glass, joints or the corners of slab-built pieces will not come apart on drying. In sculpture especially, the process has great potential.

The use of fibers and cloth as reinforcement in clay was developed by the author in a series of experiments begun in 1963. The process of using fiberglass in clay was invented and perfected by Daniel Rhodes in 1965.

The use of fiberglass, unfortunately, has some negative aspects in that the material can cut hands and cause allergies. Its use in clay bodies has largely been superseded by the addition of chopped nylon fiber in place of fiberglass. The benefits are equal to using fiberglass without the attendant problems. The methodology is basically the same.

18. Paperclay

A recent development in fiber-reinforced clays has been the research since 1989 and through the early 1990s by Rosette Gault. Her use of paper pulp in clays has made huge changes possible in the making of many forms of pottery and sculpture. Paperclay is now a licensed product made commercially by a number of ceramic materials suppliers. Here she talks about the process, its methodology, and its potential.

"Paper makers have known for a long time that up to 30% to 40% of clay in a paper pulp recipe can be an improvement to paper. In ceramics, we never considered that adding pulp to clay in inverse proportions would be worthwhile. Manmade fibers were more uniform, had less drawbacks in comparison. Pulp fibers are irregular lengths and introduce organic matter into the clay. The risk of smelly buckets was to be avoided. The trace mineral contribution of paper to a clay recipe could be a bother. Most who worked with paperclay, following the conventional methods of figure making, wanted fiber strength to interrupt fractures during forming.

"It turns out that the so-called drawbacks mentioned are, in fact, an essential prerequisite ingredient for a clay body that is more versatile to handle than normal. When pulp fiber is mixed in clay, the irregular, hollow, water-absorbent tube-like fibers wick water like capillaries through the clay body. The flexible hollow fibers shrink and expand with the clay body as it shrinks in drying or re-wetting. When the pulp is blended with clay slip, it becomes like a liquid "Velcro" that stiffens and snags especially well in the micro-pores of the bone-dry paperclay or paperclay bisque. This means that, in practice, freedom to improvise over bone-dry armature clay structures or figures is now a reality for a maker.

"One by one, kiln openings at sites all over the world in recent years told the story. Experiments with the unorthodox possibilities of paperclay over the last ten years (suggested in my articles, books, and lectures) proved reliable. Paperclays respond to imagination and practical needs of a maker in ways that were previously inaccessible in ceramics.

"Ceramic paperclay (P'Clay®, New Century Arts, POB 9060, Seattle, WA 98109) has nearly double the green strength for ease in handling and transport to kilns. Those who dip glaze greenware for once-fire projects report better adhesion of glaze. The list of advantages continues from there. Fresh soft wet paperclay can be modeled directly over bone dry, and sometimes even over bisque. Repairs and improvisation to greenware (or even bisque!) such as broken fingers, handles, feet, trim, et al. are likely to succeed.

"Base clays from one side of the planet to the other - stoneware, porcelain, terracotta, earthenware, high fire, low fire, raku, pit - can be blended with paper pulp in volume proportion from 5% to 49%, most typically somewhere between one third to one quarter by volume of pulp to slip. Unlike paper mâché, which has too much paper in it to fire, the higher proportion of clay in ceramic paperclays remains after fire for durability and structure. Those who want to adapt one of the "old-style" so-called "sculpture" or "raku" base clays with maximum grog or sand content ought to reduce the ratio of grog or other additives at least by half or one third before adding pulp. Due to huge variety in clays and papers worldwide, the volume method is a more reliable all-purpose "get started" guide than a specific weight.

"Papers, too, may be recycled in the mix. Newsprint, out-of-date brochures, writing papers, egg cartons, are suitable. Since most ink burns out in the fire, there is little effect on the ceramic result. Turn shredded or torn papers, or even toilet rolls, into pulp by blending them in a soup of water to wet fluffy consistency before scooping out of the water with a household sieve. The object is to disperse the pulp fibers uniformly throughout the clay slip to an oatmeal consistency. Pour out over a plaster drying bat and wedge up soft clay from there.

"It is possible to force paperclay dry too. Pots in

excerpt from Robin Hopper Expanded ed. Daniel Rhodes: continued next page

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the kiln fire (especially above cone 4) will expand, contract, and "move on their own" (like teapot spouts) in a hot kiln. Why not put the fresh work through a mini-version of similar stress to find out right away where or if cracks or spontaneous movement will occur. Repair, reinforce, or compensate as needed. A paperclay structure that is stable after force-drying episodes is likely dependable in kiln fire later.

"The repertoire of potential surface textures of the paperclay slip (P'Slip®) is expanded to include 'paper-like, fluid paste icing, thick smear or waves.' Those who still prefer smooth traditional burnish or terra sigillata surfaces will be pleased to find them still possible over paperclay.

"The glazed result is indistinguishable from a nonpaperclay without detailed inspection by electron micrograph. The voids from the paper fibers are very small and even in bisque they would be hard to see. The lighter weight might be the only clue. In fact, the paper burns off at approximately 120°C. When it's gone, all the rules of normal clay will apply. The paper can not rescue overfired or poorly formulated base clay blends.

"Today we see evidence of continued variation and innovation in paper-reinforced clays. These include sand cast structures, fired combinations with metals and chicken wire, public art commissions, free-standing outdoor figures, murals, tiles, innovations with latex and plaster mold forms, design and models of prototype master making in industrial labs, installations, 'big-burn' events, free-standing constructions of string or twigs dipped in P'Slip and fired out, glass slumping, and progress on 'double recycle' for building materials (i.e. blend scrap glaze/clay with recycled paper to fire to a water-tight tile).

"Because of its higher 'success rate,' use of P'Clay in elementary schools, either for fire or as affordable painted greenware is growing too. Teachers of special needs children and adults report proven advance in self esteem, which is heartwarming news.

"I see potential application of the medium that could affect every corner of contemporary ceramic art and science in the future. I am thankful to the hundreds of people behind and in front of the scenes whose efforts and experiments have collectively inspired this to be well underway.

"Today, there is my informational website - www.paperclayart.com - to serve the ever-growing community of interest. For those who do not wish to make their own batches, the ready-made prewedged P'Clay blend is a real convenience and can even be thrown on the wheel!

"Compensation for cracking and loss is so much an essential element of practice with potter's clay that it was never questioned. The day one figures out how to avoid the cracks with certainty is understood to be one of the essential prerequisites to success in the field. Once that point is attained, one can begin to produce work that is fresh and genuine. With paperclay, fears of cracking and loss are less during the critical attention to detail and finish stages of the process too. As a result more attention and time can now be directed to the bottom line - fresh imagination for surface and forms that will stand the test of the fire and time.

"The potential for an advance in artistic integrity and pleasure in the 'territory of paperclays' is underway. This new variation on an ancient approach opens up a huge range of possibilities, allowing the artist who works in clay a freedom to work with far less fear of loss in the final product. Expanded construction methods, from throwing and hand-building to exploration of unconventional forms of clay work, are now possible through this revolutionary process. The future for this new variable on an old methodology looks to be very secure. It will be interesting to speculate on what other new clay developments are just around the corner awaiting discovery."

19. Warning

All reinforcing materials may carry with them some health hazards. Fiberglass contains fine strands of glass that may severely irritate the skin. Fine nylon fiber is probably better all around than fiberglass but may have side effects from inhalation of fine fibers. Organic additions such as paper or cloth can develop molds that may cause nasal, respiratory problems and allergies. Molds can be inhibited by the use of fungicides and bactericides, but who knows what secondary problems that may cause. One other problem with reinforced clays is that since they can easily be used to patch and repair badly made work, the quality of craftsmanship is likely to suffer as poor or ill-conceived work can be saved too easily and fired into permanence.

continued excerpt from Robin Hopper Expanded ed. Daniel Rhodes
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