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A Revised Calibration of the New Zealand Geological Timescale: NZGT2015

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The New Zealand Geological Timescale is a regional geochronological timescale for the Permian to Pleistocene and comprises a sequence of stages defined in New Zealand outcrop sections. The local stages have served an important role in geological mapping since the mid-20th Century, and continue to provide a standard for stratigraphic subdivision by integrating biostratigraphic data from various fossil groups with other stratigraphic measures [1].

Many of the most useful fossil groups for subsurface exploration in New Zealand Mesozoic-Cenozoic basins have essentially local biogeographic distribution (e.g. miospores, benthic foraminifera), or local ranges which differ from those of other regions because of differences in paleoclimate or ocean circulation (e.g. planktic foraminifera, dinoflagellates), so the sequence of local stages which is closely tied to local fossils provides a more internally consistent, precise, and highly refined chronostratigraphy for routine use than international stages. Naturally, correlation with the International Geological Timescale is required for communication with the international community, and age-calibration of stage and substage boundaries for estimation of rates of geological processes and correlation with numerical age data from radiometric and other methods.

The status of the New Zealand stages is reviewed and summarised in recent publications [4, 5] focussed on age-calibration of the stage boundaries. The stages are defined for the most part by well-studied bioevents, a few by tephrochronology or global geochemical anomalies: 33 of the 54 stages have formally defined boundary stratotype sections and points (SSPs) conforming to International Subcommission on Stratigraphy guidelines. Three Upper Permian stages and one Lower Cretaceous stage are based on faunas in unconformity-bounded units and are currently regarded as informal. The remainder have provisional boundary definitions which require further resolution. Australasian stages for the Ordovician and Cambrian, based respectively on groupings of graptolite and trilobite zones, are also in use in New Zealand. In other Paleozoic systems, detailed New Zealand biostratigraphy is not established and international units are used.

The revised age calibration of the boundaries of stages and substages of the New Zealand Geological Timescale is based on the 2012 calibration of the International Geological Timescale by Gradstein et al. [3], and is consistent with the International Chronostratigraphic Chart v. 2015/1 [2]. In the Cenozoic, calibration has relied mainly on correlation of planktic microfossil bioevents with the Geomagnetic Polarity Timescale (GPTS), with input also from tephrochronology and isotope stratigraphy. In Cretaceous and older stages, the main approach has been biocorrelation of stage boundary and intra-stage macrofaunal (and a few palynological) bioevents with the International Geological Timescale, with some constraint from radiometric dating, carbon isotope stratigraphy and GPTS.

References:

[1] Cooper RA (2004) *The New Zealand Geological Timescale*. Institute of Geological and Nuclear Sciences monograph 22. 284 p.

- [2] Cohen KM et al. (2015). *International Chronostratigraphic Chart v 2015/1*.
<http://www.stratigraphy.org/ICSchart/ChronostratChart2015-01.jpg>
- [3] Gradstein FM et al. (2012). *The geological time scale 2012*. Elsevier B.V., Oxford, U.K.
- [4] Raine JI et al. (2015). *Revised calibration of the New Zealand Geological Timescale: NZGT2015*. GNS Science Report 2012/39.
- [5] Raine JI et al. (2015). *New Zealand journal of geology & geophysics* 58: 398-403.

