# Preface

Papua New Guinea and Oceania (including West Papua, the other half of New Guinea) are unique in having the highest number of distinct languages in the smallest land mass in the world and also in having related languages spread across huge ocean spaces. This extraordinary ecology creates an incredible opportunity to explore the history of number. There are indeed 1 300 languages in this region. That means 1 300 cultures. The story that unfolds in this book reaches back to an era between 1 500 and 40 000 years ago, and yet the story is still active and part of the lives of the same genealogies of people today. This active story was very much the case during the period of first contact with Europeans which began sporadically in the late 1700s but was only significant after the 1880s. Places in this story have been among some of the last to be infiltrated by European colonialists, some as recently as 60 years ago. Some of the data drawn upon for this book were the first to be recorded for the language and culture at first contact by Europeans, but much of the data were less than 50 years old. Data from living cultures were mostly recorded in the 1970s and have been compared where possible with older records. Based on variations between existing languages that are linguistically and mathematically analysed together with evidence from other disciplines such as archaeology, the ancient story of number is told.

My research and experience in Papua New Guinea (PNG) has informed my writing of this story as it did an earlier Springer book *Visuospatial Reasoning: An Ecocultural Perspective on Space, Geometry and Measurement Education.* When that book was finished, Ken Clements, one of the editors of the new series on the history of mathematics education, emailed me. He asked if I would be willing to write a history of number from the perspective of Papua New Guinea and Oceania based on Glen Lean's work. This request came because he was well aware, unlike most historians of mathematics and mathematics education, of the incredible work of his friend and colleague Glendon Angove Lean, and he was aware that my interest in Glen's work and experience in Papua New Guinea provided a good basis for writing this book. It is a story that needs to be known by others.

In 1973, I went to live in Lae, PNG, and to work in the Mathematics Department at the PNG University of Technology beginning a life-long friendship with Glen Lean who sadly passed away in 1995, a week after a special ceremony to confer his PhD. For 20 years, Glen collected data on counting systems of Papua New Guinea and Oceania which culminated in his thesis being finished in 1993, but it remained unpublished until this book incorporated it. His academic mentor and executor, Alan Bishop, sent as much of Glen's collected materials to the University of Goroka (UoG) in PNG where the Glen Lean Ethnomathematics Centre (GLEC) was established. With my husband, we were able to catalogue Glen's photocopied papers, but unfortunately half of the material was lost through the climes and transport of PNG (some we were able to replace). The University of Goroka holds the most complete copy of his resources in one place. With funds from USA's National Science Foundation, with a small team of PNG lecturers and research assistants, we were able to work on Glen's collection of counting systems and put them into a database available from the GLEC website, but the database has not been readily available for some years. This database was developed from poor and incomplete electronic copies and a rare hard copy of his provincial summaries upon which he developed his thesis.

We prepared his thesis for the GLEC website together with copies of some journal articles and other materials that Glen had sourced. The references in this book support the arguments presented in the following chapters but also provide the data sources for around 100 languages given in the Appendices and selected as evidence for the arguments. The extent of the reference list indicates how much material Glen collated for 900 languages, that is, 75% of the region's languages. However, the data collected by Glen from students and others from 1968 to 1988 provide the really rich collection of living data that are evidentially telling the ancient story of their ancestors. I say "evidentially" as this book also presents the analytic, linguistic and archaeological evidence to support this statement.

Chapter 2 indicates the nature of Glen's data collection and reflects Glen's unique abilities that meant that he was able to collate the data from written records and thousands of questionnaires completed over 20 years by PNG and Oceania students and teachers. He searched maps, he asked questions, he visited remote places and with his linguistic, historical and mathematical skills, he was able to analyse and synthesise this data. His data from people also relied on his rapport with the many PNG people with whom he associated. Again Glen's rapport was an exceptional skill to which his many friends and colleagues can testify. My forays into collecting and checking data have indicated how extraordinary his work was and the nature of his decision-making in summarising the data (e.g. Owens, 2001). One of the main issues has been that of collecting data from people whose languages and to some extent cultures are rapidly changing. Another problem was in the multiple names given to any one language and the variations between villages who speak the same language or even the same dialect of the language.

To convert Glen's work into a book readable in APA style from the poor electronic copies of his thesis with its footnote format that referred by code to the tables in his huge appendices required considerable tedious effort and PNG knowledge. His work has been extended by more recent linguistic, anthropological and archaeological papers. While Glen did place his thesis into the cultural contexts of the languages and counting systems, this book goes further. It also gives credit to the work of Papua New Guineans and others who have pursued ethnomathematics as a significant area for PNG mathematics education. Patricia Paraide and Charly Muke are authors on chapters which specifically incorporate research on their own cultures. I would also like to acknowledge the team of linguists at the Australian National University; many SIL linguists and translators; Ralph Lawton and the team of Kilivila translators; Geoffery Saxe; my former UoG colleagues Wilfred Kaleva, Martin Imong, Rex Matang (deceased), Gairo Onagi and Samuel Kopamu who have shared their counting systems and ideas with me; my many PNG friends, colleagues and students who have accepted me into their families; and researchers Joseph Fisher, Peter Dwyer, Mark Donahue and Jadran Mimica whose works have significance for this book. Geoff Smith and Sue Holzknecht are long-term friends and were colleagues at the PNG University of Technology working in the fields of language and linguistics. They have shared much with me prior to my writing this book. I sincerely thank them.

This book portrays a history of number from an ancient time uninfluenced by events occurring in the Middle East region. It is a story that begins at an often much older time than developments in the Middle East and upon which the Indo-European centric histories of number are often based. Briefly, Lean argued that the types of counting systems within different phyla and protolanguages indicate the antiquity of the systems when combined with archaeological evidence. The system classifications also indicate how counting systems spread and changed. I have been fascinated by the alternative systems of counting portrayed in this story, and I trust the reader will also be enthralled. It is my belief that without this history being taught, there is a serious lack of richness in the history of mathematics and counting systems for any school student across the world.

Owens, K. (2001). The work of Glendon Lean on the counting systems of Papua New Guinea and Oceania. *Mathematics Education Research Journal, 13*(1), 47–71.

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