A STATISTICAL ANALYSIS OF FLOOD LEGENDS

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Many flood legends have survived from all parts of the world. Nearly all of them are variations of the theme in the Biblical account; however, in none of them is there a purity of this theme. They all diverge from the Biblical account in one or more aspects.

Most of the legends fall into one of two general classifications. In one of these a favored family is saved, and in the other the survivors vary in number and relationship. Four of the aspects central to the Biblical account occur in varying combinations throughout the legends in both classifications. Because of the varying combinations, the individual legends cannot be categorized as one specific type or another. However, a statistical analysis indicates the purity of the Biblical account and reveals evidence of subsequent upheavals having corrupted in varying degrees all other accounts.

Introduction

In his book *The Deluge Story in Stone*,[1] Mr. Byron Nelson indicated variations in flood stories from around the world. In Nelson's study and the work of others[2] certain features of these flood legends may be tabulated and then compared to the Bible record of the Flood. A short statistical treatment of the historical data may yield instructive correlations between certain aspects of the legends—correlations that may shed some light on the origin of the legends and their possible relationship to the central Biblical account.

Consider now a few of these aspects as found in the legends indicated:

1. In thirty-two stories a favored family is saved.
2. In fifteen stories a remnant† survives.
3. In twenty-one stories, a survival is due to a boat.
4. In sixteen stories, other means are responsible (mountain tops, for instance).
5. In thirty-four stories only the flood is mentioned.
6. In fourteen stories other upheavals accompany the flood (Celestial events, trembling earth, fire, etc.)

Of the thirty-two legends in which a family was saved: (a) Eighteen describe survival in a boat (56%), (b) Ten describe other means of survival (31%), (c) Ten indicate a preservation of other seeds of life (31%), (d) In twelve, the family is forewarned (38%), and (e) In seven, there are upheavals in addition to the flood (22%).

Of the fifteen legends in which a remnant survived: (a) Four describe survival in a boat (27%), (b) Seven describe other means of survival (47%), (c) None indicates a preservation of other seeds of life, (d) In two, the remnant is forewarned (13%), and (e) In nine, there are upheavals in addition to the flood (60%).

These aspects are tabulated to facilitate comparison:

Table I

	Means of Survival: Boat/Other Means	Other Seeds of Life Preserved	Survivors Fore-warned	Other Upheavals
Family Saved	56%/31%	31%	38%	22%
Remnant Survived	27%/47%	0	13%	60%

A hypothesis can be proposed based upon the above information and a statistical test applied to determine its acceptability. The test employed here will be the Chi-Square Test[3]. This will by no means be conclusive; the primary shortcoming will be the limited amount of data available. However, even with extensive data, conclusions based on statistical analyses must necessarily be qualified by a statement regarding the probability of error. Additional data would serve to reduce this probability.

The attributes displayed in Table I will be considered individually, and a general conclusion will subsequently be suggested.

Means of Survival Analyzed

Looking first to the means of survival, we will attempt to show that survival by boat is contingent upon the family concept—as opposed to the remnant surviving by other means. In this case we are wondering if those stories which show survival of one family also tend to link this with survival by boat (as opposed to other means). This will be done somewhat negatively, as can be seen in the following hypothesis, the starting point for the test.

HYPOTHESIS: There is no indication of contingency in the available data between the favored family and survival by boat concepts.

First we tabulate the observed frequencies of occurrences from the data.

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†Remnant, as used here, means an unspecified number of people not necessarily related.

Table II
Observed Frequencies of Means of Survival

	Boat	Other	Unknown	Total
Family	18	10	4*	32
Remnant	4*	7	4*	15
Total	22	17	8	47

If the proposed hypothesis were true, i.e., no contingency between family and boat, the expected frequencies would be proportional to the total number of observations. Instead of 18 for family-boat, there would be $22(32/47) = 14.98$. Instead of 7 for remnant-other, there would be $17(15/47) = 5.43$, etc. This operation is performed for each observation in Table II.

Now the frequencies expected under the proposed hypothesis are tabulated.

Table III
Expected Frequencies of Means of Survival under Proposed Hypothesis

Boat		Other	Unknown	Total
Family	14.98	11.57	5.45	32
Remnant	7.02	5.43	2.55	15
Total	22	17	8	47

From these tables we calculate what is known as the Chi-Square statistic (χ^2).

$$\chi^2 = \Sigma^* \frac{(\text{Observed Frequency-Expected Frequency})^2}{\text{Expected Frequency}}$$

$$= \frac{(18-14.98)^2}{14.98} + \frac{(4-7.02)^2}{7.02} + \frac{(10-11.57)^2}{11.57} + \frac{(7-5.43)^2}{5.43} + \frac{(4-5.45)^2}{5.45} + \frac{(4-2.55)^2}{2.55}$$

$$= 3.78$$

Associated with this variable is a concept known as "degrees of freedom." This will be one less than the number of columns in Table III, i.e., 2.

Consulting a standard Chi-Square Table[4], we look for the first Chi-Square value with two degrees of freedom that is just exceeded by the above value of 3.78. This value is 3.22. Also from the table we find that associated with this value is a probability expression equal to 80%.

Simply stated: On the basis of this evidence, we can reject the proposed hypothesis with a better than 80% probability that rejection is the correct decision. We could also say there is nearly a 20% chance of error.#

An alternate hypothesis cannot normally be accepted on the strength of rejecting the original. However, in view of the limited alternatives in this case, we can be reasonably sure that survival in a boat is contingent upon the family concept as opposed to remnant. Those stories which indicate survival of a remnant have a greater than expected correlation to survival by other means than in a boat.

Subsequent tabulations will be shown with no explanations repeated for the calculations involved.

Preservation of Seeds of Life

Turning to the characteristic of preservation of other seeds of life, we find no instance of this being done by the remnant in order to save the species. This attribute is associated solely with the favored family.

Looking now to the "forewarning" we may again state a negative hypothesis.

HYPOTHESIS: There is no indication of contingency in the available data between the favored family and "forewarning."

Table IV
Observed Frequencies of Forewarning

	Forewarned	Unwarned	Total
Family	12	20	32
Remnant	2	13	15
Total	14	33	47

Table V
Expected Frequencies of Forewarning If Hypothesis Is True

	Forewarned	Unwarned	Total
Family	9.53	22.47	32
Remnant	4.47	10.53	15
Total	14	33	47

Results: $\chi^2 = 2.90$. Degrees of Freedom $= 1$. Next smaller value of χ^2 in table $= 2.71$. Also from the table this value yields a probability $= 90\%$.

We therefore reject the proposed hypothesis with a 90% probability that rejection is the correct decision, i.e., we can be reasonably sure that a forewarning is contingent upon the family concept as opposed to remnant. The idea of a family correlates closely with a forewarning.

Upheavals Besides the Flood

Now consider the upheavals besides the flood. We may assume that an occupant of the ark

*The limited amount of information to which reference has been made is reflected in these tables, in that the frequencies should actually be greater than five for this test.

*Greek Sigma, indicating a summing process.

#As will be seen in the succeeding operations, this is the worst case of those being considered. The implication in this will be made clear when the conclusion is presented.

would probably have been unaware of much of the surrounding turmoil. Again, a negative hypothesis is proposed:

HYPOTHESIS: There is no indication of contingency in the available data between the favored family and the concept of a single flood without other upheavals.

Table VI
Observed Frequencies of Other Upheavals

	Flood Only	Other Upheavals	Total
Family	25	7	32
Remnant	6	9	15
Total	31	16	47

Table VII
Expected Frequencies of Other Upheavals If Hypothesis Is True

	Flood Only	Other Upheavals	Total
Family	21.11	10.89	32
Remnant	9.89	5.11	15
Total	31	16	47

Results: $\chi^2 = 6.60$. Degrees of Freedom $= 1$. Next smaller value of χ^2 in table $= 5.41$ Also from the table this value yields a probability $= 98\%$.

We therefore reject the proposed hypothesis with a 98% probability that rejection is the correct decision, i.e., we can be reasonably sure that other upheavals are contingent upon the remnant concept as opposed to the family. Where one family is seen, the stories generally also speak of one flood only, without other upheavals.

Looking again at these same classifications (i.e., Family and Remnant) in light of their geographical distribution reveals the following:

Europe: In six instances where the survivors are described, there are four cases of a family and two of a remnant.

Middle East and Africa: In seven instances where the survivors are described, there are six cases of a family and one of a remnant.

Asia and Pacific Islands: In six instances where the survivors are described, there are four cases of a family and one of a remnant.

The Americas: In twenty-two instances where the survivors are described, there are twelve cases of a family and ten of a remnant.

Again tabulating, an interesting picture is obtained. *(See Table VIII)*

Upon first deciding to examine the geographic distributions, I expected the classification ratio (family:remnant) of each area to approximate that of the whole. As it is, the ratio decreases in proportion to the distance from the center of dispersion following the Great Deluge, i.e., the Middle East. At any rate it would not seem reasonable to ascribe such distributions to localized disasters. In both classifications there are too many world-wide similarities.

Table VIII

	Europe	Middle East Africa	Asia Pacific Islands	The Americas	World Wide
Family	67%	86%	67%	55%	63%
Remnant	33%	14%	33%	45%	37%
Approximate Ratio	2:1	6:1	2:1	1.2:1	1.7:1

Conclusions

It has been said that statistics can prove both sides of the same argument. No proof of anything is claimed to exist within these figures; however, based upon the information presented, we can suggest that the flood legends considered as a whole embody two or more world-wide catastrophes.

One of these was the Great Deluge described in Genesis, prior to which Noah was forewarned and told to build a boat, in which he and his family escaped death. In this he carried the seeds of other life (i.e., plants and animals) to preserve the species. Further, he was probably unable to observe much action other than rain, thereby precluding the association of the Great Deluge with other upheavals.

The other catastrophe(s) proposed would have also involved flooding, but various other upheavals were witnessed simultaneously in those instances. The flooding came suddenly, without warning. People used any means available in an attempt to survive, with no regard for life other than their own and their loved ones. The worst-case indication of contingency (family-boat) is to be expected. A boat would be a natural means of escaping flood conditions for any members of the remnant having access to one if they were not completely overwhelmed. Widespread use of boats by the remnant would tend to reduce the indication of family-boat contingency. The existing evidence of contingency, however, probably indicates that for the most part the population was overwhelmed; the remnant owing its survival to a favorable geographical location.

Although many people were probably killed during this (these) later event(s), remnants of people remained scattered and survived. These survivors undoubtedly also possessed oral traditions of the Great Deluge which were subsequently overlaid and intertwined by their descendants with accounts of more recent events.

Prior to its being confused with other upheavals, distortions in the account of the original Deluge would result from transmission through time only, since it was observed from only one vantage point. This provided a basic "plot" around which many other legends were woven.

Accounts of subsequent flooding suffered additionally from intermingling subjective interpretations of upheavals that varied according to their geographical location. Only in God's Word do we have a coherent account of what actually happened during the first catastrophe when the world was certainly "overflowed with water."

Following the confusion of tongues at the Tower of Babel, the Old Testament deals primarily with the Jewish Nation. An account of world events (subsequent catastrophes), other than their effect on the Jews, must come from elsewhere.

Yet it is instructive that when there is purity of one element in a group of flood legends, there is correlation with other Biblical facets of the story. As we have seen, more often than would be expected to occur naturally by chance, there is a correlation between a favored family with (1) survival by boat, (2) a forewarning, (3) one flood only, and (4) preservation of other seeds of life. Such correlations are instructive and they certainly support the authority of the Scriptural Flood record.

References

[1]Nelson, Byron. 1931. The deluge story in stone. Augsburg Publishing House, Minneapolis, Minn. Appendix II, pp. 170-190.

[2]Books used in one way or another to secure data upon which this statistical analysis rests include the following:
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[3]For a detailed discussion of this test, see Hoel, P. G. 1947. Introduction to mathematical statistics. John Wiley and Sons, N. Y.

[4]*Ibid.*

RADIO CARBON DATING*

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Introduction

It is popularly supposed that science has unequivocably established that men have been on earth for a million years or more. Such a view cannot be readily harmonized with the origin and early history of man as recorded in the first few chapters of the book of Genesis. Accordingly, it is advisable to examine the methods by which supposedly accurate dates have been obtained.

One method used to estimate the age of materials of biological origin is radio carbon or carbon-14 dating. This method, which is claimed to be able to date materials up to 50,000 years old, has obtained widespread use in archeology and geology. It was developed in the mid 1940's at the University of Chicago by Professor Willard F. Libby, who was subsequently awarded the Nobel prize for Chemistry in 1960 for this work.

In this article, the principles upon which carbon-14 dating is based will be explained, the assumptions inherent in this method of dating will be considered, and the extent to which this method has been checked against historically dated materials will be viewed.

The basic theory[1] behind carbon-14 dating is as follows. In the upper atmosphere, nitrogen is transmuted into a rare form of carbon, known as carbon-14. This is due to the bombardment of atmospheric nitrogen by atomic particles called neutrons, which occur in cosmic rays. "Ordinary" carbon is carbon-12, which has 6 protons and 6 neutrons in its atomic nucleus. Carbon-14 is, however, a different "kind" (or isotope) of carbon with 8 neutrons and 6 protons in its nucleus. The formation of carbon-14 from nitrogen can be represented by the following equation:

$$N^{14} + n^{1} \rightarrow C^{14}_{6} + H^{1}_{1}$$

i.e. NITROGEN + NEUTRON gives CARBON-14 + PROTON

Unlike carbon-12, carbon-14 is radioactive and it disintegrates to given nitrogen with the emission of an electron:

$$C^{14}_{6} \rightarrow N^{14}_{7} + e^{0}_{-1}$$

i.e. CARBON-14 gives NITROGEN + ELECTRON

This disintegration process is relatively slow. Carbon-14 is said to have a half-life of about 5,600 years. This means that starting with 1 gram of carbon-14, after 5,600 years one half of it (i.e. ½ gram) will have disintegrated into

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