OIL EXPLORATION DIRECTORATE
OFFICE OF THE PRIME MINISTER
VALLETTA, MALTA.

GEOLOGICAL MAP OF THE MALTESE ISLANDS

SHEET 2

GOZO AND COMINO

Scale 1:25,000

Sheet History:

Original geological survey of the islands carried out at 6 inches to 1 mile scale by K.C. Dunham M.R. House and A.A. Wilson on behalf of the BP Exploration Company Ltd., in 1955.

Published at 1:31680 scale by the Ordnance Survey for BP in 1955.

Resurvey of the Upper and Lower Coralline Limestone formations at 6 inches to 1 mile scale by Martyn H Pedley, 1971-1975.

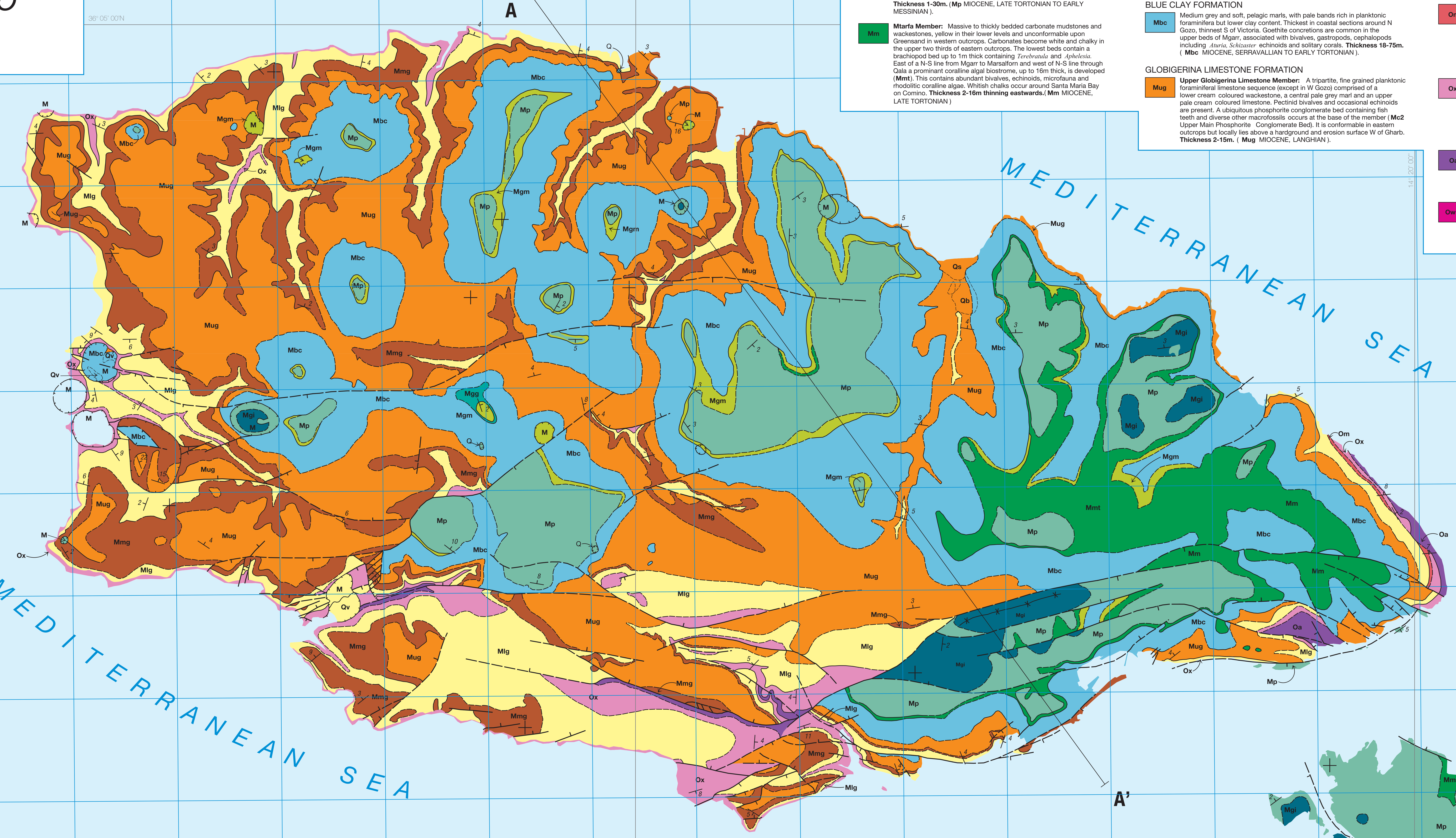
Resurveyed at 1:25,000 scale by Martyn H Pedley, School of Geography and Earth Resources, University of Hull, 1992.

Revised at 1:25,000 scale by Godwin Debono and Saviour Xerri, Oil Exploration Directorate, Office of the Prime Minister,1993.

Published by the Oil Exploration Directorate, Office of the Prime Minister, Malta, in 1993.

Printed by the British Geological Survey, Keyworth (C. Simpson, Cartographer).

Topographic details based on the Government of Malta 1:25,000 sheets of Malta and Gozo (series M898, edition 2) published in 1984. Grid lines are at 1 kilometre intervals and contours are in feet above sea level. The representation on this map of a road, track or footpath is no evidence of the existence of a right of way.



KEY TO GEOLOGICAL MEMBERS AND FORMATIONS

QUATERNARY

Qs — **Modern beach sands:** (**Qs** HOLOCENE)

Qv — **Valley fill:** Low angle subaerial fanglomerate cones, terra rossas, local clays and alluvium. Fanglomerates often dominated by subangular carbonate lithoclast breccias and interpenetrative channels. Intercalated terra rossa palaeosols often contain rhizoid (root) fabrics and nodular caliche of varying ages but all post - date valley cutting. **Thickness 0-7m.** (**Qv** LATE PLEISTOCENE-HOLOCENE, TYRRHENIAN).

Qb — **Dunes and Raised beach deposits:** Wind blown foraminiferal, marine mollusc and quartzarenitic grainstones. The Main deposits are at Ramla Bay. **Thickness 0-3m.** (**Qb** LATE PLEISTOCENE-HOLOCENE, TYRRHENIAN)

MIOCENE

UPPER CORALLINE LIMESTONE FORMATION

Mgi — **Gebel Imbark Member:** Hard, pale-grey carbonates with sparse faunas, deposits now restricted to erosional outliers and synclinal cores. Basal beds consist of cross stratified ooidal and peloidal grainstones (**Mgt** Tat - Tomna Beds). The Qammieh Beds (**Mgq**) conformably succeed the Tat - Tomna Beds and consist of carbonate mudstones associated with grey marls and palaeosol sequences. Similar beds are present in the capping sequence of Cominotto and Comino Islands. **Thickness 4-20m.** (**Mgi** MIOCENE, EARLY MESSINIAN).

Mp — **Tal - Pitkal Member:** Pale grey and brownish-grey coarse grained wackestones and packstones containing significant coralline algal, mollusc and echinoid bioclasts. Lower parts of the member show abundant large rhodoliths of *Mesophyllum* and *Lithophyllum.* The upper part contains patch-reefs and biostromes (**Mpb**, Depiru Beds). These are dominated by peloidal and molluscan carbonate mudstones, with crustose coralline algae and scattered corals, especially *Porites* and *Tarbellastraea.* Reefs are best developed in eastern Gozo especially N of Dahlet Qorrot. Similar developments, with patch - reefs in the west occupy most of the island of Comino. **Thickness 1-30m.** (**Mp** MIOCENE, LATE TORTONIAN TO EARLY MESSINIAN).

Mm — **Mtarfa Member:** Massive to thickly bedded carbonate mudstones and wackestones, yellow in their lower levels and unconformable upon Greensand in western outcrops. Carbonates become white and chalky in the upper two thirds of eastern outcrops. The lowest beds contain a brachiopod bed up to 1m thick containing *Terebratula* and *Aphelesia.* East of a N-S line from Mgarr to Marsalforn and west of N-S line through Qala a prominant coralline algal biostrome, up to 16m thick, is developed (**Mmt**). This contains abundant bivalves, echinoids, microfauna and rhodolitic coralline algae. Whitish chalks occur around Santa Maria Bay on Comino. **Thickness 2-16m thinning eastwards.** (**Mm** MIOCENE, LATE TORTONIAN)

Mgm — **Ghajn Melel Member:** Massive bedded dark to pale brown foraminiferal packstones containing glauconite occur above a basal Upper Coralline Limestone erosion surface in western Gozo. Large *Clypeaster* echinoids and *Macrochlamis* pectinid bivalves are common in eastern outcrops together with abundant abraded *Heterostegina* foraminfer bioclasts. A narrow zone extending through Zebbug - Victoria and Ghajnsielem is either unfossiliferous or contains only *Heterostegina*. Outliers capping hills further west contain coral patches dominated by *Porites* and *Tarbellastraea* corals, and large echinoids and molluscs. **Thickness 0-16m.** (**Mgm** MIOCENE, LATE TORTONIAN).

GREENSAND FORMATION

Mgg — Friable, brown to greenish glauconite-rich sands occur above a marked erosion surface truncating the Blue Clay Formation in most areas. Indigenous faunas are sparse but include *Clypeaster* echinoids, bivalves and local *Heterostegina*. Reworked moulds and casts of a diverse older Miocene marine fauna are locally common but are phosphatised or glauconitized. The deposit occupied pockets and depressions on the Blue Clay surface, well seen at Il - Gelmus, near Victoria. **Thickness 0-11m.** (**Mgg** MIOCENE, EARLY TORTONIAN).

BLUE CLAY FORMATION

Mbc — Medium grey and soft, pelagic marls, with pale bands rich in planktonic foraminifera but lower clay content. Thickest in coastal sections around N Gozo, thinnest S of Victoria. Goethite concretions are common in the upper beds of Mgarr, associated with bivalves, gastropods, cephalopods including *Aturia, Schizaster* echinoids and solitary corals. **Thickness 18-75m.** (**Mbc** MIOCENE, SERRAVALLIAN TO EARLY TORTONIAN).

GLOBIGERINA LIMESTONE FORMATION

Mug — **Upper Globigerina Limestone Member:** A tripartite, fine grained planktonic foraminiferal limestone sequence (except in W Gozo) comprised of a lower cream coloured wackestone, a central pale grey marl and an upper pale cream coloured limestone. Pectinid bivalves and occasional echinoids are present. A ubiquitous phosphorite conglomerate bed containing fish teeth and diverse other macrofossils occurs at the base of the member (**Mc2** Upper Main Phosphorite Conglomerate Bed). It is conformable in eastern outcrops but locally lies above a hardground and erosion surface W of Gharb. **Thickness 2-15m.** (**Mug** MIOCENE, LANGHIAN).

Mmg — **Middle Globigerina Limestone Member:** A planktonic foraminifera-rich sequence of massive, white, soft carbonate mudstones locally passing into pale-grey marly mudstones. Fine bed laminae are frequent otherwise burrowing is ubiquitous. Thin-shelled pectinid bivalves and *Schizaster* echinoids are typical and coccoliths are abundant. The base of the formation is unconformable upon Lower Globigerina Limestone Member. The sequence is absent from E Gozo but thickens significantly towards the west and north. **Thickness 0-15m.** (**Mmg** MIOCENE, AQUITANIAN TO BURDIGALIAN).

Mlg — **Lower Globigerina Limestone Member:** Pale cream to yellow planktonic foraminiferal packstones becoming wackestones a short distance above the base. Pectinid bivalves and *Shizaster* echinoids are common. The top of the member is marked by a ubiquitous hardground. This is phosphatised and carries up to 1m of rounded, phosphatised clasts **Mcl** Lower Phosphorite Conglomerate Bed). Common fossils include fish teeth, molluscs, solitary corals and echinoids. **Thickness 5-40m.** (**Mlg** MIOCENE, AQUITANIAN).

OLIGOCENE

LOWER CORALLINE LIMESTONE FORMATION

Om — **Il - Mara Member:** Tabular beds of pale-cream to pale-grey carbonate mudstones, wackestones and packstones in 1 to 2m thick units. The member is only locally present in N Gozo but is present in E Gozo around Qala Point. The top of the member is transitional with the Lower Globigerina Limestone Member and is taken as the highest bed containing observable *Scutella* echinoids (**Ms** '*Scutella* bed'). Abundant bryozoan fragments and locally important banks of *'Lepidocyclina'* foraminifers are present. **Thickness 0-6m.** (**Om** OLIGOCENE, CHATTIAN).

Ox — **Xlendi Member:** Planar to cross-stratified, coarse-grained limestones (packstones) with abundant foraminifera fragments. The member is best developed in NW Gozo in the Cliffs W of Reqqa point, near Zebbug. The top of the member contains abundant entire and fragmentary *Scutella* echinoids, in single to multiple beds (**Oxs** '*Scutella* Bed'). A marked erosion surface separates the member from overlying Globigerina Limestone Member in W Gozo. **Thickness 0-22m.** (**Ox** OLIGOCENE, CHATTIAN).

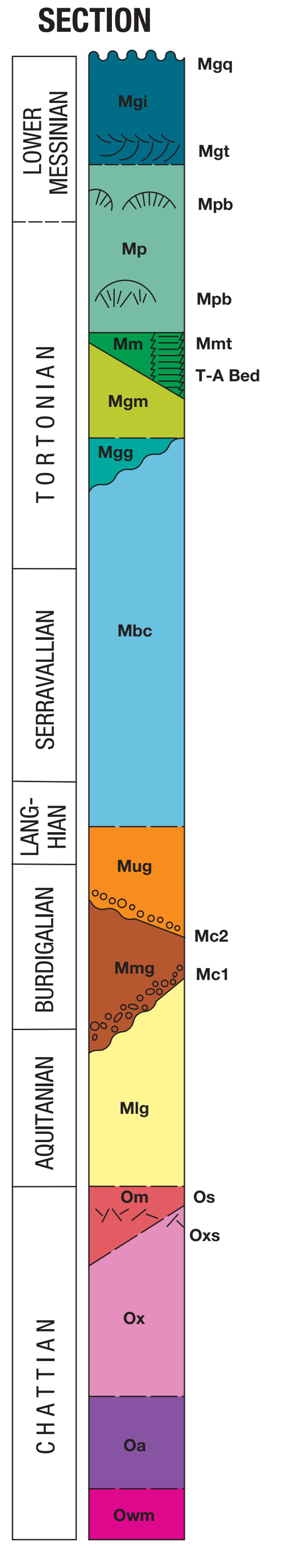
Oa — **Attard Member:** Grey limestones (wackestones and packstones) are typical throughout Malta. Large *Archaeolithothamnium* coralline algal rhodoliths are ubiquitous and are locally associated with strombid gastropods and bryozoa. The Attard Member has a transitional base with the Maghlaq Member at Il - Hnejja, SW of Qala and iscapped by Xlendi Member. **Thickness 10-15m.** (**Oa** OLIGOCENE, CHATTIAN).

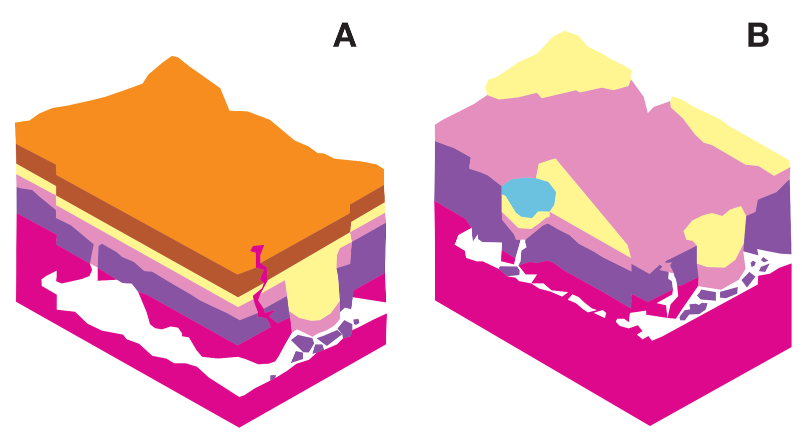
Owm — **Maghlaq Member:** Massive bedded, pale yellowish-grey carbonate mudstones. Benthonic foraminifera are the only common fossils. The member is poorly exposed and is only recognised in the Il - Hnejja quarries. Beds pass transitionally up into the Attard Member. **Thickness unknown** (**Owm** OLIGOCENE, CHATTIAN).

KEY TO GEOLOGICAL SYMBOLS

- Horizontal beds
- Dipping strata with direction and inclination in degrees
- Stratigraphical boundaries (dashed where inferred)
- Faults (dashed lines where inferred). Downthrow direction indicated by bars
- Sense of relative movement
- Fault controlled syncline axial trace
- Quaternary Solution Subsidence Structures
- Miocene Solution Subsidence Structures
- Line of geological section

GENERALIZED VERTICAL SECTION

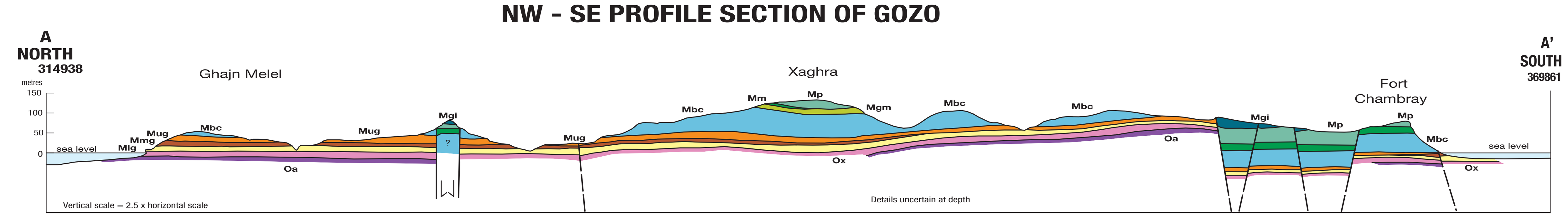




The West Gozo Solution subsidence structures.

Miocene seafloor collapse created 12 initial structures. Many others originate from Quaternary subaerial collapse. The block models illustrate the composite nature of the West Gozo Post-Miocene reactivation of structures. **A**, Early Quaternary cavernisation **B**, Roof collapse and Quaternary subsidence, together with reactivation of the Miocene features.

NW - SE PROFILE SECTION OF GOZO



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