



THE INSTITUTE'S MODEL SHOP REVISITED



Ship Research Laboratory

When the *Newsletter's* Spring 1976 issue featured an article entitled "The Institute's Model Shop," I compared INA's model building facilities to a floating crap game, appearing variously in the castle at Kyrenia, Cyprus, a garage in Denver, Pennsylvania, or wherever I happened to be working. For several years before that issue, I had been developing a process by which special forms of ship models were used as research vehicles to determine the original shape of the flattened, fragmentary hulls we were finding on the seabed. In the article, I expressed the hope that similar models could someday be used as mediums for studying various archaeological problems. I concluded by "dreaming of the day when INA's ship reconstruction . . . will include a formal center furnished with drafting rooms, library, and a properly equipped model shop."

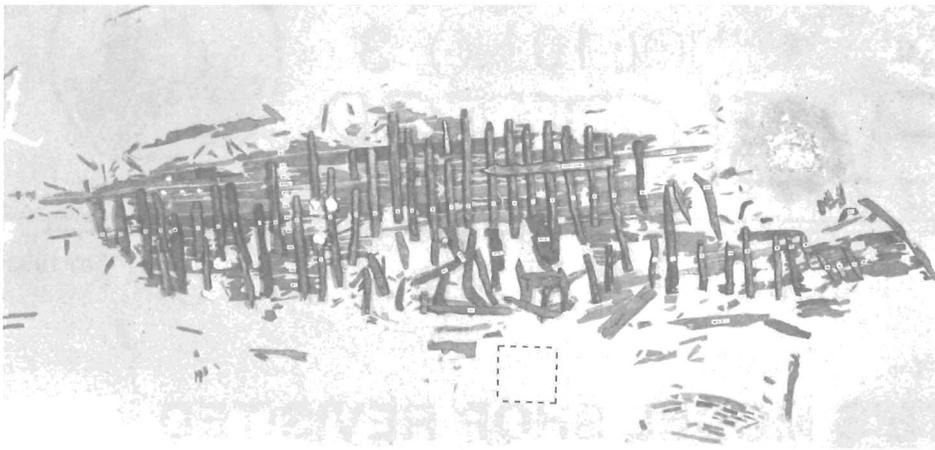
Seven years later these hopes and dreams have been far surpassed. Our

models have been used to research wrecks from Australia to Israel. They have gained international recognition by scholars and have been publicized in articles and television shows worldwide. And now we have drafting rooms, a library, and a properly equipped shop. We no longer call it a model shop; now it is a ship research laboratory. The model building process has become one small phase of the scientific and interdisciplinary research that reveals information about people, technology, economics, and dozens of other subjects involving the society which a shipwreck represents. Most importantly, I seldom complain about the loneliness of my lab anymore. I am surrounded by bright, enthusiastic young students who are certain to make my contributions to the field look primitive by comparison.

INA's headquarters are located at Texas A&M University's Research Annex, about 12 miles west of the main campus. In a

unique and highly successful arrangement, we share the facilities with the nautical archaeology section of A&M's anthropology department. Nautical archaeology professors are also INA staffers, and nautical archaeology students participate in far-flung INA projects. These students often look over our shoulders as we perform our research. They participate in discussions, and they write their theses on phases of work done on INA excavations. One building of the INA/academic complex houses offices, a seminar room, and a specialized library. Conservation laboratories occupy two small buildings where artifacts from various excavations are preserved and returned to their countries or states of origin. An old swimming pool contains sixteenth-century cannons and anchors awaiting treatment. Another small building encloses project and staff offices.

The ship research laboratory, the center of this article's attention, occupies a 100-



A one-tenth scale site diorama of the eleventh-century Serçe Liman vessel

foot long by 20-foot wide converted World War II Air Force operations building. Its outward appearance is no more impressive than that old garage in Denver, Pa., and it certainly lacks the charm of Kyrenia castle. Inside it is comfortably air-conditioned with lighting levels designed for specific tasks. One-half of the eight-room building is devoted to academic functions while the other half is used for project and long-term research. The academic section includes facilities for graduate seminar courses in the history of shipbuilding technology and laboratory courses in ship research. There are large tables for drawing ships' lines and artifacts, as well as work areas for thesis research. The projects section still contains remnants of the original model shop, although it has grown fourfold. Here the sunken ships excavated by INA teams and other institutions go through the cataloging, drafting, modeling, and research stages which eventually result in publications and lectures.

Why does INA need a model shop? Actually the designation is a misnomer; "three-dimensional research vehicles" would be a more accurate title for these little wooden assemblies. We use them to calculate curvatures, develop ideas, investigate theories, and illustrate structures so complex that a model is about the only way to clearly express the results of our work. They serve us in ways not unlike those of the botanist's experimental greenhouse plants or the aeronautical engineer's wind tunnel models. They are the best mediums we have to rediscover the long-forgotten processes of ancient shipwrights, metallurgists, and seafarers.

Ships are becoming increasingly important to nautical archaeologists because they are such complicated structures and therefore represent the best technology, craftsmanship, and materials that a society

had to offer. We record and study ships just as we would any artifact, although they are very large artifacts and require more elaborate forms of research. Sometimes tons of wood survive beneath cargo and overburden, so that our catalogs might contain hundreds of pages of data and thousands of drawings and photographs. But regardless of a wreck's age, nationality, location, or state of preservation, the same basic recording and research procedures apply.

Most ships' hull remains are carefully recorded on the seabed, then are recovered with overburden so that a future generation of archaeologists might study them further. Recording is done by means of stereophotography, triangulation measurements, and detailed sketches. In the few instances where the hull timbers are raised for later reassembly, drawings and photographs are made of each side of every fragment. Fragments might number in the thousands. In all cases data and physical descriptions are entered into a hull catalog. By the time a hull excavation is completed, the reconstructor is presented with site maps, artifact distribution plans, diving logs, catalogs, drawings, photographs, wood samples, and field notes. On most excavations, this material is sent back to the ship research laboratory where facilities and surroundings permit a more thorough investigation.

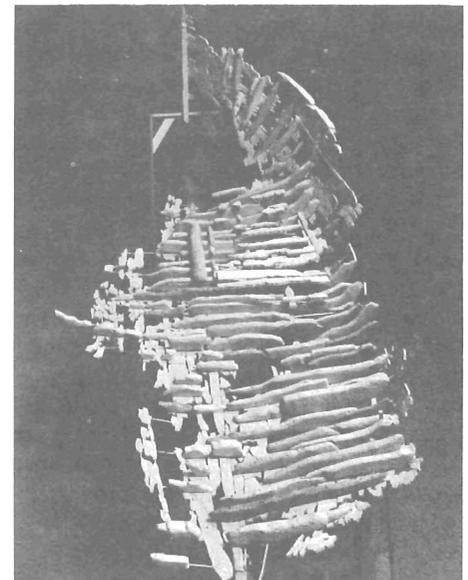
Samples of wood and metal are sent to various laboratories for identification. It is important to us to know what trees were used to build the vessel, what metals were employed in its fastenings and sheathing, and what types of pitches and paints preserved it. Piles of data sheets and drawings are processed and tabulated in specific categories. Timber sizes, tool marks, fastening methods, fabrication techniques, and dozens of other features are classified and cross-referenced. We

are interested in people, so we study tool marks to understand the expertise of the builders and the tools that they used; cargoes often reveal something about trade and economics. Normally each planking fragment will have about two dozen catalog entries. By the time the field material has been processed, we already know a lot about the ship and the people who built it.

Seabed site maps are usually reliable, but reconstructors like to think in three dimensions. Therefore, I have developed a site diorama to make the site mapping come alive. Dioramas have more flexibility than maps and drawings. They are really one-tenth scale models of the shipwreck site which permit us to move miniature timbers and artifacts around and determine how they disbursed on the sea floor. By applying a geometric process to the scattered hull remains represented by the diorama, it is possible to determine where most of the timbers were situated with respect to their adjacent hull members before the ship sank. The result is a new graphic representation of the surviving hull with all fragments now in their original orientations with respect to each other. But this drawing, called a revised wood plan, is merely a flat, two-dimensional representation of a part of the original hull. We want to determine the original three-dimensional contours of the vessel. Thus we turn to a second form of model—a fragment model—for answers.

First, one-tenth size replicas of each original hull fragment must be faithfully reproduced, including nail holes and broken edges. Information taken from the

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The Serçe Liman fragment model

PEOPLE AND PLACES

The Conference on Underwater Archaeology, held each year in conjunction with the meeting of the Society for Historical Archaeology, will be held January 4-7, 1984, in Williamsburg, Virginia. Project director D. L. Hamilton will be presenting a symposium this year on the INA/Texas A&M excavation of the sunken city of Port Royal. What better place to have a meeting of historical and underwater archaeologists than in Williamsburg, whose atmosphere re-creates our colonial past and whose proximity to Yorktown makes a quick sidetrip to the excavation of a Revolu-

tionary War vessel possible! . . . Although he is not teaching this semester, George Bass is hardly taking life easy. In addition to devoting most of his time to upcoming publications, George is lecturing at the Seventeenth Annual Conference on Medieval Archaeology being held October 21-22 at SUNY in Binghamton, New York. Joe Schwartz, a long-time INA volunteer in Turkey, is also presenting a paper at the conference. While in New York, George will be visiting the Metropolitan Museum concerning research on the Serçe Liman Glass Wreck . . . In Turkey another survey off the coast has ended. One week was spent on the site of a Bronze Age shipwreck near Kaş. Both Don Frey and George are excited about the wreck's

potential . . . Cemal Pulak is leading the crew back to the Ottoman Wreck at Yassi Ada for a few weeks in September-October. More on the work in Turkey in the next *Newsletter* . . . Robyn Woodward has completed her two-year stint as INA's Jamaica Projects Coordinator. During her tenure she served the Institute well by helping establish our presence in Caribbean underwater archaeology. She will be remaining on the island pursuing her own research and offering INA a helping hand as needed . . . Members will be interested in reading the cover article of the October 1983 issue of *Smithsonian*, "Historic shipwrecks yield prizes—but also strife." George Bass and the Institute receive substantial mention.

PROFILE



Ken Cassavoy

When Ken Cassavoy became an INA Research Associate in the fall of 1979, one of his duties was to serve as Newsletter editor. When he later assumed the position of Executive Director, he again took the helm of the Newsletter. As a result the ever-modest Ken has never been the subject of the Profile. While it might seem a little unusual to do a profile on Ken as he leaves his position at INA to take up teaching in Canada, those of us manning the ship can think of no better way to show what an asset Ken has been to the Institute and to say, "Bon voyage."

From 1959 to 1978 Ken Cassavoy worked in the communications field, starting as a broadcaster and working his way up to the position of station manager. While still at the station, Ken returned to Trent University in Peterborough, Canada, for a BA in anthropology. It was at Trent that Ken became involved in underwater archaeology. He had taken up sport diving in earlier years but had generally lost interest when it seemed that there was nothing much to see. However, while at Trent he

was introduced to George Bass' book, *Underwater Archaeology: A Personal Story*, and decided archaeology would add interest to diving, so he put on his wetsuit.

Between 1973 and 1978 he worked in Ontario as the underwater field director for the Atherley Narrows Fishweir project in Orillia; for the Penetanguishene Naval Slip project; and for the Hope Island Shipwreck project, Georgian Bay. In 1977/78 Ken was project supervisor and field director for the Charleston Lake Portage Site project.

Looking for a new challenge, Ken decided to leave the security of his career in broadcasting to study with "the man who wrote the book," George Bass. Although studying under Bass was sufficient to prompt Ken to move his family 1500 miles south, he found an added bonus in studying seafaring history with Fred van Doorninck, ship reconstruction with Dick Steffy, and conservation with Don Hamilton and in learning from other students interested in underwater archaeology.

Once at Texas A&M, Ken went to work immediately for George, using his managerial skills to coordinate the graduate program in nautical archaeology with INA. When George left for a year in Turkey in 1979/80, Ken slipped easily into the role of administrative assistant, running INA day to day in George's absence. Thus having worked in the administration of the Institute, Ken was a natural for the new position of Executive Director and of great help in the transition between presidents in 1982.

But Ken came to Texas A&M to study nautical archaeology not administration,

and that he has done with great success. In 1979 he went to Turkey where he worked on both the Glass Wreck and the Hellenistic Wreck. He has undertaken the study and publication of the gaming pieces, both chess and backgammon, found on the Glass Wreck. From 1981 to 1983 Ken served as project archaeologist on the *Hamilton/Scourge* Project, two War of 1812 vessels lying nearly 300 feet deep in Lake Ontario.

Even before coming to Texas A&M/INA and hearing George exhort his students to "publish, publish, publish," Ken had put his talents in communication to use in delivering papers on his Canadian underwater work at the Conference on Underwater Archaeology (CUA), in publishing an article in *American Antiquity* (43: 697-709) on the Fishweir site, and in co-authoring the Huronia Historical Parks publication on the Naval Slip site. Since then Ken has continued to deliver papers at the CUA and at the prestigious Archaeological Institute of America, American Historical Association, and Naval History Symposium. Proceedings from most of these conferences are to be published.

Ken maintains his close ties with INA. He is called upon not infrequently for advice, and we certainly expect to hear more from him at conferences and in publications. In the meantime, Ken and his wife, Pat, have returned to Toronto where Ken is now happily teaching at Centennial College. Two of their children, Lisa and Chris, are still living at home, but the eldest, Ed, decided to finish his undergraduate degree in Texas where winters—and summers—are considerably warmer.

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diorama and revised wood plan is then tabulated into specific lists of dimensions. By combining a form of three-dimensional geometry and a reverse method of projections used by early naval architects, it is possible to develop the wood plan into an assembly of miniature fragments. Each fragment is now in the precise location and elevation its prototype occupied before the ship sank.

One more model is usually necessary to complete the process. The fragment model merely determines the shape of the surviving portions of the hull. We want to know what the entire ship looked like and which construction sequences were followed. And so we turn to the full-hull or final research model. This may consist of a series of wooden battens—thin strips of straight-grained pine which are bent around forms derived from the fragment model to describe the missing hull areas. Or it may be a highly detailed model with every nail, joint, and timber in exactly the right place. The type we select depends upon the complexity of the ship, the size and budget of the project, and the questions still to be answered. Whatever form the research model takes, it combines everything we have learned from the fragment model, diorama, catalogs, field notes, literary evidence, and the marks left by shipwrights and sailors. If there is enough of this evidence, we will be able to produce an accurate description of the original ship; very often we will also learn something about economics, shipboard life, technology, social structures, and a myriad of other interesting details about the vessel and the people associated with it.

Rarely are these models attractive enough to be varnished and sent off to the museums where the shipwreck materials are displayed. Usually they serve briefly as teaching tools for Texas A&M students before being broken up for use in making other models. Many of them are not models of ships at all, but of anchors, rigging, or any other ship-related material that we cannot interpret by graphic or literary methods.

It is not essential to use models for our research. Similar experiments can be performed on a limited basis by graphic, mathematical, or computerized methods. But one needs only to compare a painting or drawing with a model of the same ship to discover that the model is far more illustrative. Mathematics can provide the size, weight, and shape of the vessel but



(Photo: KC Smith)

Author Dick Steffy with the seventh-century Yassi Ada ship's research model

will not supply information for all the other details in which we are interested. Computers will someday replace these models as the most efficient research mediums. We already use them to some extent. All my projects for this year will be cataloged, tabulated, and calculated by computer. Yet at present we lack the expertise, time, and money to write computer programs which can match the multitude of revelations supplied by models. We will remain receptive to computer experimentation, but for now the advantages of working with wood far surpass the mediocrity of watching those cold green lines form on the computer screen.

Are models expensive? Not when one considers the benefits. Dioramas and models built to project hull lines might be made entirely of scrap materials. We are not building mantle or museum pieces, so we can use the cheapest materials that will do the job. Except for instances where original shipbuilding woods must be duplicated, we work in the cheaper grades of soft pine. Only those features which compliment our research go into the models, so that time and money are not lost in frills. Some of the more complex assemblies do involve a lot of labor, but the time invested is usually directly proportional to the amount of information extracted. No other medium could provide similar results any faster.

Only two ships were discussed in the 1976 article because Yassi Ada and Kyrenia were then our only projects to which the model processes could be applied. In the last seven years there have been

many more wrecks which have benefited from models. The eighteenth-century brick carrier at Brown's Ferry, South Carolina, the eleventh-century medieval merchantman at Serçe Liman, Turkey, the ancient warship at Athlit, Israel, the Revolutionary War privateer *Defence* at Castine, Maine, and the sixteenth-century *San Esteban* which was wrecked at Padre Island, Texas, in 1554 are among the ships to which we have directed our model research. Our lab has also become a consulting center for many institutions in other states and countries, and sometimes their representatives visit our facilities to work with us directly. Such was the case with Western Australia's *Batavia*, a Dutch East Indiaman which sank in 1629, and the sixteenth-century Basque whaler being investigated by Parks Canada in the icy waters of Red Bay, Labrador.

This fall our lab will be humming with a fervor that will make it a far cry from our 1976 operation. Jay Rosloff is building a thesis research model of the Ronson ship,

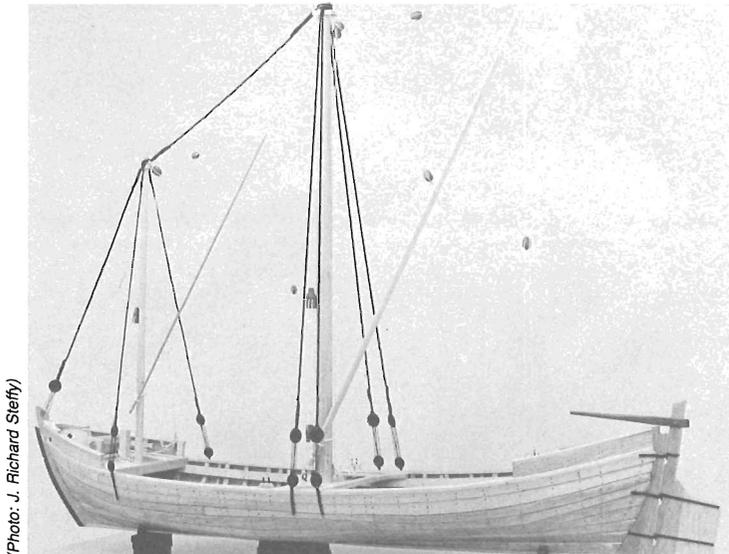
NATIONAL GEOGRAPHIC SOCIETY

We would like to express our special thanks to the National Geographic Society for its support which has enabled INA to establish an underwater archaeology program in the Caribbean. This note of appreciation is in addition to all the thanks INA has expressed to the Society for its continued support in the past.

an eighteenth-century merchantman found in the excavations for an office building in downtown Manhattan. Cheryl Ward will be working on the Serçe Liman fragment model in order to design a ghosting system for that ship's reconstructed remains and to cooperate with Turkish architects in designing museum aesthetics for the new building which will house it. By January Cemal Pulak will be doing three-dimensional research on the sixteenth-century wreck now being excavated at Yassi Ada, Turkey. Tom Oertling will be reproducing timbers from the sixteenth-century Molasses Reef wreck. Kevin Crisman has just completed and published his study of the *Ticonderoga* and will soon tackle the *Eagle*, two brigs dating to the War of 1812 which were found in Lake Ticonderoga. I will have three projects undergoing model research—an elaborate representation of the fourth-century B.C. Kyrenia ship which is designed to answer many important questions concerning ancient technology, structural studies of the bronze Athlit ram and the bow construction which supported it, and a research assembly of a first-century Roman boat now being excavated at Herculaneum, Italy. And who knows what is still to come in from the field.

On an average project, ten percent of my time goes into model related research—not very much, really, when one considers its importance to the overall job. Someday computers may replace power tools in the model shop, and floppy disks will be stored where wood is now curing, but models will probably remain the best method of illustrating our work.

J. Richard Steffy



(Photo: J. Richard Steffy)

The Brown's Ferry research model was rigged and sent to South Carolina to stimulate local interest in the project.

INA AND AUSTRALIAN INSTITUTE FOR MARITIME ARCHAEOLOGY JOIN FORCES

Although on opposite sides of the globe, the Institute of Nautical Archaeology and the Australian Institute for Maritime Archaeology share common aims and ideals. These two groups have recently joined forces as supporting institutions. If the relationship of INA and AIMA is a recent development, it is founded on a long association between INA and Jeremy Green.

The Australian Institute was formed in 1982 at the Second Southern Hemisphere Conference on Maritime Archaeology. AIMA was organized to promote the advancement of the field of maritime archaeology, both in Australia and elsewhere, by acting as a national steering group to coordinate the efforts of maritime archaeologists and maritime archaeological societies, both amateur and professional.

AIMA would be pleased to publish material from INA which may be of interest to members in Australia. With INA as a reciprocal supporting institution of AIMA, individual INA members are eligible to join AIMA as associate members at a reduced subscription fee of AUS\$7.50. AIMA publishes a biannual bulletin, quarterly newsletter, and special monographs on Institute-sponsored excavations. Membership subscriptions or inquiries should be directed to the Secretary, Australian Institute for Maritime Archaeology, W. A. Maritime Museum, Cliff Street, Fremantle, W.A. 6160.

ELIZABETH A. WHITEHEAD

Elizabeth Augustus Whitehead, one of INA's founding directors, died in New York on August 3. Many in INA first met Betsy, as she was known to us, when she was a graduate student of classical archaeology at the University of Pennsylvania, working on excavations in Turkey, Italy, and Greece. She could easily have become an outstanding archaeologist in her own right but she chose, instead, a career of service to archaeology, as general secretary of the Archaeological Institute of America from 1971 to 1978, and from 1976 as president of the board of trustees of the American School of Classical Studies at Athens; in addition she served on the executive committee of the Institute for Advanced Studies at Princeton. Because we knew Betsy well, we leaned on her heavily for advice during the Institute's formative years, and remember fondly the long telephone conversations and visits to her home in Greenwich, Connecticut, where Jack Whitehead changed the slides as we showed our work to their friends. As much as we are grateful to her for support of nautical archaeology, we remember as well the tennis, the jigsaw puzzles, the walks by the water; it is hard to accept that this vital and gracious friend is gone.

G. F. B.

JOAN DU PLAT TAYLOR

We have learned with sadness of the death in England of Joan du Plat Taylor. Underwater archaeology's present respectability owes much to her. Although not a diver, and although she already had a distinguished career in land archaeology, especially in Cyprus where she excavated and served as curator of the Cyprus Museum, she early realized the potential of marine archaeology. She was a driving force in the first scientific excavation of a shipwreck on the seabed, at Cape Gelidonya, Turkey, in 1960, and soon afterwards edited the book *Marine Archaeology*. Later while continuing dry land archaeology in Italy, she founded and for eight years served as editor of *The International Journal of Nautical Archaeology*, where INA has published most of its preliminary excavation reports. Much of the success of nautical archaeology, especially in the United Kingdom, is due to her lectures and advice to both archaeologists and sport divers, a service recognized when she was awarded an honorary doctorate by the University of Pennsylvania. She was also a good friend who will be missed by all of us at INA who knew her personally.

G. F. B.

JAMAICA BOARD MEETING

To offer the Board of Directors more firsthand contact with INA work, this summer's board meeting was conducted at INA's Caribbean base, Jamaica. A get-reacquainted party and the necessary business meetings were held July 7-9 at the Sans Souci hotel in Ocho Rios. Later INA's Board members and guests toured the Columbus caravels survey project at St. Ann's Bay and the excavation of the sunken city of Port Royal. Entertainment included a trip to the refreshingly cold water of Dunns River Falls and a dive on the reef at Discovery Bay.

(All photographs by KC Smith.)



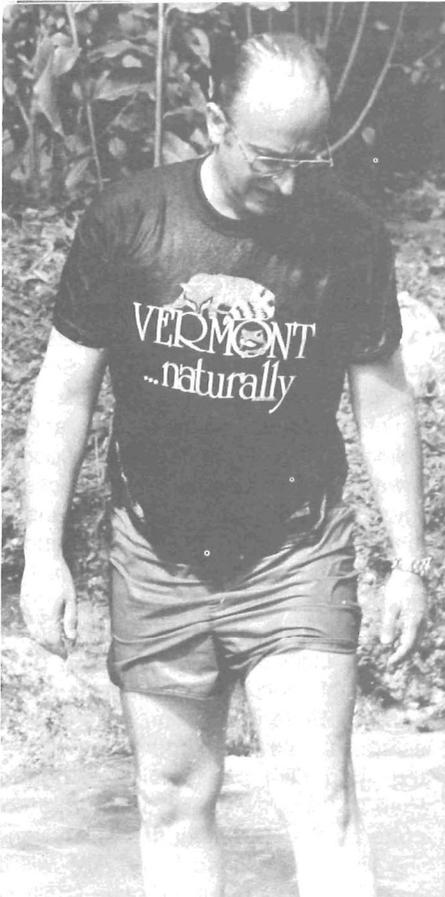
George is sans souci at the opening night party with Claude Duthuit.



Don Frey, on the other hand, has taken over the cares of the Institute, perhaps being seriously discussed with Jack Kelley.



John and Eleanor Baird and Barbara and Chuck Collins arrive to greet old friends and meet new ones.



The cool water at Dunns River Falls seems to have chilled Michael Katzev's enthusiasm...



but not his wife Susan's.



Robyn Woodward (center) shows Milann Siegfried, Jean Kelley, and Barbara Collins an encrusted artifact at Port Royal.



Jonathan Williams and Richard Hardvin demonstrate removing an artifact from its encrustation. For the uninitiated, it is not the same artifact that Robyn holds in the previous photo.



John O'Connor helps John Baird choose SCUBA gear off the racks of the Port Royal dive locker.



"I know I saw it right over there," asserts Roger Smith. "Oh, come on now!" John Baird seems incredulous.



Donny Hamilton shows off the multitude of storage tanks at Port Royal.



Relaxing at Dunns River Falls, Ken Cassavoy, with his wife, Pat, signals, "Jamaica is OK."

The Institute of Nautical Archaeology is a nonprofit scientific organization whose purpose is to gather knowledge of man's past as left in the physical remains of his maritime activities and to disseminate this knowledge through scientific and popular publications, seminars, and lectures. The INA Newsletter is published periodically by INA and is distributed to its members and Supporting Institutions to inform them of INA's current activities. INA is an equal opportunity organization.



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