to ensure that our records of cave and other locations are adequate for future use.

And yes, datums is the correct plural in this instance! Sorry for all the abbreviations.

It has been an additional pleasure in writing this ANDYSEZ that I have been able to incorporate some New Zealand content.

Addresses for further information & the great CD! –

Land Information New Zealand
National Office
Lambton House
160 Lambton Quay
Private Box 5501
Wellington
Phone: 04 460 0110
Email: <info@linz.govt.nz>

Geoscience Australia
ICSM
P O Box 2
Belconnen
ACT 2618
Phone: 02 6201 4292

Or your state mapping authority.

ACKMA ANNUAL GENERAL MEETING Weekend 2003, and CAVE PRESENTERS WORKSHOP 2003

The **ACKMA Annual General Meeting** will be held on Saturday 29th and Sunday 30th May, 2004, at Mole Creek Caves, Tasmania. The basic program will be that the ACKMA Committee will meet in the Saturday morning, followed by the AGM after lunch, followed by tourist cave visit/s. On the Sunday, there will be tourist cave and/or wild cave visits. The detailed program will be advised later this year.

Preceding the ACKMA AGM weekend, the biennial **Cave Presenter's Workshop** will be held, also at Mole Creek Caves. This will be preceded by a caving day on Sunday, 23rd May (it is likely that trips to some of the "great caves", such as Kubla Cave and Croesus, will be on offer). The Workshop itself will run from Monday 24th May, through to lunchtime on Friday, 28th May. Guides can then, if they, wish attend the ACKMA weekend, or part thereof. Additionally, if there is enough interest, a field trip to Hastings Caves will be run on 31st May/1st June. It will be noted that all these dates fall outside school holidays anywhere in Australia, and major events in Tasmania.

Further details on both events will be published in due course. Enquiries on both can be directed to Cathie Plowman: <cathie.plowman@dpiwe.tas.gov.au>