Plumb Beach Channel:

Investigating the Contemporary Taphonomy of Synthetic Debris

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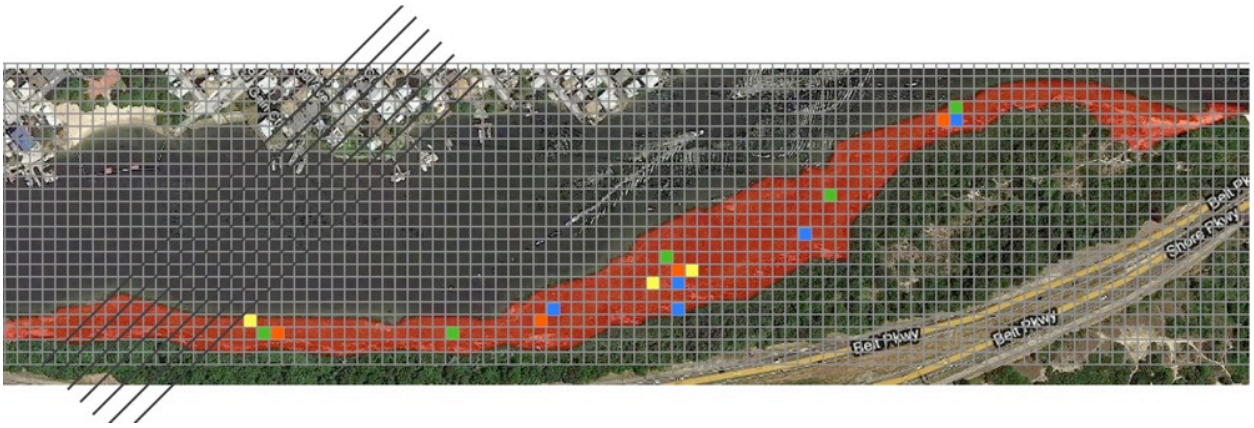
ABSTRACT



A number of contemporary geologists have suggested that today's Earth has moved beyond the Holocene and into the *Anthropocene* -- an era demarcated by human influence upon the planet. Some argue this era begins with the Industrial Revolution, while others posit the rise of agriculture as our transformative genesis. We suggest, that while both of these processes are without question of utmost significance in defining the human relationship to its environment, the most revolutionary alteration to the physical landscape has arrived in just the past century with the introduction of chemically engineered synthetics at a production of scale that makes it cheaper to produce a piece of plastic than a piece of wood. What particularly distinguishes this era of synthetics is that its output is instantly fossilized, eternally contributing to the mass of the planet. However, unlike fossils of the pre-*Anthropocene*, which lay in dormant stasis waiting for the meddling hands of intrepid archaeologists and paleontologists, the synthetic fossils of today are highly mobile and are capable of circumnavigating the planet a dozen times over the course of their existence. To better understand this "new taphonomy" of contemporary debris, we explored the composition of the Plumb Beach Channel, a densely polluted beach in New York City. This report documents our theoretical framework, methods, results, and the prospects for future research.

INTRODUCTION

We live in a fascinating new geological era. Within the past century a new species of material types has glazed the human landscape. These synthetic artifacts serve as the designer geology of our present *Anthropocene* era. It has been suggested that the *Anthropocene* begins as early as the Neolithic, with the transition to sedentary agrarian populations. Others have suggested the Industrial Revolution as the *Anthropocene's* initiation, while still others posit the detonation of the first atomic bomb as the beginning of this era (Crutzen & Steffen 2003). However, we propose that the epoch truly commences with the mass-production of synthetic materials. This rapid and pervasive alteration in the physical make-up of our environments has had the most drastic effect upon our soils, air and waterways. The present investigation aims to explore this hypothesis through a data collection exercise on the highly synthetic (polluted) landscape at the Plumb Beach Channel in New York City (see photo 1).

Photo 1: *Plumb Beach Channel, April 2011*

AUTOMATIC FOSSILS

Taphonomy, the study of fossilization, is an invaluable weapon in archaeological research which allows archaeologists to trace the life histories of organic materials Zilhão & d'Errico 1999; Behrensmeyer & Hill 1980). Of course, frustratingly little of human consumed or processed materials survive in a fossilized state, and the vast

majority of matter that we have interacted with has decomposed through the generations. Today, ever more of the materials that we build with, consume and otherwise employ are synthetically manufactured. They have a much longer permanence on this planet, as they are less susceptible to bio-degradation. Essentially, the materials that today's society is constructed out of are already fossils, mass-produced fossils – temporarily immune to senescence.

A conglomeration of laboratory created synthetic materials (including plastics, and most forms of fiber, foam, and rubber) have come to infiltrate all facets of modern civilization, altering not just our daily habits but the biological history of the planet. Yet despite inherent innovative qualities and certain advantages over "natural" materials, synthetic products exist in an interesting paradox. While on one hand synthetics appear durable and everlasting, they simultaneously exhibit traits of weakness and fragility with their lightweight and buoyant properties often leaving them at the mercy of basic elemental forces such as wind, tides, and currents. It is this combination of longevity and mobility, as well as the overabundance of which they are consumed and disposed that makes synthetics an unrivaled new category of archaeological artifact.

We propose that understanding the life histories of these synthetic fossils, that is, how they arrive where they do, and the path they have travelled from factory to shore is a critical facet of *Anthropocene* geology. Unlike previous Geologic epochs in which the Earth's crust and climate patterns altered little or "glacially," the *Anthropocene* places the surface of the Earth in a state of constant rapid flux, reconfiguring with the movements of its synthetic coating. We live in a plastic landscape in both senses of the word 'plastic'. If we know how this "trash" moves and accumulates, then we can better know how to integrate it with our socio-cultural activities, e.g., architecture, politics, transportation, or religion, creating a more amenable and equitable global material landscape.

Enabled to escape an outmoded infrastructure of disposal and sanitation, our society's trash is no longer bound to trashcans seen or landfills ignored. Instead, clues to our existence and the precessional effects of our consumption now lie within the synthetic samples occupying sites unknown. Scapes that were once virgin territories of human exploration: staggering mountains, vast oceans, even the depths of space are now all being rediscovered and examined not for containing profound examples of what is natural, but what is not.

THE PLUMB BEACH CHANNEL

The Plumb Beach Channel shore is a small peninsula on the much larger peninsula of Long Island, approximately 240,000 square feet depending on the tides. The Channel shore faces away from the Atlantic, and is opposite Plumb Beach which looks directly into the sea. The Rockaway peninsula is situated a mile and a half out to sea beyond Plumb Beach, creating a bay of sorts and serving to protect Plumb Beach

from direct interface with ocean wave systems. Plumb Beach is located at the southeastern corner of the Sheepshead Bay neighborhood of Brooklyn. The beach and the channel run parallel with the Belt and Shore Parkways. Across the Channel to the North is Marine Park. Plumb Beach concludes at the Gerritsen Inlet Bridge.

Plumb Beach Channel, Study Site in Yellow (source: Google Earth)

The Plumb Beach Channel Shore is not particularly unique among New York City's shorelines in that it is densely saturated in human-produced trash and debris. Similarly composed New York shores include many areas in Jamaica Bay (Queens) and Pelham Bay (The Bronx). The Plumb Beach Channel upon which our investigation was carried is relatively unfrequented for a city of eight million, as it is difficult to access by foot, or any other transportation except boat. It is certainly much less trafficked than Plumb Beach itself which is a popular point of leisure for New Yorkers. Because of this, or in spite of it, the Channel shore is not maintained or manicured in any traditional civic sense. Trash has piled up across the entire shore in varying densities (see photo 2). The supposition is that a majority of this trash arrives via the current, washing ashore either from the direction of the Atlantic Ocean or from further inland up the Channel. While there is certainly minor evidence of synthetic products being brought and consumed at the shore from land, the inaccessibility of the shore means that the majority of its synthetic population is not "native."

With over fifty million people in the Northeastern megalopolis stretching from Washington D.C. to Boston, there are plenty of synthetic producers and consumers whose detritus is capable of ending up in the Channel.

Photo 2: *Plumb Beach Channel Debris, April 2011*

METHODOLOGY

Our data collection and analysis of the synthetic topography of the Plumb Beach Channel site began in April of 2011 with advanced surveying trips to assess the extent of the site and to determine the layers of densest chemical composition. We accessed the site by chopping our way through the brush that protects the channel from the Belt Parkway.

In order to most judiciously analyze the geologic composition of the site, we determined that it would be necessary to take a representative sampling of randomly selected quadrants measuring five feet by feet (see photo 3). In the end, due to time and labor constraints, we were able to sample only eight quadrants, each site labeled A through H. Although the total area sampled only equaled 200 sq. feet out of approximately 240,000 sq. feet, a substantially inadequate sample area to attain any true statistical confidence, this investigation was much less concerned with the degree of confidence that can be attained by manipulating numbers than laying the groundwork for an operational understanding of how synthetic fossils sculpt human spaces.

Although our sample size was rather insignificant, the amorphous nature of coastal surfaces kept our area of focus in constant flux. The approximated 240,000 sq. feet of sample surface was based on measurements taken at low-tide. Shores and coasts, even more so than terrestrial spaces, are not static landscapes (Chappell 1982). The process of measuring and documenting coastal surface composition takes places

through time, and the 240,000 sq. feet of shore would contract significantly as the tides would rise. The waxing and waning tides also shifted the positioning of synthetic materials on the landscape -- repositioning items even as we were conducting our measurements. Below we attempt to factor this impediment into results.

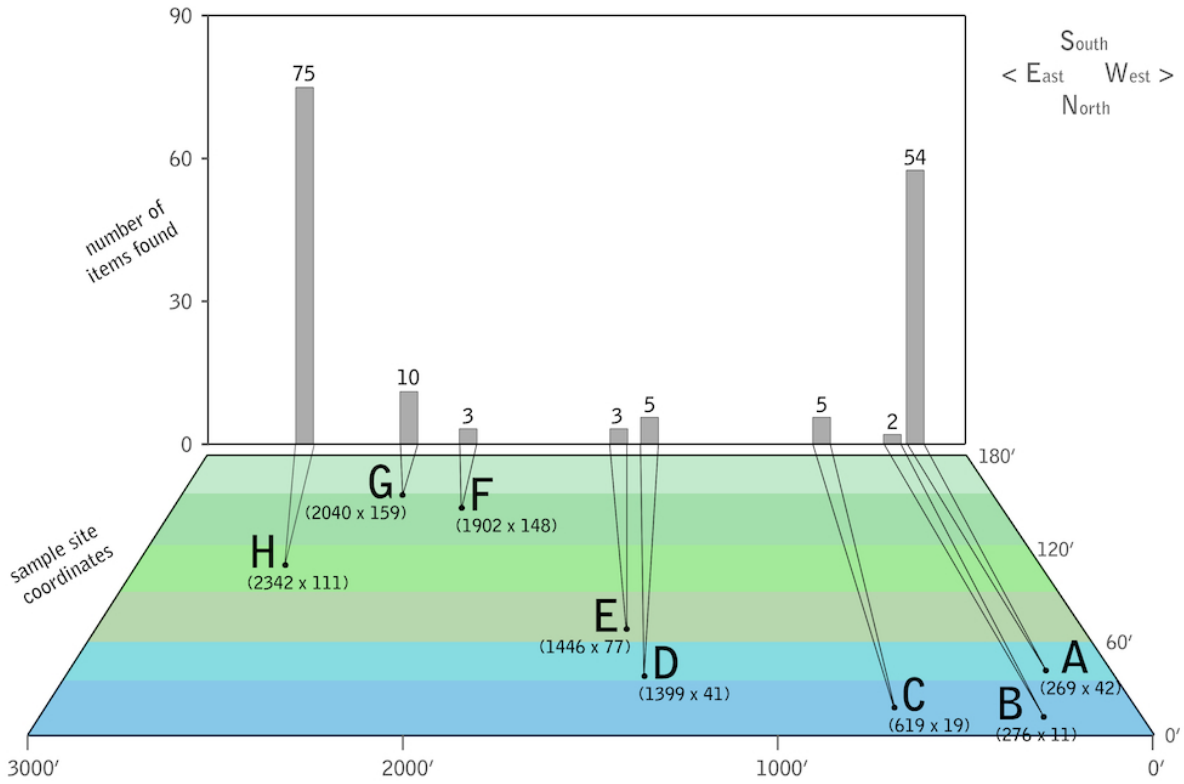
Photo 3: *Sample Site C (May 2011)*

Once our samples areas were defined, we meticulously documented and analyzed every synthetic item contained within them. Each item was documented for its material composition, size, color, function, brand, orientation to the sea, and relationship with surrounding synthetics. In recording these minute facts of every 'taphonomic event', it was our aim to extract as much data possible, no matter how banal. It is our position that regardless of its perceived relevance at any given time, pure *data* remains venerable as abstract phenomenal units, outside of a relationship to any other metrics.

REPRESENTATION AND APPRECIATION

The amount of synthetic material per sample quadrant varied significantly from as little as three artifacts to as many as seventy-five (see figure 1). Moreover, this seventy-five may be misleadingly small, as in areas such as these there existed irreducibly small plastic shards that were beyond investigation and detection by hand. Our findings from the site demonstrate the clustering nature of the new synthetic landscape and its automatic fossils. The fact that, in this case, the trash that composed the landscape

Figure 1: Sample Site Locations & Corresponding Gross Results



clustered along an otherwise indifferent shoreline tells us much about the movement of synthetic fossils. This phenomenon of clustering deposits of synthetics echoes the concept of spatial autocorrelation, originally developed in spatial analysis, but also applied in archaeology, which asserts that it is more likely that an artifact will be found next to another artifact than by itself. In the same vein metrics have been developed for Average Nearest Neighbor measurements (Voorrips and O'Shea 1987). There are quantitative analyses developed to gauge the relative ferocity of these phenomena, but our data clearly show a strong tendency toward clustering, with two of our eight sites accounting for 81% of the total synthetic artifacts.

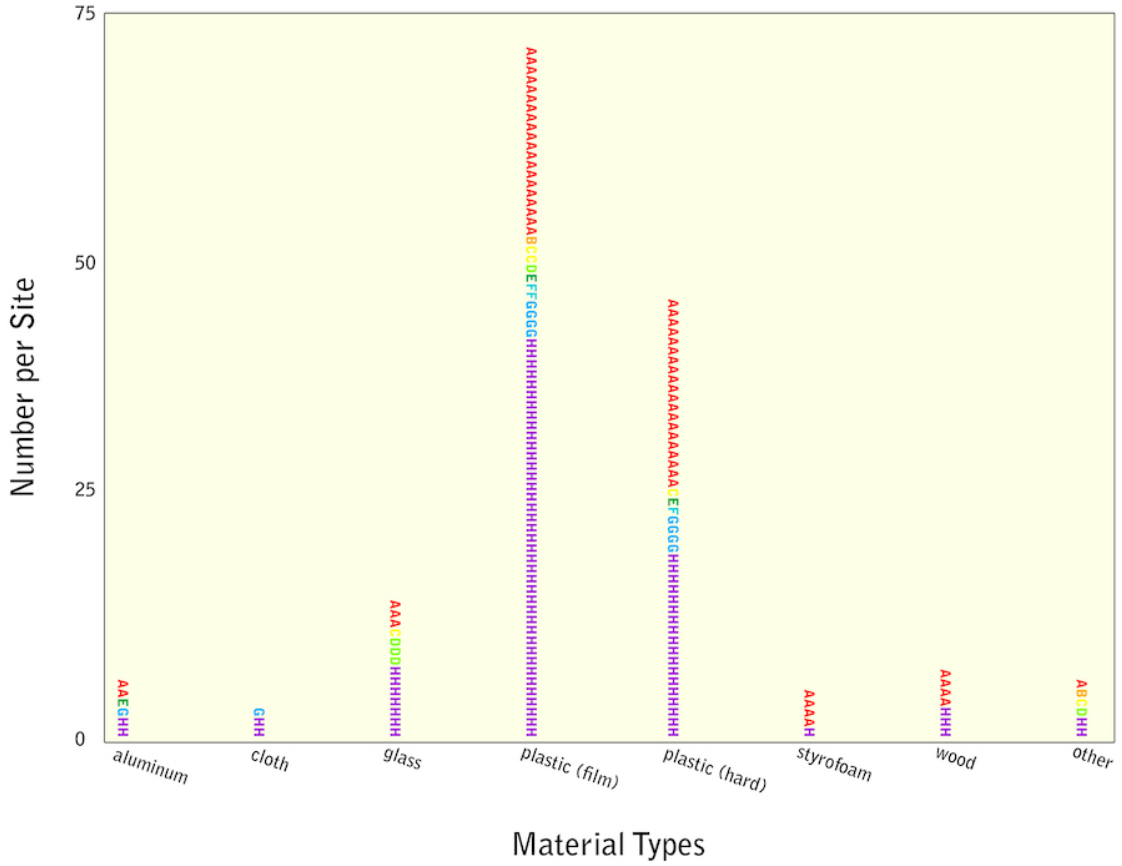
Photo 4: *Old Pepsi Aluminum Can (May 2011)*

The functionality of a high percentage of the synthetics found at the site was related to consumption (see photo 4). Beverage bottles and snack wrappers predominate. A corollary may be drawn to “traditional” archaeological

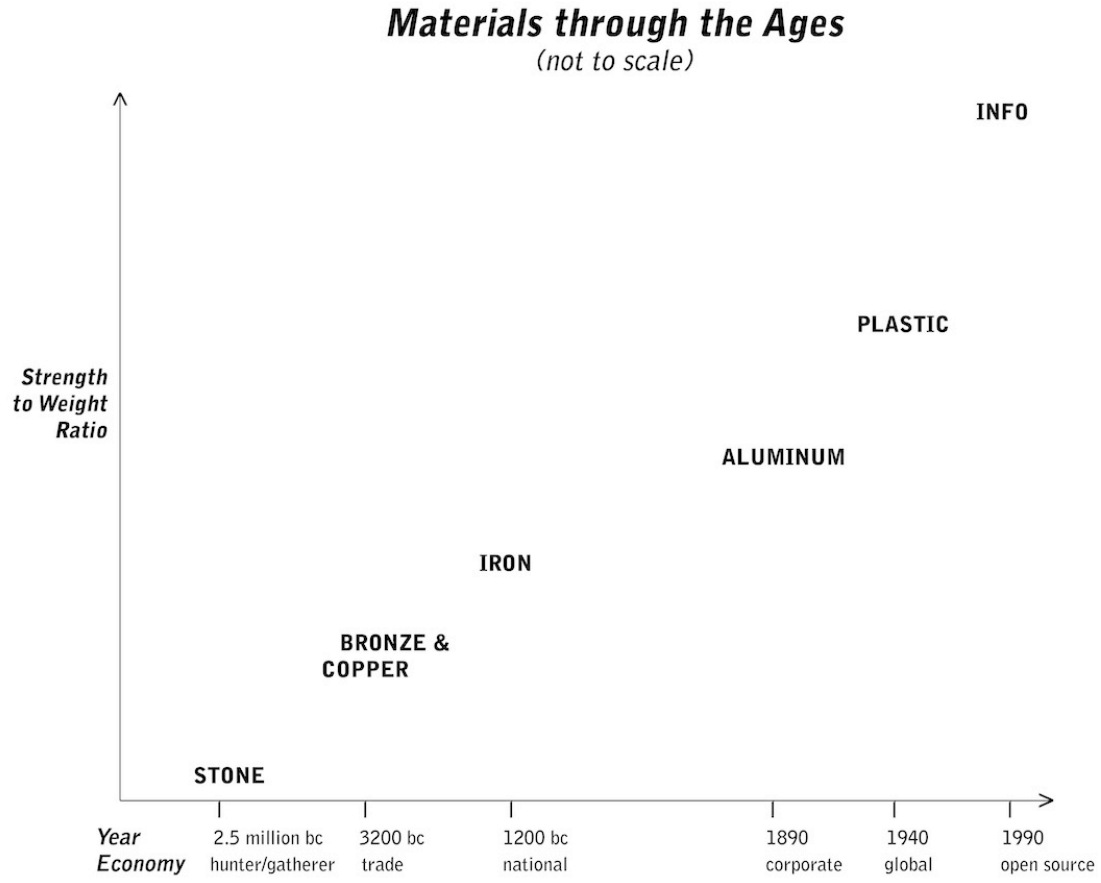
study in which much of the material record we examine is directly or indirectly related to food/beverage storage/consumption, affirming the old adage, “we are what we eat.”

A majority of the synthetics found at the site were composed of plastic. Other prominent materials included glass, aluminum, and styro-foam (see figure 2). It is interesting to chart the evolution of the human synthetic output over time, potentially beginning as early as the Copper Age through the Plastic Age, and correlate this with the increased mobility of synthetic output (see figure 3: Materials through the Ages).

Figure 2: Artifact Materials & Sites of Origin



Across our eight sample quadrants 159 total synthetic fossils were excavated. Most notably, 54 items came from Site A and 75 from Site H. Extrapolating this limited data over the entire site we derive an estimate of approximately 190,800 unique synthetic artifacts over the entire 240,000 sq. feet site -- approaching a 1:1 relationship of surface area to synthetics, and given the variable nature of the coastal surface area mentioned above, perhaps this relationship is closer to 1:1 than the numbers suggest. More interestingly, our excavation resulted in two significant clusters of synthetic debris out of eight sample sites (clustering is here defined as over one artifact per square foot, i.e., 25 or more artifacts within the 25 sq. foot sample quadrant). While the total square



footage we were able to sample was not statistically significant, we are confident in projecting this general relationship across the extent of the Channel. That is, that one fourth (two out of eight) of the Plumb Beach Channel shore contains significant clusters of synthetic geology.

Of the more unique finds recovered from the Plumb Beach sampling, was large 20 cubic inch security safe which had been forcibly broken into by what appeared to have been some variety of industrial strength saw (see photo 5). The safe was emptied of its contents and appeared to have been significantly aged. The life history of the safe sparks the imagination, and one wonders if it arrived at the site over land or water.

Photo 5: *Safe @ Sample Site H (May 2011)*

DISSOLVE

While the debate on when the *Anthropocene* actually "began" is ultimately rather academic, what this research has attempted to highlight is that the combined influences of mass and synthetic production are transforming the tangible geology of this planet like few prior trends. Like sediment upon the terrestrial surface, mass produced synthetic fossils linger and accumulate, becoming indelible geological features. The Past is supposed to dissolve. Archaeology is of value because it illuminates cultural behaviors that would otherwise be incinerated in the flames of duration. The scale and composition of industrial production is such that its output transcends the relentlessness of duration. Essentially, we are surrounded by synthetic ghosts whose functional utility on this planet has long-since expired, yet their souls are trapped within our ecosphere, haunting the future geology of Earth.

Clearly, much future research is still needed in order to further understand the nuance of the observed geo-synthetic activity on Plumb Beach. Potential lines of research would hopefully be able accommodate more extensive "excavations" with more relevant sample sizes. Of course, it would also be of interest to explore more diverse geographies, i.e., not coasts or major urban areas.

What does it ultimately mean if our hypothesis is true? That is, what if the most lasting impression that Homo sapiens leave on this planet is our trail of synthetic mass production, as opposed to agriculture, industry or atomic mastery? And, what will future stratigraphies reveal about our culture if this century-long trend continues unabated? To satisfactorily answer these questions will require more research and a drop of clairvoyance, but it is clear that the automatic fossils of the synthetic age are reshaping our landscapes and once again re-drawing the ideological chasm between nature and society.

ACKNOWLEDGMENTS

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Location / Item #	Material	Size	Color	Function	Brand	Notes
A-01	plastic (hard)	16 oz	clear	bottle (water)		no cap, facing W
A-02	glass	12 oz	brown	bottle (beer)	budweiser	
A-03	glass	12 oz	clear	bottle (beverage)		no label, facing W
A-04	plastic (film)	1.5" sq	gold	wrapper		metal cap, gum inside, facing NW
A-05	plastic (hard)	32 oz	clear	bottle (water)		unopened, facing SW
A-06	plastic (hard)	5" long	clear	drinking straw		
A-07	plastic (hard)	3 oz	clear	alcohol bottle		red metal top, facing NE
A-08	plastic (hard)	1.5" diameter	white	shower curtain ring		http://www.mclaren-plastics.co.uk/shower.htm
A-09	plastic (film)	4" sq	clear	cigarette packaging		
A-10	plastic (hard)	1" diameter	blue	bottle cap	pepsi	
A-11	plastic (film)	8" sq	white	--		shard, attached to string
A-12	styrofoam	1" sq	white	packaging		
A-13	styrofoam	3" sq	white	packaging		
A-14	styrofoam	1" sq	white	packaging		part of cup?
A-15	glass	12 oz	brown	bottle (beer)	budweiser	broken apart
A-16	plastic (film)	21" sq	clear, red	wrapper (candy)	twizzlers	
A-17	plastic (film)	3" sq	green	bag (narcotics)		
A-18	plastic (film)	9" sq	white	packaging		shard
A-19	plastic (film)	4" sq	white	packaging		shard
A-20	plastic (film)	1" sq	clear, blue	wrapper (candy)		shard
A-21	plastic (film)	3" sq	silver	--		shard
A-22	plastic (hard)	1" diameter	red	bottle cap	coca-cola	smashed
A-23	wood	84" cubic	brown	lumber		heavy
A-24	styrofoam	4" sq	orange	industrial		
A-25	wood	24" cubic	brown	lumber		
A-26	wood	6" sq	brown	lumber		
A-27	plastic (film)	9" sq	blue	tarp		shard
A-28	plastic (hard)	1"	off-white	cigarello tip		
A-29	plastic (film)	3"	clear	band-aid		missing cloth
A-30	plastic (film)	9" sq	clear	packaging		shard
A-31	plastic (film)	7" sq	clear	packaging		shard
A-32	plastic (hard)	6" long	opaque	industrial		
A-33	plastic (hard)	1" long	white	drinking straw		
A-34	plastic (film)	1.5" long	gold	packaging		
A-35	plastic (hard)	1"	blue	--		shard
A-36	plastic (hard)	.5" sq	green	bottle cap		shard
A-37	plastic (hard)	3" long	teal	--		shard
A-38	wood	1" long	brown	lumber		
A-39	plastic (hard)	1.5" diameter	white	bottle cap		wider than soda mouth
A-40	plastic (hard)	3" diameter	white, blue	container top	Breakstowes Butter	
A-41	plastic (film)	4" sq	clear	--		shard
A-42	plastic (film)	1" sq	clear	wrapper (gum)	Cry Baby Sour Bubble Gum	
A-43	plastic (film)	4" sq	clear	wrapper (candy)		
A-44	plastic (film)	3" sq	clear	--		shard
A-45	plastic (hard)	8" long	white	drinking straw		bendy neck straw
A-46	aluminum	12 oz	silver	soda bottle	diet coke	crunched
A-47	cellulose acetate	.5" long	white	cigarette butt		
A-48	plastic (hard)	1" diameter	white	bottle cap		shard
A-49	plastic (hard)	1" long	opaque	hook		
A-50	plastic (hard)	8" sq	opaque	bottle (beverage)		split in half
A-51	plastic (film)	4" sq	white	packaging		shard
A-52	plastic (hard)	3" sq	clear	--		shard
A-53	plastic (film)	4" sq	clear	--		shard
A-54	aluminum	12 oz	silver	can (soda)	pepsi	torn, old logo
B-01	plastic (film)	85" sq	clear	bag	mcdonalds	torn
B-02	nylon	159" long	blue, white	string		
C-01	glass	12 oz	brown	bottle (beer)	budweiser	facing S
C-02	plastic (film)	2" long	clear	packaging		
C-03	plastic (hard)	6.5" long	clear	drinking straw		
C-04	latex	1.5" diameter	white	condom		compacted
C-05	plastic (film)	4.5" sq	blue	tarp		
D-01	glass	10 oz	brown	bottle (beer)	budweiser	facing S
D-02	plastic (film)	12" sq	clear	packaging		
D-03	rubber	3.5" long	black	--		tube shaped
D-04	glass	4" long	clear	--		shard
D-05	glass	3" long	clear	--		shard
E-01	plastic (hard)	3.5" diameter	white	coffee cup lid		
E-02	aluminum	12oz	silver, blue	can (soda)	pepsi	old logo, old spout
E-03	plastic (film)	1.5" long	clear	packaging		
F-01	plastic (film)	2" sq	white	packaging		
F-02	plastic (film)	10" long	clear	--		
F-03	plastic (hard)	3.5" long	clear	--		
F-04	TURTLE	--	--	--		
G-01	aluminum	12oz	silver	can (soda)	pepsi	old logo, old spout
G-02	plastic (film)	24" sq	silver, white	wrapper (candy)	hershey's cookies & creme	
G-03	plastic (film)	12" long	white, green	packaging		
G-04	plastic (hard)	1.5" long	white	straw-like		
G-05	plastic (film)	3" long	clear	packaging		
G-06	plastic (film)	3" sq	white	packaging	advil	
G-07	plastic (hard)	1.5" diameter	teal	drink top peel		
G-08	plastic (hard)	10" long	white, red stripes	drinking straw		
G-09	plastic (hard)	9" long	white	drinking straw		dirty with mud
G-10	cloth	324" sq	brown	--		dirty with mud
H-01	plastic (hard)	48" sq	white	container top	clorox	
H-02	plastic (hard)	36" long	black	tube		
H-03	glass	12 oz	clear	bottle (beer)	corona	NE facing
H-04	plastic (film)	8" sq	silver	wrapper (candy)	scooby doo (general mills)	
H-05	plastic (film)	8" sq	clear	packaging		
H-06	plastic (film)	6" sq	clear	bag	ziplock	
H-07	plastic (film)	2" sq	clear	packaging		
H-08	plastic (film)	3" sq	white	packaging		
H-09	plastic (film)	18" sq	yellow	bag	yellowbook	

H-10	plastic (hard)	2.5" long	white	rod		lollipop? stirrer?
H-11	plastic (film)	4" sq	white	label	diet dr. pepper	
H-12	plastic (film)	6" long	clear	cigarette packaging		
H-13	plastic (film)	16" sq	brown	wrapper (candy)	snickers	
H-14	plastic (hard)	1.5" diameter	blue	bottle cap		pop top
H-15	plastic (film)	30" sq	orange	wrapper (chips)	fritos	
H-16	plastic (hard)	1.5" diameter	blue	bottle cap		screw top
H-17	plastic (film)	18" long	clear	packaging		teeth on top
H-18	plastic (hard)	12 oz	clear	bottle (water)		W facing
H-19	plastic (film)	12" long	opaque	packaging		
H-20	plastic (hard)	14" long	white	--		rod shaped, hanger?
H-21	plastic (hard)	6" long	white	silverware (spoon)		
H-22	plastic (film)	1" long	blue	cigar packaging	dutch masters	
H-23	plastic (hard)	1" long	white	--		
H-24	styrofoam	1" long	white	packaging		
H-25	plastic (film)	10" long	blue (dark)	packaging		
H-26	aluminum	1" sq	silver	foil		
H-27	cloth	5" long	white	tampon		
H-28	wood	1728" cubic	brown	telephone pole		
H-29	plastic (hard)	1.5" diameter	white	bottle cap		screw top
H-30	plastic (film)	1" sq	clear	bag (narcotics)		
H-31	plastic (film)	2" sq	yellow	wrapper (candy)	reeses	
H-32	plastic (hard)	4" long	black	--		
H-33	glass	3" sq	brown	bottle (beer)		shard
H-34	cloth	10" long	brown	glove		
H-35	plastic (film)	1" sq	clear	bag (narcotics)		
H-36	wood	480" cubic	red	lumber		
H-37	steel, foam, plastic	20" cubic	white	security safe	sentry s3117	square hole cut into left side, contents empty, 65-75 lbs
H-38	plastic (hard)	18 oz	clear	bottle (water)		
H-39	aluminum	22.5 oz	green (light)	beverage can	arizona green tea	N facing
H-40	glass	20 oz	clear	bottle (beverage)	tom and tom nantucket	S facing
H-41	glass	32 oz	clear	bottle (beer)	sol	SE facing
H-42	plastic (hard)	32 oz	clear	beverage (iced coffee)	dunkin donuts	N facing, NY Yankees logo on cup
H-43	glass	20 oz	clear	bottle (beverage)	snapple	NW facing
H-44	plastic (film)	36" sq	white	wrapper (ice cream sandwich)	blue bunny	
H-45	plastic (film)	12" sq	clear, silver	wrapper (candy)		
H-46	plastic (film)	4" sq	clear	packaging (cigarette)		
H-47	plastic (hard)	5" long	orange	--	3m	
H-48	plastic (hard)	10" long	orange	--	3m	
H-49	plastic (film)	144" sq	white	bag (shopping)	mets (baseball)	
H-50	plastic (hard)	6" long	white	silverware (spoon)		
H-51	plastic (film)	3" long	clear	packaging	wise, mets (baseball)	
H-52	plastic (hard)	4" diameter	yellow	drink lid	lipton	in 2 pieces
H-53	nylon	60" long	white	--		frayed
H-54	plastic (film)	6" sq	orange	wrapper (candy)	reese's peanut butter cup	
H-55	plastic (film)	4" sq	clear	wrapper (candy)	nestle	
H-56	wood	12" x 12" x 5"	brown	lumber		triangular w/ nail
H-57	plastic (film)	144" sq	black	garbage bag		
H-58	plastic (film)	6" long	brown	wrapper (candy)	snickers	
H-59	plastic (film)	288" sq	black	bag (shopping)		
H-60	plastic (film)	432" sq	black	garbage bag		
H-61	plastic (film)	30" sq	orange	wrapper (chips)	doritos	
H-62	plastic (hard)	2" long	white (faded)	bottle cap		screw top
H-63	plastic (film)	144" sq	clear	bag		
H-64	plastic (film)	6" sq	black	bag		
H-65	glass	20 oz	clear	bottle (beverage)	snapple	broken into about 15 pieces
H-66	glass	12 oz	green	bottle (beer)		broken into 5 pieces
H-67	plastic (film)	96" sq	clear, green	wrapper (food)	herrs popcorn	
H-68	plastic (film)	144" sq	white, blue	bag (shopping)	waldbaums	
H-69	plastic (film)	144" sq	black	bag (shopping)		
H-70	plastic (film)	3" sq	clear	packaging (cigarette)		
H-71	plastic (film)	3" sq	clear	packaging (cigarette)		
H-72	plastic (film)	4" sq	clear	wrapper		quart size'
H-73	plastic (film)	1" sq	white	wrapper (candy)	freshmint	
H-74	plastic (film)	1" sq	yellow	--		
H-75	plastic (film)	1" sq	clear	wrapper (candy)		