AN UNDERSEA FEATURES NAMES FILE FOR THE PERSONAL COMPUTER

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ABSTRACT

An undersea features names file has been created by NOAA for use in mapping the Exclusive Economic Zone (EEZ) and other ocean areas. It supplements and updates the 1981 edition of the "Gazetteer of Undersea Features", which is published about every ten years by the Defense Mapping Agency in cooperation with the U. S. Board on Geographic Names. The new data base contains 3,407 official and 2,659 additional variant names, making a total of 6066 records covering all offshore ocean areas of the world. The records are maintained in dBase III files having fields for name, type of feature, latitude, longitude, and a six digit index number to allow rapid sorting into one degree square blocks. The over 504,000-byte world data base may be sorted into smaller geographical areas, and may be further sorted on any combination of fields, using an IBM-compatible personal computer and standard dBase III commands.

INTRODUCTION

Bathymetric mapping is receiving new emphasis because of detailed geological studies of the sea floor and the exploration for new resources. The long-range prospects for economic development of the sea have resulted in the proclamation of the U. S. Exclusive Economic Zone (EEZ) by President Reagan in 1983. In response to that proclamation, a new EEZ mapping program has been launched as a joint effort of the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce and the Geological Survey in the Department of the Interior (Perry, 1985; Pryor, 1985; McGregor and Lockwood, 1985). In mapping large areas of the sea floor the Geological Survey is concentrating on geologic characterization using long-range side-scan imagery obtained from GLORIA (Geological LOng-Range Inclined Asdic). They have produced an atlas of GLORIA images covering the entire Western Conterminous U. S. (EEZ SCAN 84 Scientific Staff, 1986). The NOAA National Ocean Service has run detailed multibeam surveys with total coverage of portions of the West Coast EEZ using Sea Beam and the Bathymetric Swath Survey System. Sea Beam and other types of survey systems also are being used by universities for detailed sea floor mapping.

The new bathymetric mapping programs are unique in giving full coverage of the sea floor in adjoining swaths of imagery or multibeam soundings. This results in a comprehensive picture of the extent and shape of every large feature on the sea floor. The detailed twists and interconnection of canyons become much more apparent than with the widely-spaced single-beam surveys that were available previously. For example, what was thought to be one seamount may turn out to be several seamounts. Some seamounts shown in GLORIA imagery from the West Coast EEZ are not located on previous bathymetric maps (EEZ SCAN 84 Scientific Staff, 1986).

The discovery of new undersea features, and the refinement in the shape of others, is leading to an information "explosion" in bathymetric mapping. There will be many undersea features to be described and named. Unfortunately, the only authoritative gazetteer on undersea names that have been approved by the Board on Geographic Names is published only once every ten years. Maps published by the U. S. Government are required to carry names approved by that Board. With many new maps, atlases, and scientific papers being published, a more rapid dissemination of approved names is needed.

Fortunately, the same developments in computers that are making swath mapping possible, are also making possible efficient data base management. Large data bases may be used not only on mainframe computers, but also on machines down to the personal computer size. This paper will deal with the development of an official names file that can be used on a

personal computer or any larger machine. The paper then will cover some applications of the new data base.

OFFICIAL NAMES FILES

The U. S. Board on Geographic Names is the official body created in 1890 to provide for uniform usage of geographic names throughout the Federal Government. Established in its present form by a Public Law enacted in 1947, it operates through several committees to standardize names of geographic features in the U. S., foreign areas, Antarctica, undersea areas, and extraterrestrial bodies. The Board shares its responsibility with the Secretary of the Interior, who approves names recommended by the Board, appoints members to certain committees, and ratifies principles and procedures. Members of the Board represent various Federal departments and agencies, but there is no separate agency set up to operate the Board. The Executive Secretary, Richard R. Randall, may be contacted at the Defense Mapping Agency, Building 56, U. S. Naval Observatory, Washington, D. C. 20305.

The decisions on undersea feature names by the Board have been approved upon recommendations of its Advisory Committee on Undersea Features (ACUF). The members of ACUF serve as individuals with special knowledge, not as official representatives of agencies. They usually are drawn from those agencies concerned with undersea mapping and scientific studies, and the first author is a member. The Executive Secretary of the Board on Geographic Names mentioned above is an ex officio member of ACUF, and generally represents ACUF in dealing with international organizations. ACUF meetings are held several times a year as needed.

The official names files of ACUF are maintained by foreign language specialists at the Support Division (SDST) of the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D. C. 20315. The names are filed alphabetically on cards, which carry a complete history of the naming of each feature. Approximately every ten years the pertinent data on the card files is compiled into the "Gazetteer of Undersea Features", which is published and sold by the Defense Mapping Agency. The Gazetteer, which was last published in 1981, is used by geographers, cartographers, and scientists as the official source of names. Although many names may be approved between publications of the Gazetteer, the only public notice of the changes is through Board minutes. The Gazetteer also contains information on naming features, as well as procedures and forms for submitting those names to ACUF through the Executive Secretary of the Board on Geographic Names. Information on obtaining the Gazetteer (Stock Number GAZGNUNDERSEA) may be obtained from DMAODS, Attention: DDCP, 6500 Brookes Lane, Washington, D. C. 20315.

There is a somewhat parallel international subcommittee set up in connection with the compilation and publication of the "General Bathymetric Chart of the Oceans (GEBCO)", a 1:10,000,000-scale chart of the world oceans (Minister of Supply and Services Canada, 1984). That series of charts is produced under the supervision of the Joint Intergovernmental Oceanographic Commission-International Hydrographic Office Guiding Committee for GEBCO. It in turn has a Sub-Committee on Geographical Names and Nomenclature of Ocean Bottom Features. That subcommittee has issued guidelines for naming ocean bottom features which are similar to those issued by ACUF (International Hydrographic Bureau, 1981). They have compiled a draft working document "List of Geographical Names of Undersea Features shown on the GEBCO 5th Edition and on the Small-Scale IHO International Chart Series".

COMPUTERIZED NAMES FILE

In setting up a computerized undersea features names file, the intent is to make the updated information more accessible and easier to sort, not to replace the official files on cards or the Gazetteer. While the card files may be computerized in the future, they probably will remain the official authority for the names for many years. They contain a great deal of background data on the history of the names, as well as the foreign punctuation.

The new names files were set up with an International Business Machines PC/XT with a hard disk drive and dBase III software, both of which already were available in the EEZ Project Office. Compatible hardware and software is available throughout the NOAA fleet, and is widely available to other users. No attempt was made to evaluate other hardware and software, although the files which have been created can be made available in standard ASCII output for use with other systems.

The first step in creating the new file was to obtain the magnetic tape used in printing the 1981 Gazetteer. After some difficulty, it was read onto a mainframe computer, edited for format and removal of italics, and then was read into the dBase III files on the PC/XT. The dBase files were edited to cut out duplication and

correct errors. Then all changes since 1981 were entered based upon the ACUF minutes.

The fields in the dBase files include the name of the feature, the type of feature, latitude, longitude, and an index number. The structure of the data base parallels that of the Gazetteer except for the addition of the index number. The official names stand alone, while variant names are followed by ": see" and the official name of the feature. Variant names usually are those that have been applied to the feature on some map, but are not currently recognized as the official name. In order to print the files in the Gazetteer format on an 8 1/2"-wide page, it was necessary to limit the field for the names to 50 characters. There are 145 records where the official and variant names exceed 50 characters, and they are kept in an alternate names subfile that is indexed to the main file. When the list is printed out in the Gazetteer format, the extra characters are printed on the next line in a manner similar to the Gazetteer (see Figure 1). A separate file of just the 3407 official names without variants also has been created, together with the computer programs to print it out.

It was found that the PC/XT and its associated laser printer would not handle all of the foreign punctuation, so that punctuation was edited out. Most of the names entries of immediate use to the U. S. EEZ mapping program do not contain foreign punctuation. Anyone needing all of the foreign punctuation, including some symbols that are not part of the ASCII standards, might wish to choose another data base or computer system. Under the dBase filing system, however, it would be a relatively simple task to set up a punctuation subfile that was indexed to the main files. The subfile could automatically flag entries with foreign punctuation and provide information on what it should be. The subfiles also can contain any other remarks such as the history of the origin of the names or the numbers of the bathymetric maps and charts which use those names.

The type of feature, such as canyon or seamount, is generally taken from a list of designators which is published in the front of the Gazetteer. Because the computerized data base may be sorted relatively easily, a summary of the number of each type of feature has been compiled using the data base with just the 3407 official names (see Table 1). The categories seamount, tablemount, and guyot include a total of 796, or 23% of all of the entries. The 444 canyons represent about 13%, and the 400 reefs about 12% of the entries.

TABLE 1 - NUMBERS OF FEATURE TYPES

Type	Number
Seamount	708
Canyon	444
Reef	400
Basin	285
Bank	280
Ridge	230
Trough	134
Fracture Zone	102
Valley	101
Knoll	88
Plain	74
Rise	66
Tablemount*	61
Shoal	54
Plateau	51
Trench	46
Spur	39
Escarpment	36
Terrace	33
Seachannel	29
Guyot*	27
Fan	27
Gap	23
Shelf	23
Slope	11
Cordillera	5
Saddle	4
Sill	4
Hill	3
Tongue	3
Deep	3
Furrow	2
Province	2
Borderland	2
Moat	1
Hole	1
Scarp	1
Apron	1
Pass	1
Arch**	1
Arrugado**	1
TOTAL	3407

* The terms tablemount and guyot are synonynous, but are included separately for historical reasons.
** The terms arch and arrugado (an area of subdued corrugations) are not approved designators, but are included based upon established usage.
Other terms approved for usage, but not represented include bench, continental rise, flat, fork, gully, ledge, levee, median valley, mound, mountains, peak, pinnacle, ramp, range, and ravine.

Abbott Seamount	seamount	31	48N	174	18E
Abington Reef	reef	18	00S	149	45E
Abington, Rif: see Abington Reef	reef	18	00S	149	45E
Abra Canyon	canyon	17	31N	120	22E
Abraham Canyon	canyon	52	37N	172	20E
Abraham Sea Valley: see Abraham Canyon	canyon	52	37N	172	20E
Abrolhos Bank	bank	18	30S	38	45W
Abrolhos Seamounts	seamounts	17	20S	36	30W
Academie des Sciences de l'URSS, Massif sous-marin see An Rise	rise	49	30N	150	00E
Acapulco Trench: see Middle America Trench	trench	15	00N	95	00W
Acapulco, Fosse d': see Middle America Trench	trench	15	00N	95	00W
Accomac Canyon	canyon	37	46N	74	02W
Acis Shoals	reefs	3	45N	112	39E
Acor Bank	bank	38	10N	29	20W
Adak Basin	basin	51	05N	177	00W
Adak Canyon	canyon	51	25N	177	05W
Adams Bank	bank	41	20S	176	00E
Adams Seamount	seamount	50	01N	176	14W
Addington Patch	reef	15	36N	114	24E
Addington, Banc: see Addington Patch	reef	15	36N	114	24E
Adelie Depression: see Mertz Ninnis Valley	valley	67	25S	146	00E
Adelie Trough: see Adelie Valley	valley	65	30S	136	00E
Adelie Valley	valley	65	30S	136	00E
Admiral Tsenker, Gora: see Zenker Seamount	seamount	41	00S	6	00W
Admiral Zenker: see Zenker Seamount	seamount	41	00S	6	00W
Admundsen Trough	trough	70	30N	123	00W
Admundsen Valley	valley	71	30N	128	00W
Adolph Knoll: see Adolph Seamount	seamount	11	55S	178	10W
Adolph Seamount	seamount	11	55S	178	10W
Adriatic Basin	basin	42	00N	17	30E
Adriatic Plain	plain	41	50N	17	55E
Adventure Bank	bank	37	20N	12	10E
Aegir Ridge	ridge	66	10N	3	45W
Afanasii Nikitin: see Nikitin Seamount	seamount	3	00S	83	00E
Afanasiy Nikitin Massif: see Nikitin Seamount	seamount	3	00S	83	00E
Afanasiy Nikitin: see Nikitin Seamount	seamount	3	00S	83	00E
Afanasiya Nikitina, Gora: see Nikitin Seamount	seamount	3	00S	83	00E
Africana II Bank	bank	46	00S	42	30E
Africana Seamount	seamount	37	10S	29	10E
Afrikansko-Antarkticheskaya Kotlovina: see Atlantic-Indian Basin	basin	60	00S	15	00E
Afrikansko-Antarkticheskaya Vozvyshennost': see Atlantic-Indian Ridge	ridge	53	00S	15	00E
Afrikansko-Antarkticheskiy Khrebet: see Atlantic-Indian Ridge	ridge	53	00S	15	00E
Afungi Canyon	canyon	10	47S	40	47E
Agadak Canyon: see Ayugadak Canyon	canyon	51	30N	178	07E
Agadir Canyon	canyon	32	30N	12	50W
Aganak Canyon	canyon	51	55N	177	18W
Agassiz Fracture Zone	fracture zone	38	15S	127	15W
Agassiz Valleys	valleys	24	00N	82	45W
Agattu Canyon	canyon	52	23N	172	35E
Agattu Sea Valley: see Agattu Canyon	canyon	52	23N	172	35E
Agerholm Seamount	seamount	34	25N	135	35W
Aguja Canyon	canyon	11	40N	74	10W
Agul'yas, Banka: see Agulhas Bank	bank	35	30S	21	00E
Agul'yas, Kotlovina: see Agulhas Basin	basin	47	00S	27	00E
Agulhas Bank	bank	35	30S	21	00E

FIGURE 1 - FIRST PAGE OF GAZETTEER-FORMAT PRINTOUT

The latitude amd longitude of each named feature are expressed in degrees and whole minutes, with the customary north, south, east and west designators. While there are programs to sort the data base using the latitudes and longitudes, it also is possible to do faster sorts using a six digit index number which has been incorporated into the entry for each name. The first digit is for the quadrant of the earth: 1=NE, 2=NW, 3=SW, and 4=SE. The second and third digits are for the latitude, and the last three digits for the longitude. The number is keyed to the lower right corner of one by one degree blocks. Thus Adak Canyon, located at 51 25N, 177 05W, has an index number 251177. To search for all of the named features in that one degree block, one calls for a search where index="251177". The results of the search are shown in Table 2.

TABLE 2 - SEARCH OF BLOCK 251177

	FEATURE	TYPE	LAT.	LONG.
1	Adak Basin	basin	51 05N	177 00W
2	Adak Canyon	canyon	51 25N	177 05W
3	Aganak Canyon	canyon	51 55N	177 18W
4	Bobrof Canyon	canyon	51 57N	177 32W

The index numbers also may be used to create subsets of the data, since many people just survey or compile maps for one quadrant of the earth or one ocean. A search of the 3407 official name entries shows that 934 (27%) are in the NE quadrant, 1662 (49%) are in the NW quadrant, 223 (7%) are in the SW quadrant, and 588 (17%) are in the SE quadrant.

EXPECTED NAMES DATA BASE APPLICATIONS

The new undersea features names data base is used to plan survey operations of the NOAA EEZ Program. The planning frequently assigns a high priority to certain geographical or geological features that have been selected by users such as the Geological Survey, the Environmental Protection Agency, Federal-State task forces, States, the NOAA nautical charting and marine sanctuary programs, and others. Many of these requests are in terms of a particular named feature such as a bank or seamount, and the names file facilitates a rapid search for the location. This is expected to be particularly useful in surveying the many seamounts that are to be mapped for possible cobalt-rich manganese crusts.

The names data base can be useful in map and chart compilation for cartographers and geographers to check on which features have been named or need to be named. At present the searches are done manually using the sometimes outdated Gazetteer and card files, as well as whatever other maps and charts may be available. The computerized names file can provide a much faster search of all of the names in a given area. In addition to the NOAA bathymetric map series, the file could be used in connection with the compilation of the Geological Survey GLORIA atlases to check whether all of the appropriate features have been named. There is an obvious parallel use for private mapping organizations such as the National Geographic Society. It is anticipated that academic research workers also will find the names file to be very useful, since they do much of the mapping in frontier areas of the oceans, and must know whether particular features have been named or need a name assigned.

The computerized files of the U. S. undersea features names may be of considerable use in making intercomparisons to names on GEBCO sheets. The DMA Hydrographic/Topographic Center staff workers assigned to ACUF duties compare the names on GEBCO sheets to those in the ACUF files, and then present the findings at ACUF meetings. The dBase files could be used to find all of the ACUF-approved names on a given GEBCO sheet relatively rapidly. It may also be possible to make comparisons with a computerized version of the list of names on the GEBCO sheets.

Interactive mapping data bases with multiple parameters covering the same geographical area are under development by the Geological Survey, NOAA, and many others. They are used extensively in geological and geophysical interpretation, particularly by those companies who explore for oil and gas. Oceanographic users can call up a map projection or grid on a computer screen, and then selectively add items such as the shoreline, land and bottom contours, sediment type, thickness of sediments to the basement, lease blocks, and names. Under this concept, the data usually have been digitized at one or more scales, and are called up at the appropriate scale by the user. The Geological Survey is planning a series of 1:1,000,000-scale maps of the U. S. EEZ that will be developed from that data base concept. NOAA is accelerating the digitizing of U. S. shorelines in support of that series. The new names data base, particularly the version with just the official names, is particularly suited to computerized data bases of that type. A

copy of the new names data base has been furnished to the Geological Survey. The data base is expected to be available to others upon request by late 1986. It is anticipated that it will be updated after the appropriate Board name approvals, and that it may be distributed on floppy disks through the National Geophysical Data Center in Boulder, Colorado. The materials to be distributed may include information on selecting and submitting new names for approval.

CONCLUSIONS

The development of the undersea names file for the personal computer should make it available at a nominal cost to any hydrographer, geologist, cartographer, or geographer, whether they be on shore or at sea. It may be used alone or as part of a larger set of data with other parameters.

Once the file is in a data base management system such as dBase III, it is a relatively simple matter to sort it by any of the fields such as name, type of feature, or location. The index numbers for location are particularly useful for generating rapid searches.

The dBase III commands are in plain English and are relatively easy to use to sort and copy materials. Persons with little or no computer experience should be able to use the system for sorting with little difficulty, although putting the output into custom formats requires some programming skills. Access to these files on a widely-used personal computer should allow a much more rapid exchange of the names of undersea features, so that the user does not have to wait ten years for an updated data listing as was the case before. This will in turn encourage the user to submit proposed names for approval.

As the exploration of the sea floor floods users with massive amounts of new detailed sounding data, there will be a corresponding need to keep track of that data in an efficient, orderly manner. It is expected that good data base management will be at the heart of a successful mapping program, and that other files of this type will be put onto personal computers.

REFERENCES

Defense Mapping Agency, 1981, Gazetteer of Undersea Features, Third Edition, Washington, D. C., 161 p. plus forms.

EEZ SCAN 84 Scientific Staff, 1986, Atlas of the Exclusive Economic Zone, Western Conterminous United States: U. S. Geological Survey Miscellaneous Investigations Series I-1792, 152 p., scale 1:500,000.

International Hydrographic Bureau, 1981, Standardization of Undersea Feature Names (Guidelines, Proposal Form, Terminology) , Monoco, 1981, 27 p.

Minister of Supply and Services Canada, 1984, General Bathymetric Chart of the Oceans (GEBCO), 5th Edition: Department of Fisheries and Oceans, Scientific Information and Publications Branch for the Canadian Hydrographic Service, under the authority of the International Hydrographic Office and the Intergovernmental Oceanographic Commission (UNESCO), 19 maps, legend, and supporting volumes.

McGregor, Bonnie A. and Millington Lockwood ,1985, Mapping and Research in the Exclusive Economic Zone: U. S. Geological Survey, Department of the Interior and National Oceanic and Atmospheric Administration, Department of Commerce, 40 p.

Perry, Richard B., 1985, Mapping the Exclusive Economic Zone: in Conference Record, Ocean Engineering and the Environment, OCEANS 85, Marine Technology Society and IEEE Ocean Engineering Society, San Diego, p. 1190-1195.

Pryor, Donald E., 1985, Overview of NOAA's Exclusive Economic Zone Survey Program: in Conference Record, Ocean Engineering and the Environment, OCEANS 85, Marine Technology Society and IEEE Ocean Engineering Society, San Diego, p. 1186-1189.