

the purchase of actual goods and services (labor, materials, capital goods) and those expenditures which do not (lease bonuses and rentals, royalties, and various taxes). Some rudimentary estimates of supply schedules for Arctic oil have been made.

STEHLLI, F. G., Dept. Geol., Case-Western Reserve Univ., Cleveland, Ohio

PROVINCIALISM IN PERMIAN FAUNAS AND ITS APPLICATION TO PALEOCLIMATIC EVOLUTIONARY BIOSTRATIGRAPHIC STUDIES

The faunal assemblages characteristic of the Boreal and Tethyan faunal provinces of the Permian can be identified objectively by cluster analysis. The Boreal assemblage at high taxonomic levels consists predominantly of cosmopolitan elements and includes few endemic forms. The Tethyan assemblage includes the cosmopolitan forms and a large group of endemics. Temperature sensitivity characterizes the endemic Tethyan forms, whereas the cosmopolitan types are relatively free of temperature control. Among brachiopod families, the ratio of cosmopolitan families found to the total number provides an excellent index of sampling efficiency at a reconnaissance level. The ratio: total number of brachiopod families minus number of cosmopolitan families found, divided by the number of cosmopolitan families found, provides a measure that is both temperature sensitive and self-normalizing for sampling efficiency. Thus, it can be used to reconstruct the Permian planetary temperature gradient.

The available data suggest little or no N-S movement of continents, but E-W motion is not precluded. Permian and recent data show that evolution as seen at generic and higher levels proceeds more rapidly in warm than in cold regions. This phenomenon inevitably provides for the highest biostratigraphic resolution in E-W correlations within the warm water region and for lower resolution in E-W correlations within the Boreal province and in N-S correlations between the Boreal and Tethyan provinces which must both depend on the slowly evolving cosmopolitan forms. Examination of well-controlled recent data suggests that correlations based on first occurrences of genera transgressed time where followed across temperature gradients. If this has been a general condition throughout geologic time, "biostratigraphic time planes" are inherently time transgressive across latitude gradients.

STOLL, SARAH J., Gulf Oil Co. U.S., New Orleans, La.

FORAMINIFERAL STUDY OF KARA SEA NORTH OF 76° NORTH LATITUDE

Population counts were made from 36 bottom samples taken during the 1965 cruise of the USCG *Northwind* in the Kara sea. Attempts were made to compare the distribution of the species of Foraminifera to the ecologic parameters, depth, bottom temperature, bottom salinity, oxygen, phosphate, free and dissolved nitrogen, silica, pH, water content of the surface sediment, soluble carbonates, organic carbon, median chlorite-kaolinite ratio, and percentages of sand, silt, coarse clay, and fine materials less than 0.001 mm. The population counts were not made from living Foraminifera. The water chemistry data represent a single reading at each station, taken during the late summer.

The distribution is not a simple depth zonation, primarily because of the presence of the warmer, more saline Atlantic waters which touch the bottom at vari-

ous depths, compounded by widespread manganese oxidation in the bottom sediments. Abundance of Foraminifera appears to be directly proportional to bottom temperature and pH, and inversely related to oxygen, free nitrogen, and organic carbon. The other parameters indicate a more complex, nonlinear, relation to abundance.

Fifteen genera and 19 species of Foraminifera are common in these waters. Arenaceous Foraminifera are dominant. Calcareous species are abundant only in the northernmost stations which are in direct contact with the open Arctic waters. *Globigerina pachyderma* is the only planktonic species found.

STUART-SMITH, J. H., J. C. Sproule and Associates Ltd., Calgary, Alta.

HYDROCARBON POTENTIAL OF NORTHERN GREENLAND

The prospects for finding hydrocarbons in northern Greenland are confined to an area stretching from Washington Land in the west to the vicinity of Station Nord in the east. Only early and middle Paleozoic sediments are present over most of the area although evidence for the presence of late Paleozoic(?) to Tertiary(?) sedimentation exists on northeastern Greenland.

The Paleozoic beds can be divided into 2 major zones. A belt of highly folded rocks of variable width is present along northern Greenland from Polaris Promontory to eastern Peary Land. This area is too disturbed to be a potential hydrocarbon province.

South of the fold belt lies an area of less folded beds that merge southward with gently northward-dipping beds of the Stable Shelf area. Both areas may contain hydrocarbons. Thick reefal and reefoid developments are present, as are "patch reefs." Porosity is well developed in certain units. Source rocks have been mapped. Potential structural traps have been mapped and stratigraphic traps are presumed to exist.

Little is known of the late Paleozoic to Tertiary "basin" in the east. The limited information available indicates that a sequence very similar in age and lithology to the beds of the Sverdrup basin in the Canadian Arctic Islands may be present.

SWETT, K., Univ. Iowa, Iowa City, Iowa

CAMBRO-ORDOVICIAN DEPOSITIONAL ENVIRONMENTS IN CENTRAL EAST GREENLAND

The Cambro-Ordovician sedimentary succession in central East Greenland is considered to represent deposits formed during a slow, westward-advancing marine transgression. The sandstones, shales, limestones, and dolostones comprising the succession range in age from Early Cambrian through Middle Ordovician (Champlainian) and appear to reflect patterns of deposition comparable to modern shallow-marine shelf sediments. The roughly 3,000 m of Cambro-Ordovician strata lie with apparent conformity on Precambrian rocks of glacial and marine origin and are superposed unconformably by Devonian "Old Red" fluvial deposits. Tidal current-bedding structures in the sandstones exhibit a marked bimodality with vector means on the east and presumably downslope. Intraformational flat-pebble or flake conglomerates, stromatolitic algal structures, oolitic textures, and desiccation phenomena in the shale and carbonates also favor a shallow marine environment for these deposits. Measured sections at 2 widely spaced localities demonstrate a remarkable lithologic lateral continuity presumed attributable to deposition on a broad marine shelf with very low relief.